February 2009

RAIL OPERATIONS

NEWMAN – PORT HEDLAND RAILWAY
CHICHESTER DEVIATION

ENVIRONMENTAL REFERRAL DOCUMENT

IRON ORE

bhpbilliton

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EXECUTIVE SUMMARY

BHP Billiton Iron Ore (BHPBIO) is seeking approval under Part IV of the *Environmental Protection Act 1986* (EP Act) for the proposed construction of a new section of rail through the Chichester Ranges (the Chichester Deviation), as part of Rapid Growth Project 5 (RGP5). The project involves construction of 23 km of dual track railway and associated rail infrastructure up to 6 km west of the existing Port Hedland to Newman railway (the Mainline).

The key characteristics of this proposal are outlined below in Table ES.1.

Table ES.1 – Proposal Key Characteristics

Element	Description
Project proponent	BHP Billiton Iron Ore
Construction period	2 stages of approximately 12 months*
Approximate disturbance area	400 ha
Railway length	Approximately 23 km
Supporting infrastructure	Communications cabling, level crossings, signalling, access tracks

* *Stage 1* - Construction of the first track of the Deviation plus a siding. *Stage 2* - Construction of the second track of the Deviation adjacent to the first track. The second track will encompass the siding constructed in Stage 1.

BHPBIO is expanding its Pilbara iron ore mines in response to the significant rise in worldwide demand for iron ore. However, its single track rail Mainline and rail line gradient limit the efficiency and capacity to transport ore to Port Hedland.

The proposal, as described in this Environmental Referral Document (ERD), has been developed to avoid, minimise, manage and mitigate environmental impacts and aims to:

- reduce the gradient of the rail line through the Chichester Ranges, thereby increasing the efficiency of BHPBIO Pilbara operations; and
- maximise the operational efficiency of transporting materials from BHPBIO's mine sites to its port at Port Hedland.

BHPBIO has adopted a risk based approach to determine the relevant environmental and social factors for the Chichester Deviation proposal. The overarching principles of sustainability and biodiversity have been considered within the context of this proposal and have been incorporated into the assessment of the identified environmental factors. These environmental and social factors have been identified through existing information, findings of investigative studies and consultation with stakeholders.

A preliminary impact assessment was used to categorise the inherent risk of the environmental factors as critical, major, moderate, minor or low depending upon the potential significance of the impacts of any management controls. There are no environmental or social factors identified with major or critical inherent risks.

Table ES.2 – Environmental Factors and Inherent Risk

Moderate	Minor
Terrestrial Flora and Vegetation	Subterranean Fauna
Surface Hydrology	Groundwater Quality
Terrestrial Fauna	Greenhouse Gas Emissions
Weed Management	Dust Emissions
	Noise and Vibration
	Surface Water Quality
	Waste Management
	Rehabilitation
	Decommissioning of rail
	Economic and Social Impacts
	Visual Amenity
	Recreational Activity

This ERD provides a detailed assessment of the moderate risk factors as they are considered to be 'key' to the project. For each of the 'key' factors the ERD discusses the objective and potential impacts. Subsequent assessment, as detailed in Section 7, demonstrates that through incorporation of management controls, the potential impacts can be managed so that residual risk is minimised.

Management plans have been developed for the 'key' environmental factors which require management actions beyond those included in existing BHPBIO management plans. These plans are included in the ERD and include a:

- Surface Water Management Plan;
- Significant Species Management Plan; and a
- Weed Management Plan.

The minor environmental risk factors are assessed as 'other' relevant factors within the ERD (Section 8). These factors have not been considered to the same extent as the key factors, given the potential impacts are likely to be minor.

In summary, this document identifies and describes potential impacts associated with the proposal. For each environmental and social factor, the following key aspects are discussed:

- EPA objective;
- potential impact;
- mitigation and management of impacts; and
- outcome.

For all factors assessed, it is considered that the EPA's objectives can be met with appropriate management and mitigation. BHPBIO's full list of Environmental Commitments to achieve this are outlined in Section 9.

The following table summarises BHPBIO's evaluation of each of the environmental factors, associated potential environmental impacts and management objectives. Proposed management actions to reduce the environmental risk are also described.

Table ES.3 – Summary of Environmental Impacts and Management for the Proposal

Over-arching Principles

Key Environmental Factor

Other Relevant Environmental Factor

Factor	Environmental Objective	Potential Impacts	Proposed Management and Mitigation	Relevant Guidance
Over-arching BHPBIO Principles				
Biodiversity	To minimise adverse impacts on biological diversity, comprising the different plants and animals and the ecosystem they form, at the levels of genetic diversity, species diversity and ecosystem diversity.	• Reduced distribution or geographical extent in local and regional context; • reduced species and ecosystem diversity; • cumulative loss of vegetation communities, flora and fauna species and habitats within the region; and • increase in invasive species (e.g. weeds).	• Avoid disturbance of significant habitat/s as far as practicable; • carry out progressive rehabilitation; and • maintenance of biodiversity within the proposal area will be managed in accordance with BHPBIO's standard operating practices Construction Environmental Management Plan (EMP).	• BHPBIO Biodiversity Strategy; • EPA Position Statement No. 3; • EPA Guidance Statement No. 51; and • EPA Guidance Statement No. 56.
Sustainability	To ensure, as far as practicable, that the proposal meets or is consistent with the sustainability principles in the National Strategy for Ecologically Sustainable Development (Ecologically Sustainable Development Steering Committee 1992).	• Poor design and management of the project may impact on important economic, environmental and social attributes on local and regional scales.	• Project review to ensure that the design considers leading practice controls to manage environmental issues associated with site preparation, construction, installation, commissioning, operation, maintenance, decommissioning and closure.	• BHP Billiton Sustainable Development Policy 2005; • EPA Guidance Statement No. 55; • Hope for the Future: the Western Australian State Sustainability Strategy (Govt. of WA 2003); and • National Strategy for Ecologically Sustainable Development (Ecologically Sustainable Development Steering Committee 1992).

Factor	EPA Objective	Potential Impacts	Inherent Risk	Proposed Management and Mitigation	Relevant Guidance	Residual Risk
Biophysical						

Flora and Vegetation	To maintain the abundance, species diversity, geographic distribution and productivity of flora at the species and ecosystem levels through the avoidance or management of adverse impacts and improvement in knowledge.	• Loss of vegetation communities and fauna habitat.
		• loss of surface water dependent vegetation, loss of vegetation communities or loss of fauna habitat due to alterations to surface water regimes;
		• loss of previously unsurveyed flora of conservation significance;
		• increased risk of fire disturbance; and
		• increase in weeds.
			Moderate	• Implementation of the Surface Water Management Plan to manage impacts on sheet flow sensitive mulga communities; and
				• implementation of the following management controls:
				  • clearing of vegetation minimised as far as practicable;
				  • internal Environmental & Aboriginal Heritage Review to be approved prior to commencement of clearing;
				  • flagging of the clearing area prior to commencement of clearing activities; and
				  • avoidance of conservation significant flora and significant vegetation where practicable.
					• EPA Position Statement No. 2; EPA Position Statement No. 3; EPA Position Statement No. 9;
					• EPA Guidance Statement No. 3;
					• EPA Guidance Statement No. 51;
					• EPA Guidance Statement No. 56; and
					• CALM Policy Statement No. 9.
						Moderate

Factor	EPA Objective	Potential Impacts	Inherent Risk	Proposed Management and Mitigation	Relevant Guidance	Residual Risk
Terrestrial Fauna	To maintain the abundance, diversity, geographic distribution and productivity of fauna at species and ecosystem levels through the avoidance or management of adverse impacts and improvement in knowledge.	• Reduction of fauna habitat and general fauna movement; • potential fauna death and reduced representation of significant species; • fire causing fauna death or injury, or loss of machinery resulting in pollution; • human interaction with fauna causing fauna death or illness; • fauna strike resulting in injury or death; • fauna falling into trenches or excavations resulting in fauna death or injury; • fragmentation of habitat and reduction of fauna corridors as a result of rail formation; • predation of native fauna or competition for native fauna due to the introduction or spread of feral animals; and • loss of previously unsurveyed fauna species of conservation significance.	Moderate	• Implementation of the Significant Species Management Plan, including species specific management measures.	• EPA Guidance Statement No. 56; • EPA Position Statement No. 3; • *Environment Protection and Biodiversity Conservation Act (1999);* • *Wildlife Conservation Act (1950).*	Moderate

Factor	EPA Objective	Potential Impacts	Inherent Risk	Proposed Management and Mitigation	Relevant Guidance	Residual Risk
Weeds	To maintain the abundance, species diversity, geographic distribution and productivity of vegetation communities through the avoidance or management of adverse impacts and improvement in knowledge.	• Increased competition with native species leading to loss of biodiversity.	Moderate	• Implementation of the Weed Management Plan, including weed hygiene procedures and ongoing monitoring of existing and potential new weed populations.	• The National Weeds Strategy (ARMCANZ, ANZECC); • Environmental Weed Strategy for Western Australia (CALM); and • A Weed Plan for Western Australia (State Weed Plan Steering Group).	Minor

Surface Hydrology	To maintain the quantity of surface water so that existing and potential environmental values, including ecosystem maintenance, are protected.	• General clearing of vegetation resulting in a reduction in vegetation cover and increases or changes to surface water flow velocity;
		• surface water flows altered by rail formation resulting in vegetation loss and possible reduction of groundwater aquifer recharge;
		• fire resulting in a reduction in vegetation cover and increase in surface water flow velocity; and
		• weed enhancement through altered surface hydrology.
			Moderate	• Shifting the alignment as far upslope as possible (within the constraints of tenure) to mitigate potential impacts on down-slope mulga communities;
				• Implementation of the Surface Water Management Plan, including the following measures:
				  • placement of environmental culverts at 50 m intervals along the rail formation in areas of sheet flow sensitive mulga vegetation;
				  • visual inspection of culverts prior to the onset of wet season, and as required following significant rainfall events;
				  • installation of low spur embankments on the upstream side of the rail line to direct surface water flows to culverts;
					• Australian and New Zealand Water Quality Guidelines; and
					• EPA Position Statement 4.
						Minor

Factor	EPA Objective	Potential Impacts	Inherent Risk	Proposed Management and Mitigation	Relevant Guidance	Residual Risk
				• installation of shallow cement stabilised road based dip in the rail access road downstream of environmental culverts; • installation of riprap pads immediately downstream of environmental culverts and railway access roads; • refinement of alignment design to maximise natural surface water flows; and • design of rail formation for a 1 in 50 year flood event.		
Groundwater	To maintain the quantity of water so that existing and potential environmental values, including ecosystem maintenance, are protected.	• Reduction of future water supply or impact on station bores.	Minor	• All groundwater abstraction bores are to be licensed and operated in accordance with the approved Groundwater Licence Operating Strategy.	• The National Water Quality Management Strategy (NRMMC); and • State Water Quality Management Strategy (Government of WA).	Minor
Subterranean Fauna	To maintain the abundance, diversity and geographic distribution of subterranean fauna.	• Groundwater abstraction resulting in disruption to fauna habitat; • vibrations due to blasting resulting in disruption to fauna habitat; and • hydrocarbon spill causing pollution of fauna habitat.	Minor	• Operation of all groundwater bores in accordance with the approved Groundwater Licence Operating Strategy; • minimise the depth of cuttings as far as practicable; and • appropriate transport and handling, storage and disposal of hydrocarbons and hazardous materials.	• EPA Guidance Statement No. 54; • EPA Guidance Statement No. 33.	Minor

Factor	EPA Objective	Potential Impacts	Inherent Risk	Proposed Management and Mitigation	Relevant Guidance	Residual Risk
Rehabilitation	To ensure, as far as practicable, that rehabilitation achieves a stable and functioning landform which is consistent with the surrounding landscape and other environmental values; To ensure that rehabilitation achieves an acceptable standard compatible with the intended land use, and consistent with appropriate criteria; and To maintain the integrity, ecological functions and environmental values of the soil and landform.	• Fire resulting in damage or loss of rootstock and seed stores, and increased potential for erosion; • ineffective storage of topsoil resulting in poor seed store retention, loss of stockpiles due to rain or wind erosion or weed invasion; and • unsuccessful rehabilitation resulting in permanent exposed areas, susceptible to erosion and weed invasion.	Minor	• Areas not required for ongoing operations will be progressively rehabilitated. • The rehabilitation procedure will include: ▪ respreading of available topsoil and vegetative matter, either directly from areas undergoing disturbance, or from stockpiled material; ▪ scarification of compacted surfaces to a depth of approximately 300 mm, along contour lines where ground conditions and hydrology allow; and ▪ construction of erosion controls where required.	• EPA Guidance Statement No. 6.	Minor
Decommissioning of Rail	To ensure, as far as practicable, that rehabilitation achieves a stable and functioning landform which is consistent with the surrounding landscape and other environmental values; To ensure that rehabilitation achieves an acceptable standard compatible with the intended land use, and consistent with appropriate criteria; and To maintain the integrity, ecological functions and environmental values of the soil and landform.	• Culvert failure resulting in altered surface water flows; • negative visual amenity; and • permanent barrier for land access.	Minor	• Development of a detailed closure plan in accordance with relevant legislation and standards prior to decommissioning.		Minor
Pollution Management						

Factor	EPA Objective	Potential Impacts	Inherent Risk	Proposed Management and Mitigation	Relevant Guidance	Residual Risk

Surface Water Quality	To ensure that emissions do not adversely affect environmental values or the health, welfare and amenity of people and land uses by meeting statutory requirements and acceptable standards.	• Pollution of surface water and potential downstream impacts on flora or fauna;
		• increased turbidity in waterways; and
		• hydrocarbon, chemical or septic spill.
			Minor	• Implementation of the Surface Water Management Plan, including the following controls:
				  • appropriate transport and handling, storage and disposal of hydrocarbons and hazardous materials;
				  • containment and control of any spills to localise impact; and
				  • minimising potential for erosion of stockpiles during heavy rainfall.
					• Environmental Water Requirements to Maintain Wetlands of National and International Importance;
					• Australian and New Zealand Water Quality Guidelines; and
					• EPA Position Statement 4.
						Minor

Groundwater Quality	To ensure that emissions do not adversely affect environmental values or the health, welfare and amenity of people and land uses by meeting statutory requirements and acceptable standards.	• Hydrocarbon spill resulting in reduced groundwater quality; and • reduced groundwater quality resulting in disturbance to stygofauna.	Minor	• Implementation of hydrocarbons and chemicals procedures in the construction EMP.	• The National Water Quality Management Strategy (NRMMC); and • State Water Quality Management Strategy (Government of WA).	Minor
Greenhouse Gases	To minimise emissions to levels as low as practicable on an on-going basis and consider offsets to further reduce cumulative emissions.	• Generation of carbon emissions from operation of vehicles and plant; and • generation of carbon emissions from operating locomotives.	Minor	• Regular machinery maintenance to maintain efficiency and reduce emissions; • reduce the rail gradient to increase efficiency of rail operations; and • rehabilitation of areas not required for ongoing operations.	• Western Australian Greenhouse Strategy; and • EPA Guidance Statement No. 12.	Low

Factor	EPA Objective	Potential Impacts	Inherent Risk	Proposed Management and Mitigation	Relevant Guidance	Residual Risk

Dust Emissions	To ensure that emissions do not adversely affect environmental values or the health, welfare and amenity of people and land uses by meeting statutory requirements and acceptable standards.	• Generation of dust causing general nuisance.	Minor	• Implementation of the following management measures:
				  • use of water to suppress dust emissions;
				  • reduction of vehicle speed limits; and
				  • regular visual monitoring to identify and eliminate excessive dust events.
					• EPA Guidance Statement No. 18; and
					• *Occupational Safety Regulations (1996).*
						Minor

Waste Management	To maintain the integrity, ecological function and values of the environment; and To ensure that solid and liquid wastes do not adversely affect the health, welfare and amenity of people and land uses.	• Incorrect disposal of waste resulting in injury, illness or death of fauna.	Minor	• Adoption of the waste management hierarchy of elimination, reduction, reuse, recycling, treatment and disposal.	• *Environmental Protection (Controlled Waste) Regulations 2004;* • *Litter Regulations 1981*; and • Review of Waste Classification and Waste Definitions 1996 (as amended) (DoE).	Minor

Factor	EPA Objective	Potential Impacts	Inherent Risk	Proposed Management and Mitigation	Relevant Guidance	Residual Risk
Noise and Vibration	To protect the amenity of the community from noise and vibration impacts associated with development or land use by ensuring that statutory requirements and acceptable standards are met; and To avoid unacceptable adverse impacts on the natural environment, including native fauna.	• Excessive noise event resulting in disturbance to fauna; and • excessive vibration event resulting in disturbance to fauna.	Minor	• Management of all activities in accordance with the *Environmental Protection (Noise) Regulations 1997* and ADP Health and Safety Management Plan (PP-09-100); • Routine vehicle and machinery maintenance; and • use of noise reduction devices on equipment if necessary.	• *Environmental Protection (Noise) Regulations (1997).*	Minor
Social Surrounds						
Economic and Social Impacts	To ensure that risk from the proposal is as low as reasonably achievable and complies with acceptable standards and EPA criteria.	• Fire resulting in negative community response and/or reduced pastoral productivity; • reduced productivity of pastoral stations; • limitations to transport of goods and services to stations due to blockage or temporary removal of access track; and • vehicular accident, damage to public vehicles or fire impacting on public access track users.	Minor	• Regular communication will be maintained with surrounding landholders regarding the timing and location of construction activities; • Implementation of preventative and mitigating controls for fire.		Minor

Factor	EPA Objective	Potential Impacts	Inherent Risk	Proposed Management and Mitigation	Relevant Guidance	Residual Risk
Visual Amenity	To ensure that visual amenity is considered and measures are adopted to reduce adverse visual impacts on the surrounding environment as low as reasonably practicable.	• Poorly designed or located borrow pits resulting in negative community or stakeholder response to Project; and • general clearing and/or poor rehabilitation resulting in negative community or stakeholder response to Project.	Minor	• Implementation of progressive rehabilitation in all areas not required during ongoing operations; and • appropriate planning, design and location of borrow pits.	• Visual Landscape Planning in Western Australia (WAPC).	Minor
Recreational Activity	To ensure that existing and planned recreational uses are not compromised.	• Negative community response to Project due to temporary impacts on public access.	Minor	• Regular communication will be maintained with surrounding landholders regarding the timing and location of construction activities.		Minor

1 INTRODUCTION

1.1 BACKGROUND

BHP Billiton Iron Ore Pty Ltd (BHPBIO) owns and operates the Port Hedland to Newman railway (the Mainline). The Mainline is a 426 km rail line which services mines at Mt Whaleback and Ore Bodies 23, 25 and 29, with extensions to Ore Body 18, Jimblebar, the Yandi Mine and Area C (see Figure 1.1). The Mainline is integral to the transport of iron ore from BHPBIO's mines throughout the Pilbara region, to port facilities at Port Hedland.

As a result of significant growth in the world iron ore market, BHPBIO is carrying out a number of expansion projects to increase the efficiency and capacity of its rail network. BHPBIO propose to increase the efficiency of transporting iron ore from operations in the Pilbara region to Port Hedland, through the construction of 23 km of dual track railway through the Chichester Ranges (known as the Chichester Deviation), located approximately 230 km south of Port Hedland (Figure 1.1). The Chichester Deviation will deviate to the west of the existing Mainline.

1.2 PURPOSE AND STRUCTURE OF THIS DOCUMENT

The purpose of this Environmental Referral Document (ERD) is to formally refer the proposal to construct the Chichester Deviation and associated rail infrastructure (the Proposal) to the Environmental Protection Authority (EPA) to set the appropriate level of assessment under s38 of the *Environmental Protection Act 1986* (EP Act).

This document has been prepared in accordance with the requirements of Part IV of the EP Act and is structured in nine sections.

Section 1 describes the Environmental Impact Assessment Process and provides a description of the assessment approach, applicable legislation and standards.

Section 2 provides a project description, including a summary description of the proposal, a summary of alternatives considered and justification for the selection of the preferred option.

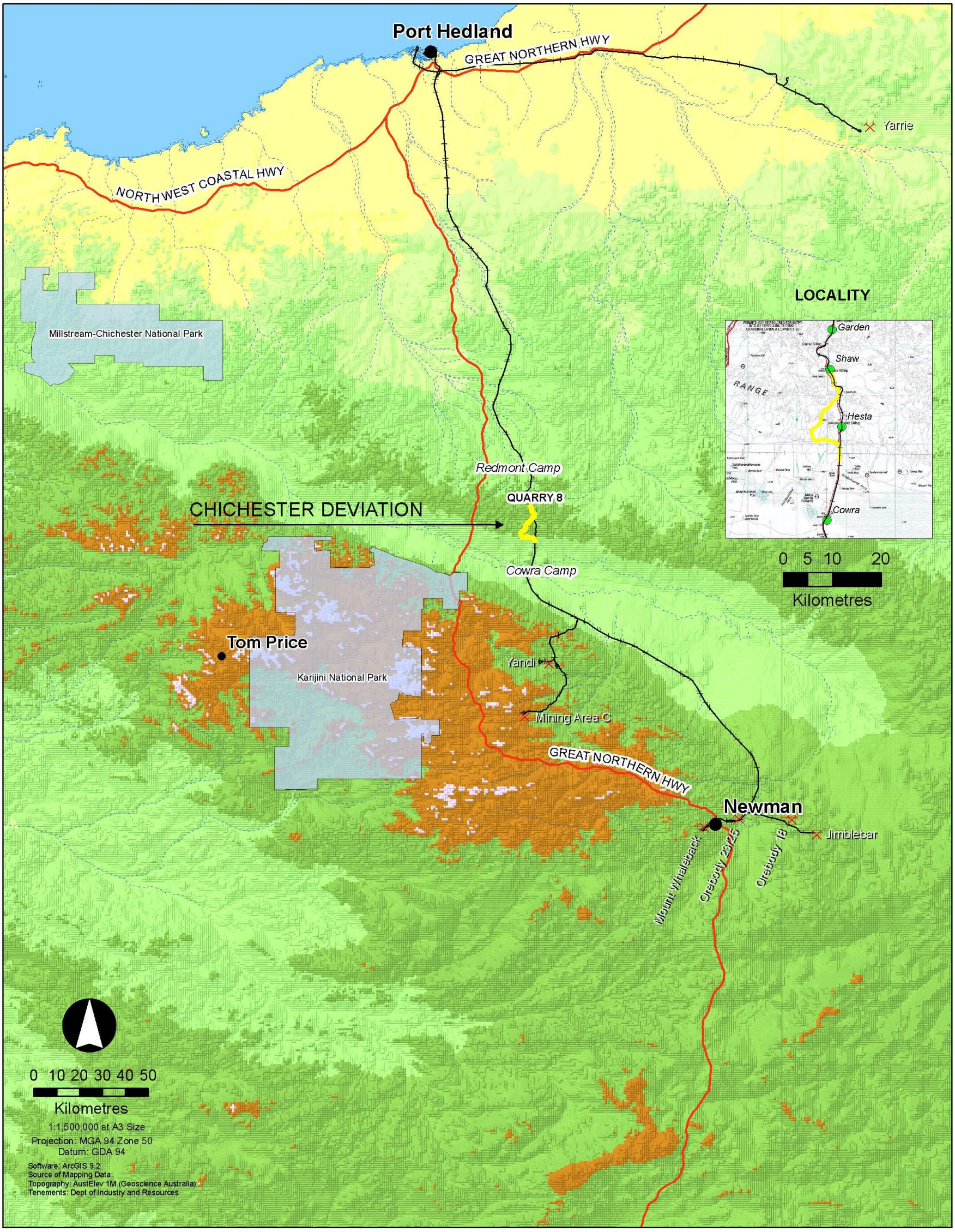
Section 3 describes the stakeholder consultation undertaken to date for the proposal.

Sections 4 and 5 provide a summary of the existing environmental and social conditions, respectively, within the proposal area.

Sections 6 through 8 address impact assessment and management, identifying relevant environmental factors and the potential environmental impacts for the proposal. These sections also address the findings of a risk assessment of the potential environmental impacts, their significance and identification of the key and other environmental factors to be addressed in the impact assessment.

Section 9 establishes Environmental Management Commitments and provides conclusions.

Figure 1.1 – Project Location



1.3 PROPOSAL LOCATION

The proposal area is located in the Shire of Ashburton, approximately 90 km northwest of Newman (Figure 1.1).

1.4 PROPONENT DETAILS

The Proponent for the Project is:

BHP Billiton Iron Ore Pty Ltd
225 St Georges Terrace
Perth WA 6000

Contact details:

Gavin Price
Manager Environment
BHP Billiton Iron Ore Pty Ltd
Telephone: 6224 4024
Email: gavin.price@bhpbilliton.com

1.5 TENEMENT DETAILS

The tenement for the Project consists of Miscellaneous Licence L45/147. The application for tenure is currently being assessed under the *Mining Act 1978*.

The Tenement will be managed by BHPBIO on behalf of the Mount Newman Joint Venture (MNJV) comprising:

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

1.6 ASSESSMENT APPROACH

1.6.1 Overview

The EP Act legislates environmental protection in the State of Western Australia, providing for the prevention, control and abatement of pollution and environmental harm as well as the conservation, preservation, protection, enhancement and management of the environment. The Act is administered by the EPA, the Department of Environment and Conservation (DEC) and the Minister for the Environment.

Preliminary discussions held with the EPA Service Unit indicated that an Assessment on Referral Information (ARI) level of assessment under the EP Act was likely for this proposal if the activities can be managed within the existing EPA policy framework.

The ARI level of assessment is usually applied to proposed developments that raise one, or a small number of significant environmental factors which can be readily managed (EPA, 2002).

BHPBIO elected to complete all environmental studies prior to referring the proposal to the EPA. These studies are now complete and form the basis of this document. Having assessed the findings of the environmental studies, BHPBIO believes that potential impacts on the environment can be readily managed.

1.6.2 Risk-Based Assessment

Sustainability and biodiversity principles have been applied during the planning phase of the proposal to ensure that potential environmental impacts are identified and avoided as far as practicable. These principles form an integral part of the impact assessment approach outlined in

this referral document and have been used to guide the preferred construction method and materials management approach.

A qualitative risk-based approach has been adopted to systematically determine the relevant environmental and social risks posed by the proposal. These risk factors have been identified through a review of existing information, findings of investigative studies and consultation with relevant stakeholders.

To determine the 'key' environmental and social factors, the inherent risk of each factor was assessed using BHPBIO's risk assessment methodology which categorises consequence as critical, major, moderate, minor or low. Environmental and social factors were determined to be key for the proposal if they:

- were of moderate or greater consequence;
- required more detailed assessment; and
- required specific management measures and controls to ensure minimal impacts.

The key environmental factors identified for the proposal are:

- terrestrial flora and vegetation;
- terrestrial fauna;
- weed management; and
- surface hydrology.

Environmental factors, termed 'other' environmental factors, were determined to be non-key if they:

- were of minor or low consequence;
- required a less detailed assessment; and
- could be managed via existing controls and supporting procedures.

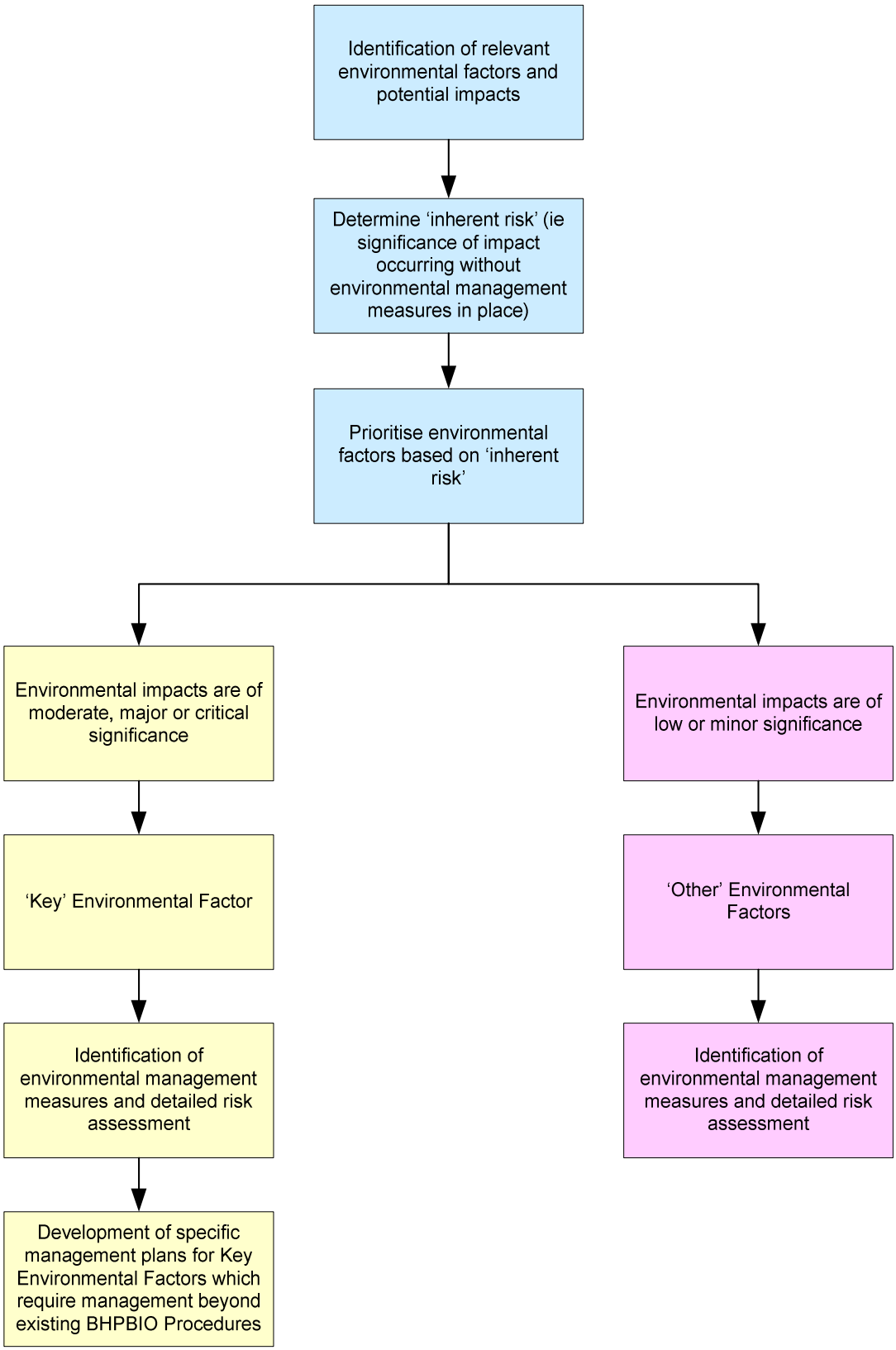
The other environmental factors for the proposal are:

- groundwater;
- subterranean fauna;
- rehabilitation;
- decommissioning of rail;
- greenhouse gas emissions;
- dust emissions;
- surface water quality;
- groundwater quality;
- waste management;
- noise and vibration;
- economic and social impacts;
- visual amenity; and
- recreational activity.

The residual risk associated with factors once management and mitigation strategies are applied, is discussed in Sections 7 and 8. Management plans have been developed for the key environmental factors that require management actions beyond those included in existing BHPBIO management plans and procedures (see Appendix A to Appendix C).

The risk assessment approach applied to the proposal is outlined in Figure 1.2.

Figure 1.2 – Risk-based Approach to Identifying Key Environmental Factors



1.7 APPLICABLE LEGISLATION AND STANDARDS

The EPA and DEC provide direction for environmental protection and impact assessment through published guidelines and position statements. BHPBIO has referred to these publications in investigating and reporting of aspects of the proposal.

The EPA Position Statements and Guideline Statements likely to be of relevance to the proposal include:

- Position Statement 5 Environmental Protection and Ecological Sustainability of the Rangelands of WA (November 2004);
- Position Statement 6 Towards Sustainability (August 2004);
- Position Statement 7 Principles of Environmental Protection (August 2004);
- EPA Guidance Statement No. 8 Draft Environmental Noise (May 2007);
- EPA Guidance Statement No. 12 Minimising Greenhouse Gases (October 2002);
- EPA Guidance Statement No. 33 Environmental Guidance for Planning and Development (May 2008);
- EPA Guidance Statement No. 41 Assessment of Aboriginal Heritage (April 2004);
- EPA Guidance Statement No. 51 Terrestrial Flora and Vegetation Surveys for Environmental Impact Assessment (June 2004);
- EPA Guidance Statement No. 55 Implementing Best Practice in Proposals Submitted to the Environmental Impact Assessment Process (December 2003);
- EPA Guidance Statement No. 56 Terrestrial Fauna Surveys for Environmental Impact Assessment (June 2004); and
- EPA Interim Industry Consultation Guide to Community Consultation (2003).

BHPBIO, in planning and implementing the proposal, has adopted the Principles of Environmental Protection, as outlined in Section 4A of the EP Act and expanded upon in EPA Position Statement No. 7 (EPA, 2004) (Table 1.1).

Table 1.1 – Principles of Environmental Protection

Principle of Environmental Protection	Relevant	Consideration
Precautionary Principle	Yes	Scientific studies have been completed to determine the baseline conditions of the existing environment (Section 4). BHPBIO has completed a risk assessment for the proposal, which identified the key environmental factors for the proposal (Section 6). The proposal has been designed such as to avoid, where practicable, serious or irreversible damage to the environment.
Principle of Intergenerational Equity	Yes	BHPBIO is committed to the principles of sustainable development, and considers that the proposal can be implemented to not adversely impact on the environment for future generations. BHPBIO has developed a community consultation program to ensure that the local communities are involved and their input is integrated into the decision making process for the proposal (Section 3). Where practicable, indigenous heritage sites will be avoided and if any Aboriginal sites or objects will be disturbed by the proposal, BHPBIO will seek to obtain relevant clearances (Section 5).
Principle of Conservation of Biological Diversity and Ecological Integrity	Yes	Biological investigations have been completed to identify and determine the environmental baseline. The project will adhere to Western Australian and Commonwealth statutes and regulations as well as key International Agreements which may apply, as outlined in this section.
Principles relating to improved Valuation, Pricing and incentive Mechanism	Yes	BHPBIO recognises and accepts the costs of managing the proposal and its environmental impacts. The cost of environmental management has been included in the proposal costs and has been forwarded to the BHPBIO Board for approval. Within the execution phase of the proposal, BHPBIO will make procurement decisions which incorporate valuation, pricing and incentive mechanism. BHPBIO will endeavour to adhere to these principles in all phases of the proposal. Decommissioning estimates will be accrued as part of closure planning.
Principles of Waste Minimisation	Yes	BHPBIO will adopt the following approach to waste management for the proposal: • Avoid waste creation and reduce waste generation at source; • Reuse and recycle; and • Treat and/or dispose. The Project has been designed to achieve a balance between cut and fill requirements, to minimise waste spoil material.

In addition to the EP Act, there are other Western Australian Acts and Regulations that may apply to this proposal, which may include but are not limited to the following:

- *Environmental Protection (Noise) Regulations 1997;*
- *Aboriginal Heritage Act 1972;*
- *Soil and Land Conservation Act 1945;*
- *Rights in Water and Irrigation Act 1914;*
- *Mining Act 1978;* and
- *Wildlife Conservation Act 1950.*

Commonwealth legislation and regulations which may apply to the proposal include, but are not limited to, the following:

- *Aboriginal and Torres Strait Islander Heritage Protection Act 1984;*
- *Australian Heritage Council Act 2003;* and
- *Environment Protection and Biodiversity Conservation Act 1999.*

International Agreements which may apply to the proposal include, but are not limited to, the following:

- *The Japan-Australia Migratory Bird Agreement (1974) (JAMBA);*
- *The China-Australia Migratory Bird Agreement (1986) (CAMBA)*; and
- *Convention on the Conservation of Migratory Species of Wild Animals (The Bonn Convention) (1979).*

1.7.1 Other Approvals

The proposal is not expected to significantly impact on any matters of National Environmental Significance and as such, BHPBIO is not intending to refer the proposal to the Department of the Environment, Water, Heritage and the Arts under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

In accordance with the *Aboriginal Heritage Act 1972* (AH Act), consent is required to use land on which Aboriginal sites or objects are located. If Aboriginal sites or objects will be disturbed by the proposed works, BHPBIO will seek to obtain the relevant clearance required under Section 18 of the AH Act prior to site disturbance.

A Mining Proposal will be submitted to the Department of Mines and Petroleum (DMP) in accordance with tenement conditions, which are expected to be attached to L45/147 (once granted).

BHPBIO has obtained 5C groundwater abstraction licences under the *Rights in Water and Irrigation Act) 1914* (RIWI Act) to take groundwater from existing bores on the Mainline. These licences include GWL 167112(1) and GWL 167113(1) granted 19 November 2008.

BHPBIO anticipate that one additional bore may be required at approximately Ch 225 km on the Mainline. If additional bores are required for the proposal, BHPBIO will obtain the relevant licences under section 26D and 5C of the RIWI Act from the Department of Water (DoW).

BHPBIO will apply to the DoW for a permit to interfere with the bed and banks for all prescribed watercourses intersected by the proposal.

2 PROPOSAL DESCRIPTION

2.1 OVERVIEW

BHPBIO is proposing to construct 23 km of dual track railway and associated rail infrastructure within the Chichester Ranges, approximately 220 km south of Port Hedland. The dual tracks will be approximately 5 m apart and contained within a nominal 200 m wide corridor (within L45/147). The chainage[1] designation for the new rail tracks is D220 to D242.

The proposal will involve:

- construction of 23 km of rail formation and rail track;
- construction of temporary unsealed access tracks;
- widening of cuttings for borrow;
- installation of two controlled level crossings;
- installation of engineering culverts in approximately 46 locations;
- installation of environmental culverts at 50 m intervals in areas of sheet flow;
- construction of a permanent unsealed access track for inspection and maintenance purposes;
- installation of signalling equipment;
- installation of a communications tower; and
- laying of approximately 23 km of fibre optic cable adjacent to the new rail tracks.

The key characteristics of the proposal are given in Table 2.1.

Table 2.1 – Proposal Key Characteristics

Element	Description
Project proponent	BHP Billiton Iron Ore
Construction period	2 stages of approximately 12 months each*
Approximate disturbance area	400 ha
Railway length	Approximately 23 km
Supporting infrastructure	Communications cabling, level crossings, signalling, access tracks

* *Stage 1* - Construction of the first track of the Deviation plus a siding. *Stage 2* - Construction of the second track of the Deviation adjacent to the first track. The second track will encompass the siding constructed in Stage 1.

Operation of the existing Mainline through the Chichester Range will continue following construction of the Chichester Deviation.

2.2 JUSTIFICATION AND CONTEXT OF PROPOSAL

BHPBIO is expanding its Pilbara iron ore mines in response to the significant rise in worldwide demand for iron ore. The capacity to transport iron ore to Port Hedland is limited by the single track rail Mainline. Trains are currently required to pull into sidings to allow for passage of trains travelling in the opposite direction. The dual track will assist in reducing transport times by eliminating the need for these stoppages.

The efficiency of iron ore transport is restricted by the gradient of the existing Mainline, which averages 0.55% through the Chichester Range. This average gradient demands the use of additional rail engines to transport iron ore over the Chichester Ranges. The Project aims to remove the requirement for additional engines by deviating the path of travel such that the average track gradient through the Chichester Range is reduced to 0.33%.

[1] The 'chainage' is the distance in kilometres south along the Mainline from Port Hedland. The chainages of the Deviation are denoted by the prefix 'D'.

The Project will eliminate the requirement for train stoppages and will improve fuel efficiency for transport of iron ore by approximately 6%.

Alternative rail alignments for the Deviation were assessed in 2003 with the objective of selecting a railway corridor for future rail capacity expansion between Newman and Port Hedland.

The proposed alignment for the Deviation was selected because it is the shortest route which achieves an average rail gradient of 0.33% and results in least impact to the local and regional environment.

2.3 DISTURBANCE AREA

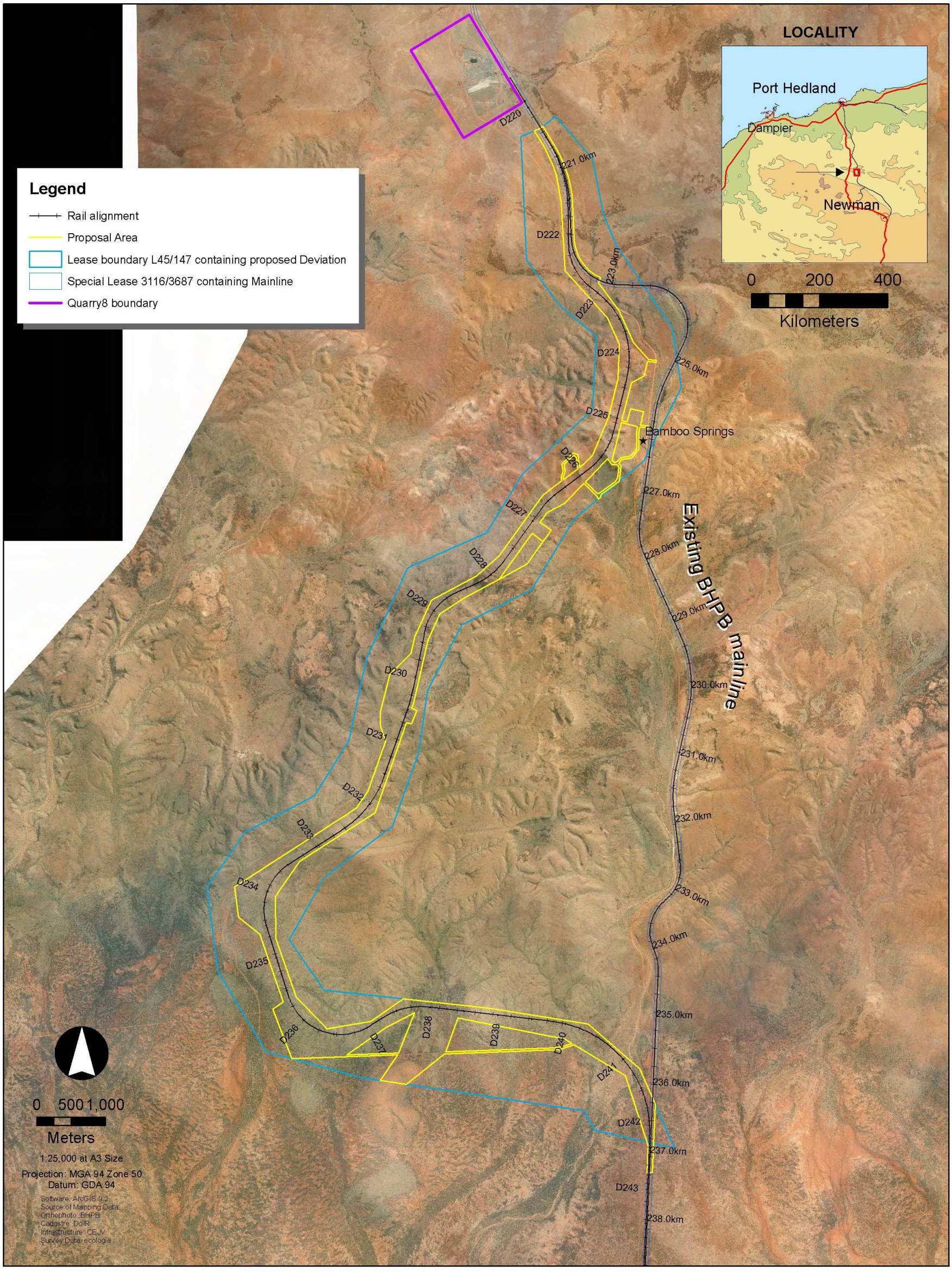
Disturbance will be minimised to that area required for safe and efficient construction and operation of the proposed rail infrastructure. Miscellaneous Licence L45/147 covers an area of 2449 ha, of which 664 ha has been identified by BHPBIO as the proposal area (Figure 2.1). The estimated disturbance footprint within the proposal area is 400 ha (Table 2.2), which accounts for approximately 16.5% of the Miscellaneous Licence area.

Table 2.2 – Estimated Ground Disturbance for the Proposal

Proposal component	Estimated Area of Disturbance (ha)
Rail formation	88
Borrow sources	220
Temporary construction roads	8
Maintenance access tracks	30
Fibre optic cable	32
Laydown areas	22
TOTAL	**400**

Cleared areas which will not be required for permanent infrastructure (approximately 282 ha) will be rehabilitated. Examples of such areas include borrow sources, temporary construction roads, fibre optic cable corridors and laydown areas. Rehabilitation activities will be completed prior to demobilisation of contractors.

Figure 2.1 – Proposal Area



2.4 RAIL FORMATION

2.4.1 Components

Figure 2.1 shows the proposed centreline of the rail line. The rail formation for the proposal will consist of:

- rail line and concrete sleepers;
- ballast of blue metal;
- sub-ballast of blue metal;
- compacted base of borrow materials; and
- culverts as required.

Ballast for the rail line is likely to be sourced from BHPBIO's existing Quarry 8 (Figure 2.1) and will be transported to the proposal area by ballast train and/or truck. The project has been designed to avoid the requirement for ballast stockpiles within the proposal area as far as possible.

2.4.2 Earthworks

Construction of the rail formation for the proposal will require cut and fill (Figure 2.2 and Figure 2.3). The cut and fill plan for the proposal has been designed to minimise disturbance and to target a cut and fill balance over the whole of the proposed alignment (Figure 2.4).

Blasting of rock faces will be required in the proposal area to maintain the proposed grade of the new rail tracks. BHPBIO intends to extend cuttings to obtain fill material rather than establishing new borrow sources. Where possible, borrow materials will be sourced from upslope of the rail formation.

If geotechnical investigations conclude that material from within the cuttings is unsuitable, new borrow pits may be required in areas adjacent to the rail. BHPBIO will provide the DEC with an opportunity to attend a site visit to advise on the siting of borrow pits.

Borrow pits will be constructed and managed in accordance with the procedures specified in the construction EMP (Appendix D). Borrow pits will be designed and constructed to ensure pits are free draining.

Figure 2.2 – Examples of Cut and Fill

2.5 CULVERTS

Engineering culverts are proposed for approximately 46 locations along the proposed rail formation. In addition, environmental culverts (minimum 300 mm diameter) are proposed at intervals of 50 m in areas of sheet flow to allow for conveyance of surface water downstream of the rail line. Engineering culverts will be sized for a 1 in 50 year rainfall event. Figure 2.5 shows typical culverts along the Mainline.

BHPBIO will provide the DEC with an opportunity to attend a site visit to advise on the suitability of culvert locations.

Scour protection structures (i.e. riprap pads) are proposed to be installed immediately upstream and downstream of culverts. Figure 2.6 shows typical riprap and culvert details.

2.6 CONTROLLED LEVEL CROSSINGS

Controlled level crossings will be installed where the rail access track crosses the new rail tracks at approximately chainages D221 and D237. The crossings will be appropriately sign-posted and will have solar powered flashing lights.

2.7 SIGNALS

Signals are proposed to be constructed for the new rail tracks at approximately chainages D227 and D233. All signals will be powered by solar panels located adjacent to the signal stations.

2.8 ACCESS TRACKS

A permanent maintenance access track will be constructed along the route of the Deviation, immediately adjacent to the rail formation (Figure 2.3). Additional temporary access tracks will be required during the construction phase to allow for materials handling. Access tracks will be constructed from locally sourced material with vee drains incorporated where necessary. Vee drains will not be constructed in locations where they may interfere with surface water drainage from environmental culvert outlets.

Where possible, existing tracks will be utilised for materials handling during the construction phase. Access tracks not required during ongoing operations will be rehabilitated at the end of the construction phase.

2.9 LAYDOWN AREAS

During construction, laydown areas will be required within the proposal area for storage of equipment, parking of vehicles and placement of temporary facilities.

Figure 2.3 – Typical Cross-Sections

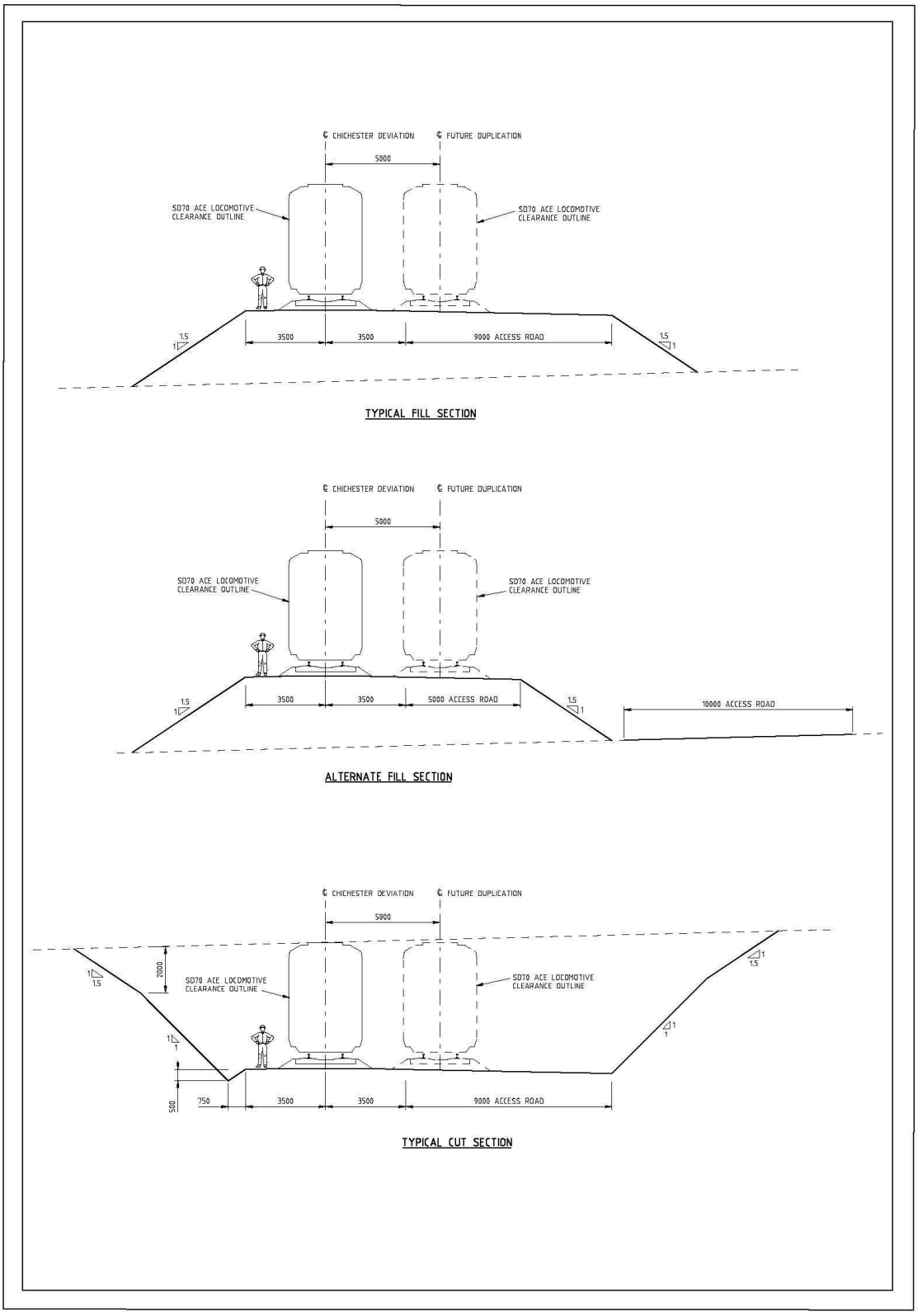


Figure 2.4 – Proposed Rail Formation Design

(Sheet 1 of 2)

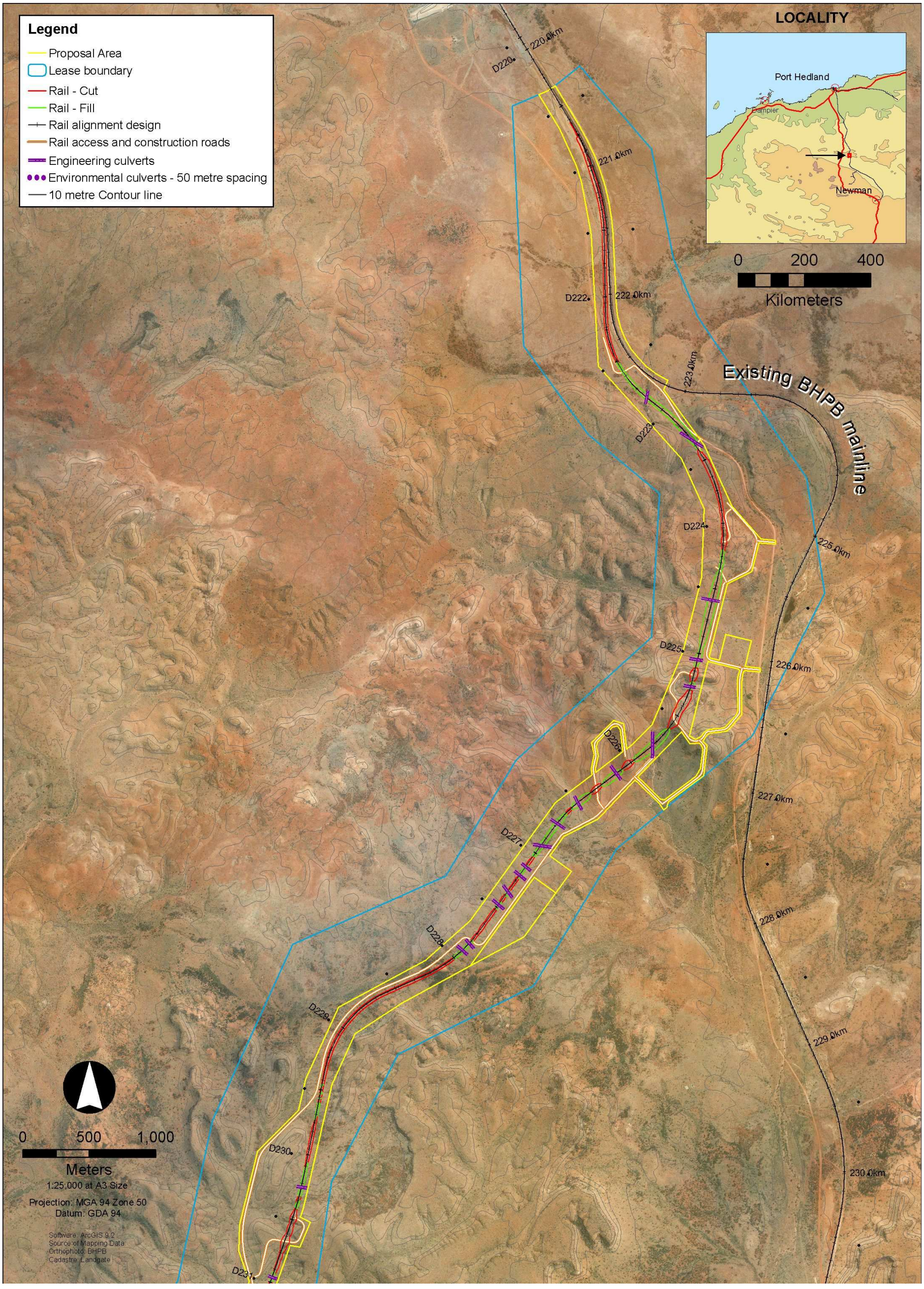


Figure 2.4 – Proposed Rail Formation Design

(Sheet 2 of 2)

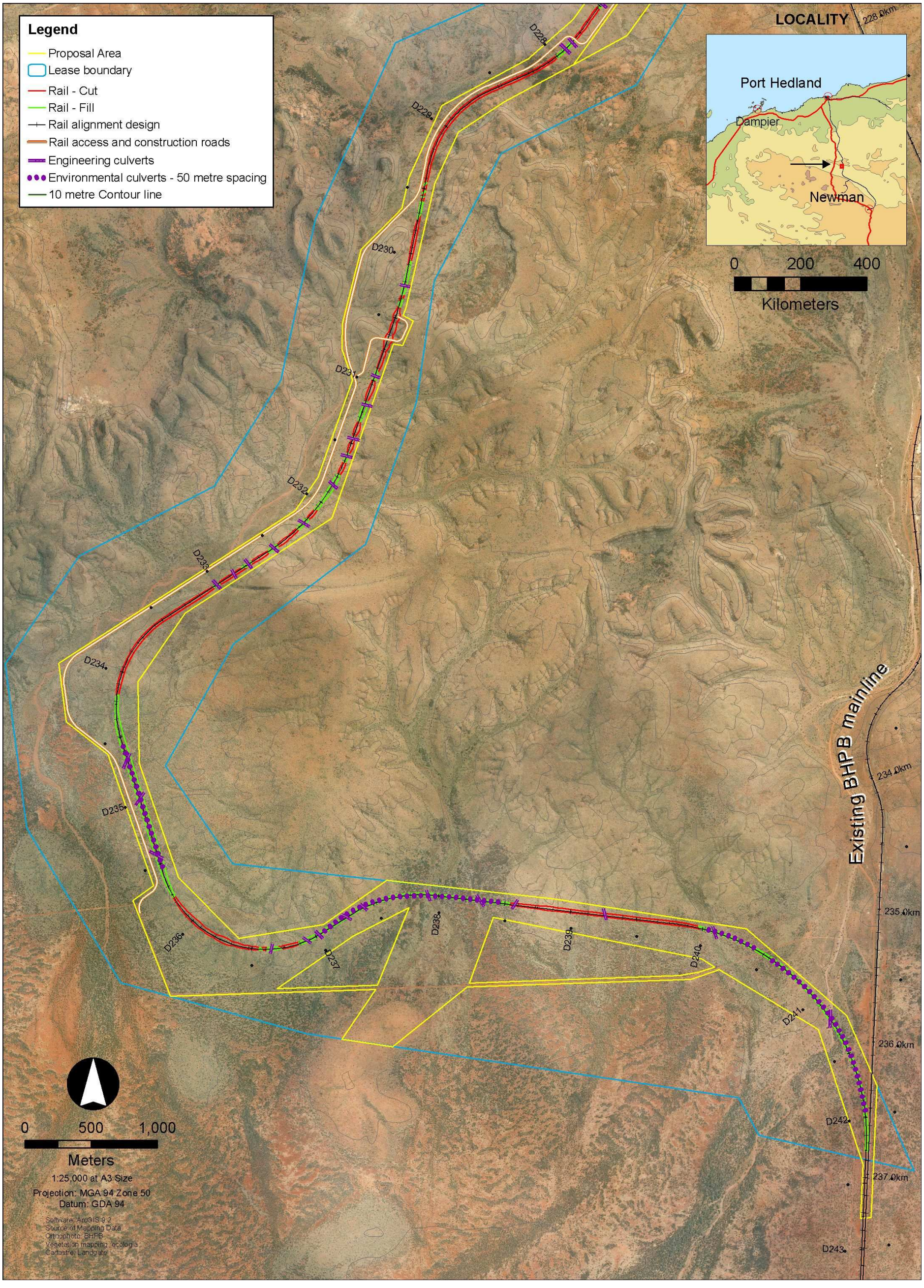


Figure 2.5 – Typical Culverts on the Mainline

2.10 FIBRE OPTIC CABLE

To provide for communications along the new rail tracks, fibre optic cable (FOC) will be direct buried along the length of the Deviation route. The FOC will be laid within a dedicated 10 m wide corridor located adjacent to the new tracks. Cable joints and spur pits will be located within this corridor.

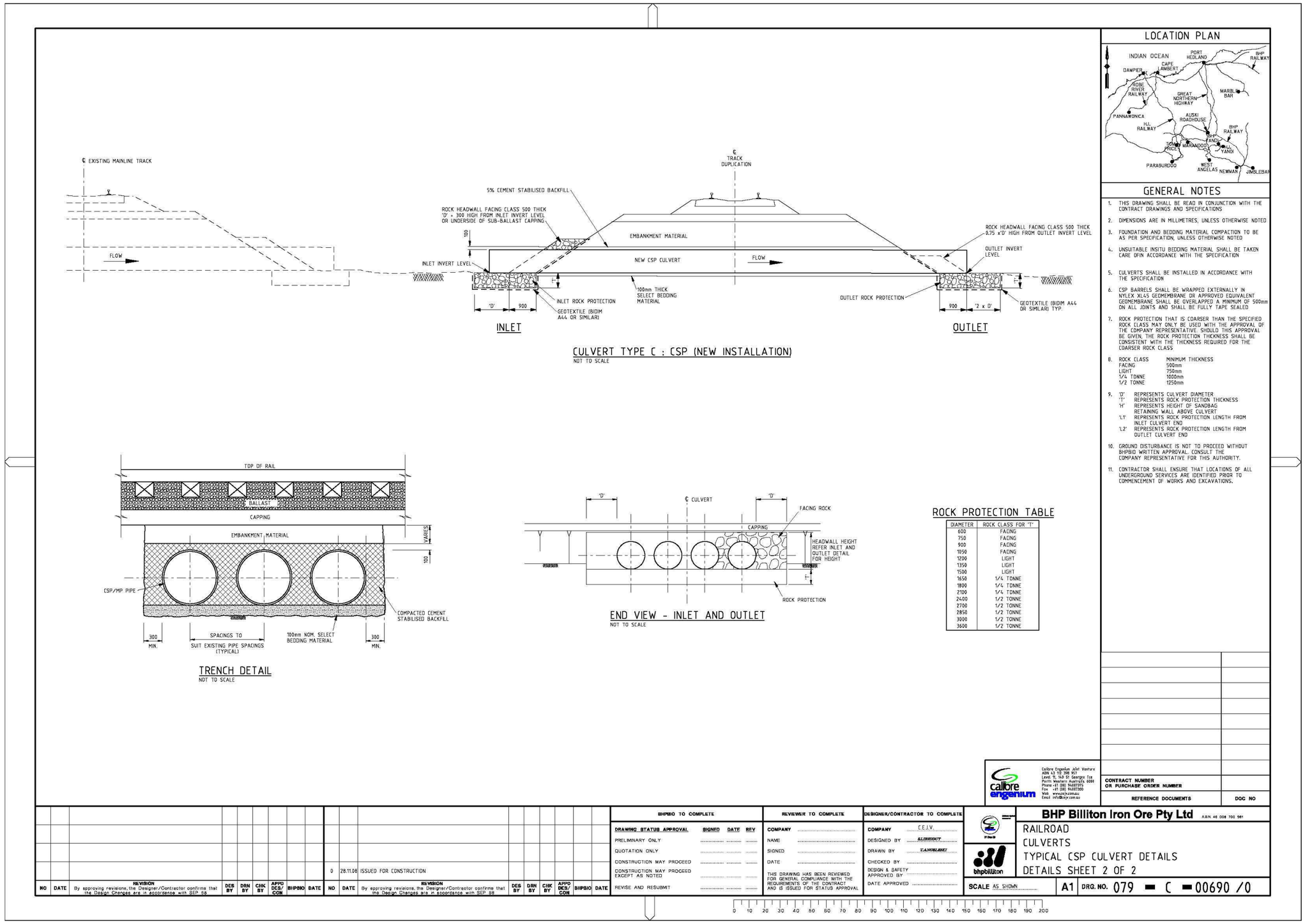
The fibre optic cable will be installed by first creating a rip line within an approximately three metre wide corridor. The cable will then be buried at a depth of approximately 1200 mm in the rip line using a modified bulldozer. Once the cable is installed, the rip line will be levelled with a grader.

For creek crossings, the cable will be installed using under-boring or trenching methods. BHPBIO will obtain a Permit to Interfere with Bed and Banks under the *Rights in Water and Irrigation Act*, *1914* for all watercourses intersected by the proposal.

If trenching is required for creek crossings, the project schedule will be managed to minimise the duration the trench must remain open. If trenches are left open overnight, fauna egress ramps will be installed in open trenches at the conclusion of each day's work. Where fauna egress ramps are required, these shall be placed at an angle no greater than 45 degrees.

A communications tower will also be required within the proposal area to facilitate VHF communications between train drivers.

Figure 2.6 – Typical Riprap and Culvert Specifications



2.11 WATER SUPPLY

Approximately 1000 kL/day (365 ML per annum) of water will be required during the proposal construction phase for activities including conditioning of fill material and dust suppression. This water will be supplied from two existing licensed bores (T234 and T243) located adjacent to the Mainline (see Table 2.3). Abstraction from these bores is authorised under GWL 167113(1). Groundwater quality in the existing bores is fresh to brackish (620 – 3800 mg/L total dissolved solids [TDS]) with a neutral pH (6.9 – 7.0).

In addition to using the existing turkey nest dams at each of the bores for water storage, water will be piped from bores T234 and T243 to approximately 10 turkey nest dams to be constructed along the Deviation within Miscellaneous Licence L45/147. There will be no additional clearing required for water supply pipelines.

BHPBIO propose to construct an additional bore at approximately Ch 225 km on the Mainline to supply water for the proposal. BHPBIO will obtain the relevant licences under section 26D and 5C of the *Rights in Water and Irrigation Act 1914* from the DoW for any additional bores required.

Existing bores will be retained post-construction for operational use. Pipelines and turkeys nests shall be decommissioned and all infrastructure removed from site during demobilisation.

Table 2.3 – Existing Groundwater Allocation

Groundwater Sub-Area	Aquifer	Allocation (kL/yr)	BHPBIO Rail Bores	Water Usage
Ashburton	Hamersley Fractured Rock	438,000	T226*	Earthworks and construction, dust suppression, rail operations
Ashburton	Hamersley Fortescue	105,000	T234, T243	Earthworks and construction, dust suppression, rail operations, camp purposes

* Abstraction rates from T226 will be reviewed to ensure no impact on Bamboo Springs. For construction purposes a new bore may be drilled approximately 1 km north of Bamboo Springs (approximate Ch 225 km).

2.12 POWER SUPPLY

Mobile diesel generators will be used to supply power for the proposal construction phase.

One generator of up to 30 Kva will be required for each water supply bore. Additional generators may be required to power site offices or crib huts which may be mobilised to the proposal area.

2.13 ACCOMMODATION

The construction workforce for the proposal will likely be accommodated at BHPBIO's Redmont rail camp, located near the Mainline approximately 205 km south of Port Hedland (see Figure 1.1). Redmont Camp is located approximately 15 km north of the proposal area. No additional approvals are required as part of this ERD for Redmont Camp.

A camp may also be required at Cowra siding, approximately 12 km to the south of the proposal area. BHPBIO will seek separate approvals for the construction of Cowra camp should this infrastructure be required.

2.14 SCHEDULE

The proposal will be implemented in two stages. The first stage will involve bulk earthworks (cut and fill) to establish the grade for the dual railway line. During the first stage, only single tracks will be laid. Duplicate rail track will be installed at a later date, but will not require additional earthworks.

Work for Stage 1 is scheduled to commence in Q3 (calendar year [CY]) 2009, and be completed in Q2 (CY) 2010, and Stage 2 is scheduled to commence in Q2 (CY) 2014, and be completed in

Q2 (CY) 2015. These milestones are indicative and subject to change based on actual construction timeframes and market conditions.

3 STAKEHOLDER CONSULTATION

Community involvement is an integral component of the environmental and social aspects of any future development in the Pilbara. With numerous expansion and development activities in and around Port Hedland and Newman, the dissemination of information to stakeholders and their involvement in the decision-making process is vital in facilitating the progression of these developments. BHPBIO's approach to community involvement is described in the company's 'Sustainable Development Policy' (Figure 6.2) which states that wherever the company operates BHPBIO will:

"Engage regularly, openly and honestly with people affected by our operations and take their views and concerns into account in our decision making".

BHPBIO recognises that developments within the Pilbara have the potential to impact the local community and environment and therefore considers it critical that community and government stakeholders are adequately briefed on the project and associated implications so as to allow for an informed assessment of the potential impacts.

3.1 CONSULTATION PLAN

In January 2008, BHPBIO released the "Expansion in the Pilbara: Community Engagement and Communication Plan" (BHPBIO, 2008c). This plan is designed to inform stakeholders and provide an opportunity for discussion and mechanisms for feedback through established, ongoing communications channels.

It draws on the principles of BHPBIO's existing HSEC policies and standards, communication and engagement plans for associated projects and data gathered through previous expansion projects. It also reflects information gathered from relevant stakeholders about how they wish to be engaged on BHPBIO's growth plans and EPA guidelines on community consultation.

The scope of the plan is predominately targeted towards the effective engagement of Pilbara communities, but also includes processes to facilitate existing communication and engagement processes with other stakeholder groups such as State and Commonwealth departments and Indigenous communities.

As part of this ongoing plan, BHPBIO has developed a community engagement and communication process which presents the approach BHPBIO is adopting in addressing the social and community issues associated with the growth projects.

This ongoing community engagement is supported by a range of mass media tools designed to inform the communities of Newman and Port Hedland about BHPBIO's growth plans and community investments, including the quarterly feature in the North West Telegraph newspaper "Partners in Community".

3.2 SOCIAL IMPACT ASSESSMENT

BHPBIO has conducted extensive Social Impact Assessments (SIA) since 2004 together with regular community focussed surveys and has collected significant data on issues of community interest and concern during periods of rapid expansion. This data has highlighted consistent, reoccurring themes and the themes relevant to the Chichester Proposal include:

1. Indigenous Issues (i.e. Aboriginal Heritage);
2. Operational – road and rail traffic; and
3. Regional Sustainability.

The SIA process is an ongoing monitored management system with a twelve monthly review. Whilst previous Social Impact Assessments have highlighted existing areas of concern to the community, the ongoing dialogue with the community, embedded in the approach to community consultation and social impact assessment, will identify emerging issues early in the project lifecycle and allow for effective management, mitigation or benefit opportunities to be addressed.

BHPBIO values the feedback provided by the communities in which it operates and this data helps inform decision making on management plans and community investment. BHPBIO contributes to community development projects designed to support these focus areas and reduce impacts of existing growth projects and prevent further impacts through effective mitigation.

BHPBIO has reviewed existing community consultation activities and undertaken a social impact assessment for the RGP5 project activities using primary data collected throughout the robust community consultation process in Newman and Port Hedland, extensive internal risk reviews and secondary data through BHPBIO involvement in the Pilbara Industry Community Council and other studies examining the unique social challenges faced in the Pilbara.

The assessment compared BHPBIO community consultation activities and management plans to address social impacts against global best practice and made recommendations for areas of improvement to effectively manage social impacts associated with the RGP5 project and future expansion plans.

Social impacts associated with the Chichester Deviation are likely to be limited to the increased construction workforce required to construct the project. These impacts are temporary and of low significance given the duration of the work and proximity of the accommodation Village at Redmont from the Town of Port Hedland. Some impact may be experienced at Port Hedland airport and on Great Northern Highway with increased people and vehicle traffic.

3.3 KEY STAKEHOLDERS

The public engagement program for BHPBIO's expansion projects involves consultation with a range of stakeholders representing the following main groups:

- Members of the public;
- Business associations;
- Contractors and partners;
- Conservation groups;
- Martu Idja Banyjima and Palyku claimant groups;
- Local community groups;
- Non-Government organisations (NGOs); and
- Local Council, State and Commonwealth government departments.

BHPBIO has identified a list of stakeholders who have an interest in the proposed Chichester Deviation activities, and who may be affected by the project. Key project stakeholders include, but are not limited to:

- Tourism operators;
- Pastoralists and Graziers association and individual pastoralists;
- Representatives of the Martu, Idja, Banyjima (MIB) and Palyku native title claimant groups;
- Pilbara communities in general;
- Community Consultative Groups, Newman and Port Hedland;
- Pilbara Development Commission;
- Environmental Protection Authority;
- Department of Environment and Conservation;
- Department of Mines and Petroleum (DMP);
- Department of State Development (DSD);
- Department of Water (DoW);

- Department of Indigenous Affairs;
- Town of Port Hedland;
- Shire of East Pilbara;
- Shire of Ashburton;
- Pilbara Dialogue – Growth Forum;
- Port Hedland Chamber of Commerce and Industry;
- Pilbara Industry Community Council;
- Chamber of Minerals and Energy; and
- Department of Consumer and Employment Protection.

3.4 COMMUNICATION AND STAKEHOLDER ENGAGEMENT

Specific engagement tailored to particular approval requirements is underpinned by regular communication with stakeholders on the broader subject of growth (including specific emerging impacts). Stakeholders have been categorised in accordance with the level of impact the activity will have on them and the level of interest expressed towards the activity. There are three methods of communication:

- ongoing communication primarily via personal interaction;
- ongoing consultation via existing community groups, NGOs and community forums; and
- regular routine updates via media advertorials and editorials, electronic tools tailored to the regional audiences such as DVD's, letters, internet and email distribution.

All growth communication tools and mechanisms include the capacity for feedback (i.e. provision of email address, telephone number or response sheet for formal tools and discussion component in personal interactions). All feedback is recorded, evaluated and appropriate action taken where required. Stakeholders are informed on the progress of the project or their concern to ensure the matter is resolved to their satisfaction. BHPBIO Community relations personnel actively participate in the consultation process.

The proposed Project and associated activities are expected to come into contact with a minimal number of community members, groups and associations. Given that, BHPBIO has continued to consult with key community stakeholders for other growth project components and included information related to the Chichester Deviation. BHPBIO has tracked responses and to date minimal to no concerns have been raised during these consultations relating to the Chichester Deviation. Consultation more closely focussing on and including information around Chichester Deviation began in mid 2008.

Table 3.1 provides a summary of community-related stakeholders that BHPBIO have engaged with on the Project and a record of any queries/concerns raised.

Table 3.1 – Community Consultation Summary

Themes	Stakeholder	Summary of Queries/Comments Raised
General Growth	Shire of East Pilbara – 28th Apr 2008	Meeting driven by Mine expansions, Rail expansions and Camps. General Growth update. No issues raised.
	Newman Chamber of Commerce and Industry (NCCI) - 10th Jun 2008	General Growth update including rail components. No issues raised.
	State Government – Minister for Mines, Petroleum and Fisheries, (Electorate Officer on behalf of Minister) – 8th Jul 2008	General Growth update including rail components. No issues raised.
	Shire of Ashburton – 6th Aug 2008	General growth updates. Planning Application requirements discussed and potential developments in the Shire.
	Shire of East Pilbara – 20th Aug 2008	General Growth updates.
	Newman Community Consultative Group (CCG) – 23rd Jul 2008	General Growth update including rail components. No issues raised.
	Newman CCG – 24th Sep 2008	General town updates. No Growth issues.
Town Services	Shire of East Pilbara – 7th Nov 2008	General Growth update. Discussed camps and Newman town services current state.
Chichester Regrade	Palyku Native Title Claimants – 12th Nov 2007	BHPBIO representatives attended a Palyku working group meeting and discussed some aspects of the project proposal, including outlining Aboriginal heritage issues.
	Palyku Native Title Claimants – 11th Dec 2007	BHPBIO representatives attended a Palyku working group meeting and discussed some aspects of the project proposal including Aboriginal heritage.
	Palyku Native Title Claimants– 1st Aug 2008	BHPBIO provided updated information on the project proposal.
	Palyku Native Title Claimants – 22nd Oct 2008	BHPBIO presentation on project proposal to the Palyku Working Group including an invitation to visit the project area with BHPBIO engineering and project personnel in attendance. Presentation included information on the works proposed, flora and fauna, rehabilitation, construction impacts, water and drainage issues
	Palyku Native Title Claimants – 17th Nov 2008	BHPBIO provided follow up advice and plans for project proposal to the Palyku's legal representatives about hydrological issues.
	Martu Idja Banyjima Native Title Claimants – 15th Dec 2007	BHPBIO representatives attend MIB Working Group meeting to make a presentation on the proposal. BHPBIO's offer was refused but the presentation and information were left with working group members for consideration. BHPBIO also offered to take the MIB to the area of the application.
	Martu Idja Banyjima Native Title Claimants – Jan 08 to Aug 08	Correspondence between BHPBIO and MIB representatives in relation to the proposal including the provision of information in relation to the proposal and offers to the MIB to consult with BHPBIO.
	Martu Idja Banyjima Native Title Claimants – 28th Aug 2008	BHPBIO presentation on project proposal to the MIB Working Group including an invitation to visit the project area. Presentation included information on the works proposed, flora and fauna, rehabilitation, construction impacts, water and drainage issues

Key government agencies were also briefed on the project with input from specialist branches obtained during scoping and implementation of the various environmental studies undertaken for the Project. A copy of the draft referral was also distributed to key government agencies (DoW, DEC and DMP) for review prior to submission to the EPA.

Project briefing meetings were held with representatives from the following State government agencies:

- Department of Environment and Conservation – Regional Office (Karratha);
- Department of Environment and Conservation – Environmental Management Branch;
- Department of Water;
- Department of Mines and Petroleum
- Environmental Protection Authority Service Unit;

Table 3.2 provides a summary of comments and queries raised by government agencies during development of the Referral Document.

Table 3.2 – Government Consultation Summary

Factor / Aspect	Agency	Comment	Response	Relevant Section
Groundwater	**Department of Water** - Pilbara Region	BHPBIO will be required to apply for licences under section 26D and 5C of the RIWI Act to construct bores and abstract groundwater. It is expected that due to the small volumes of water required from each bore and the short periods of draw that impacts will be minimal.	Water requirements for construction of the Chichester Deviation will be sourced from existing bores located adjacent to the Newman to Port Hedland Mainline. Abstraction from these bores is covered under GWL 167 112(1) and 167113(1). If additional bores are required for the proposal, BHPBIO will obtain the relevant licences under section 26D and 5C of the *Rights in Water and Irrigation Act 1914.*	2.12 4.5
	Department of Environment and Conservation - Environmental Management Branch	Information to be provided on whether extraction of groundwater will impact on groundwater dependent ecosystems, such as Bamboo Springs.	Water requirements for construction of the Chichester Deviation will be sourced from existing bores located adjacent to the Newman to Port Hedland Mainline. The closest existing groundwater bore (T226 at approximate chainage 226 km) is located 170 metres south-east of Bamboo Springs. BHPBIO anticipate that groundwater abstraction from this bore will have negligible impact on Bamboo Springs. An additional bore may be constructed approximately 1 km north of Bamboo Springs at approximate chainage 225 km on the Mainline in the event that abstraction does impact on the Spring. All groundwater abstraction activities will be undertaken in accordance with GWL 167112(1) and GWL 167113 (1) and the Groundwater Operating Strategy that has been approved by the Department of Water. Groundwater drawdown will be monitored and measured as per the Groundwater Operating Strategy. If additional bores are required for the proposal, BHPBIO will obtain the relevant licences under section 26D and 5C of the *Rights in Water and Irrigation Act 1914.* This will include a review of potential impacts on Bamboo Springs.	8.1

Factor / Aspect	Agency	Comment	Response	Relevant Section
Surface Water	**Department of Environment and Conservation** - Environmental Management Branch	DEC requests the opportunity to be involved in ground truthing the location of: - rail alignment; - borrow pits; and - environmental culverts.	Noted. BHPBIO is happy to provide the Department of Environment and Conservation with an opportunity to attend a site visit and advise on the suitability of culvert and borrow pit locations.	2.5 7.2
	Department of Mines and Petroleum - Minerals Environment Branch	Will refinement of alignment design to maximise natural surface water flows be pre or post the approval process? If post the approval process what are the likely changes to the impacts being considered in the documents reviewed and how will those changes be assessed?	BHPBIO has sought to refine the proposed rail alignment prior to seeking approval. The alignment and associated design outlined in the Environmental Referral Document aims to maximise surface water flows by: • Shifting the alignment as far upslope as possible (within the constraints of tenure) in areas of cut to mitigate potential impacts on down-slope mulga communities; • Designing environmental culverts at 50 m intervals in areas upslope of sheetflow dependent mulga. As part of the construction of the Chichester Deviation BHPBIO has also committed to: • Installation of low spur embankments on the upstream side of the rail line to direct surface water flows to culverts and maintain existing drainage patterns; • Installation of a shallow cement stabilised road based dip in the rail access road downsteam of environmental culverts; and • Installation of riprap pads immediately downstream of environmental culverts and railway access roads to disperse surface water runoff. BHPBIO does not anticipate that the impacts that have been identified and evaluated in the Environmental Referral Document will differ post approvals. However, potential impacts will be monitored and managed in accordance with the Surface Water Management Plan.	Executive Summary 7.2

Factor / Aspect	Agency	Comment	Response	Relevant Section
	Department of Mines and Petroleum - Minerals Environment Branch	The maintenance access track will need to be engineered to minimise sheetflow disruptions in areas where this has been identified as a concern. There is little point in installing environmental culverts for sheetflow purposes if the maintenance track downhill from those culverts is going to act as a barrier by being raised above the surrounding surface or by having V drains either side. The provision of V drain/spoon drains etc provides for all weather access but is not compatible with the requirement to minimise sheetflow disruptions. The location of the maintenance access track is probably best put in the areas of more incised drainage to minimise those issues.	Vee drains will not be constructed adjacent to access tracks where they may obstruct water flow from culvert outlets. To minimise sheetflow disruption BHPBIO is proposing to install shallow cement stabilised road based dip in the rail access road downstream of environmental culverts.	2.9
	Department of Mines and Petroleum - Minerals Environment Branch	Is a culvert necessary at approx Ch 222.0 km? It looks like the proposed railway line crosses a local drainage.	The rail formation is in a cutting at this location and is not expected to change the existing drainage pattern.	Fig 2.4
	Department of Mines and Petroleum - Minerals Environment Branch	While the sheetflow distruption due to the fill section of the railway can be managed by the provision of culverts, how are the potential sheetflow issues for the cut sections addressed? Main problem areas seem to be chainage 236 - 237 and 238 - 240.	The rail alignment has been located as far upslope as possible within the constraints of tenure to minimise impacts on areas of sheetflow sensitive mulga vegetation. BHPBIO anticipate that impacts on sheetflow sensitive mulga vegetation will be minimal in areas of cut. These cuts are typically in areas where the slope is greater than 2% and sheetflow is unlikely to occur.	7.2
	Department of Mines and Petroleum - Minerals Environment Branch	Please provide some information on the effectiveness of having minimum 300 mm diameter culverts at 50 meter intervals. Is this requirements backed by some research on effective management measures? Why 300 mm diameter and 50 m spacing?	Minimum culvert specifications (300 mm diameter at 50 m intervals) were incorporated into the rail design based on advice from the Department of Environment and Conservation (Environmental Management Branch).	Table 9.1
	Department of Mines and Petroleum - Minerals Environment Branch	What specifications for the riprap? Does culvert maintenance include riprap maintenance as well? Why the twice yearly requirement for maintenance? Is this based on previous experience? Would it not be	Riprap specifications are included in Section 2 (Figure 2.6). Noted. BHPBIO will ensure that visual inspection of culverts is undertaken prior to the onset of the typical wet	2.6 SWMP 7.2 Table 9.1

Factor / Aspect	Agency	Comment	Response	Relevant Section
		better / more efficient to carry out such maintenance following large rainfall events?	season, and as required following significant rainfall events. Ripraps will be included in inspections and maintenance conducted as required.	
	Department of Mines and Petroleum - Minerals Environment Branch	Does the additional engineering listed as a potential remedy to damaged or ineffective sheetflow distribution extend to constructing additional culverts? How practical / financially feasible would it be to install additional culverts post railway construction?	BHPBIO does not intend to install additional culverts once the rail line is operational. However, BHPBIO will monitor the effectiveness of the sheetflow redistribution structures through visual inspections. If these are damaged or ineffective, additional engineering (ie re-design) or maintenance will be undertaken to ensure sheetflow is re-established.	SWMP 7.2
Borrow Pits	**Department of Environment and Conservation** - Environmental Management Branch	Ensure borrow pits are located and designed to allow for best rehabilitation outcomes (eg no weeds, self-draining). DEC should be involved in determining suitable borrow pit locations.	BHPBIO is happy to provide the Department of Environment and Conservation with an opportunity to attend a site visit and advise on the suitability of borrow pit locations. All borrow pits on the Chichester Deviation will be constructed in accordance with the Construction Environmental Management Plan. This includes ensuring that the borrow pits are free draining following the rehabilitation of the borrow pit. All borrow pits will be managed in accordance with the measures outlined in the Weed Management Plan to minimise the potential for introducing or spreading weed species.	2.5
Mulga	**Department of Environment and Conservation** - Environmental Management Branch	Provide detail on scope and design of mulga monitoring program. Further information should be provided on: - methodology of mulga monitoring; - trigger levels; and - contingency actions. Suggested that mulga monitoring includes quantitative and qualitative measures of plant health.	A mulga monitoring program will be developed in consultation with the DEC. It is proposed that monitoring will involve field assessment including quantitative and qualitative monitoring of mulga at various distances from the rail line and at suitable reference sites outside of the potential impact zone. Assessment shall consider structure, composition and health/condition as stress indicators. It is proposed that monitoring shall be conducted prior to construction to establish a baseline, following conclusion of construction activities and then on a 2-yearly basis. Trigger levels and appropriate actions will be developed,	7.2 SWMP

Factor / Aspect	Agency	Comment	Response	Relevant Section
			if necessary, in consultation with DEC and will be determined following analysis and reporting of results.	
	Department of Environment and Conservation - Environmental Management Branch	A baseline condition assessment prior to construction should be undertaken to provide a valid health comparison for monitoring.	BHPBIO will undertake a baseline condition assessment prior to the commencement of construction activities. The quadrats that are selected for the baseline assessment will be utilised for the ongoing monitoring program and will also include suitable reference sites.	7.2 SWMP
	Department of Environment and Conservation - Environmental Management Branch	*"No significant impact to upstream or downstream vegetation, particularly sheetflow dependent mulga communities".* Clarify performance indicator with reference to sub-critical levels of impact. 'Significant' levels of impact need to avoided rather than used as initial trigger levels.	Trigger levels and appropriate actions will be developed, if necessary, in consultation with DEC and will be determined following analysis and reporting of results from the baseline mulga condition assessment.	SWMP
	Department of Mines and Petroleum - Minerals Environment Branch	Are quantitative monitoring measures planned to monitor sheetflow impacts as well as the proposed qualitative visual inspections by the site Environmental Officer of the day? This approach requires an assessment of control areas as well. Who will develop and assess the required methodology? Trees tend to be long lived and may not show significant signs of decline for quite some time following sheetflow disruptions. Those impacts may include reduced flowering and seed set which may not be detectable from visual inspections alone. The tenure of site environment officers tends to be of a limited nature (less than it would take a mature Mulga tree to decline or die) and the comparisons made by different individuals over time may not be all that useful to assess long term changes. It may be a good idea to look at what is being done in relation to that issue at CloudBreak (FMG) HopeDowns rail spur line (Rio/Hancock Prospecting) and potentially other BHPBIO / Rio sites.	A mulga monitoring program will be developed in consultation with the DEC and will take into consideration monitoring programs that have been established on other rail projects. It is proposed that monitoring will involve field assessment including quantitative and qualitative monitoring of mulga at various distances from the rail line and at suitable reference sites outside of the potential impact zone. Assessment shall consider structure, composition and health/condition as stress indicators.	7.2 SWMP

Factor / Aspect	Agency	Comment	Response	Relevant Section
Fauna	**Department of Environment and Conservation** - Environmental Management Branch	Implement reasonable speed limits, with driving preferably avoided between dusk and dawn, or in instances where night time driving is required, stringent speed limits (eg 40 km/hr) in place.	BHPBIO will implement reasonable speed limits to minimise the potential roadkill of fauna. Night time activities will also be avoided where practicable. Speed limits for driving activities will be subject to a risk-assessment and will take into account environmental and safety factors.	7.3.5 SSMP
	Department of Environment and Conservation - Environmental Management Branch	Barbed wire fences should be avoided.	Barbed wire fencing will not be used in the project area.	7.3.5
	Department of Mines and Petroleum - Minerals Environment Branch	Northern Quoll has also been recorded (scats and trapped animals) from Talison Minerals Wodgina mine site recently (Bamford 2008, to the north of the proposal)	Noted.	Fauna Report
Vegetation	**Department of Mines and Petroleum - Minerals Environment Branch**	The vegetation condition index is not listed in the text. It is also not listed in section 3.2.6 of Ecologia's Flora report. Generally a recognised vegetation condition index is used and referred to. See table 12, page 48 of Bush Forever Volume 2 published by DPI in 2000.	The vegetation condition index is included as Table 3.6 of Ecologia's flora report (Appendix F). This index is based on the vegetation scales in Table 12 of Bush Forever Volume 2, December 2000.	
Weeds	**Department of Environment and Conservation** - Environmental Management Branch	Weeds need to be mapped prior to disturbance / construction.	BHPBIO will conduct baseline weed mapping prior to commencement of construction to identify existing weed populations.	7.5 WMP
	Department of Environment and Conservation - Environmental Management Branch	Any weed areas should be quarantined. Should access be required to these areas, there is a need for suitably located wash down bays, in order to ensure that all machinery and vehicles operating in infested areas are cleaned down and inspected prior to moving from the area.	BHPBIO has made the following commitments within the Weed Management Plan to minimise the potential for introducing or spreading weed species within the Chichester Deviation project area: - Areas of known weed infestation will be shown as 'Weed Risk' areas on construction plans and marked on the ground (using signs or other clearly recognisable measures) in order to minimise the potential for inadvertent access and spread of weeds. - Access to 'Weed Risk' areas with known infestations will be restricted to authorised personnel. - Mobile machinery and equipment will be inspected,	7.5 WMP

Factor / Aspect	Agency	Comment	Response	Relevant Section
			cleaned and certified prior to being brought into the Chichester Deviation Project area, being moved from a 'Weed Risk' area to another part of the site, or being removed from the Project area.	
	Department of Environment and Conservation - Environmental Management Branch	Need to make a long term commitment to monitoring and managing weeds along the rail deviation through construction and operation.	BHPBIO is committed to monitoring and managing weeds along the rail deviation and will undertake quarterly monitoring during construction and annual monitoring once operational. Measures to manage weeds found on the deviation are outlined in the Weed Management Plan.	WMP
Rehabilitation	**Department of Environment and Conservation** - Environmental Management Branch	Need to ensure that topsoil and vegetation are systematically managed along the rail alignment to ensure most efficient and effective use of this material in progressive rehabilitation.	Vegetation and topsoil will be recovered and preferably, directly placed on disturbed areas. It is likely that some material will need to be stockpiled. These stockpiles will be placed in designated areas and be no more than 1.5 m in height for topsoil and 2 m in height for vegetation stockpiles to allow for maintenance of viable residual soil seed.	8.3
	Department of Environment and Conservation - Environmental Management Branch	The location of topsoil and vegetation stockpiles needs to avoid low lying and sheet flow dependent areas to minimise interruptions to sheetflow.	The location of topsoil and vegetation stockpiles will be preferentially located to avoid drainage lines and low lying and sheet flow dependent areas.	8.7.5 SWMP
	Department of Environment and Conservation - Environmental Management Branch	Provide detail on the process for developing completion criteria and when/what context completion criteria will be developed.	Closure planning for BHPBIO's rail operation will be undertaken in accordance with BHP Billiton's Standards and procedures. This will take into consideration the Chichester Deviation and will include the development of completion criteria. Closure planning and establishment of completion criteria will also be undertaken in consultation with relevant stakeholders.	8.3
	Department of Environment and Conservation - Environmental Management Branch	Ensure borrow pit rehabilitation is included in development of completion criteria.	Borrow pits will be rehabilitated progressively when they are no longer of use and will be rehabilitated in accordance with the Construction Environmental Management Plan to ensure that they are self-draining. BHPBIO's closure planning process for the rail operations will include suitable completion criteria that will be developed in consultation with relevant stakeholders. The Closure Plan will also encompass the	8.3

Factor / Aspect	Agency	Comment	Response	Relevant Section
			Chichester Deviation. Completion criteria that are developed will take into consideration borrow pit rehabilitation and final landuse. Any borrow pits that are progressively rehabilitated as part of the Chichester Deviation will be reassessed when the Closure Plan is in place to ensure that they meet the completion criteria.	
	Department of Environment and Conservation - Environmental Management Branch	Consider rehabilitating old legacy disturbed areas (eg borrow pits, quarries) associated with existing rail.	BHPBIO is progressing a Closure Plan for the rail operations, which takes into consideration old legacy disturbed areas such as borrow pits and quarries. Completion criteria will be developed in consultation with relevant stakeholders and will include borrow pit and quarry rehabilitation and final landuse. BHPBIO is committed to seeking opportunities for progressive rehabilitation of historically disturbed areas along the Newman-to-Port Hedland mainline in advance of closure. This is dependent to some extent on having suitable material to backfill disused borrow areas and is typically dealt with on a case-by-case basis. The proposed alignment of the Chichester Deviation has been designed to ensure that cut-to-fill ratios are approximately equal and hence there is no surplus material that can be used for backfill and rehabilitation of historical borrow pits.	8.3
	Department of Mines and Petroleum - Minerals Environment Branch	Additional potential impact is not recovering or insufficient recovery of topsoil/subsoil resource as part of pre-strip for the project. It is standard *Mining Act 1978* tenement condition that topsoil be stripped and stockpiled separately as part of mining operations. If there is likely to be a shortfall of topsoil a topsoil/subsoil budget showing how much is required and how much is available is a good idea to document such issues over time and plan on how to remedy a shortfall at various closure stages. The proposed management and mitigation	Noted. This has been included as a potential impact. BHPBIO is committed to recovering as much topsoil as is reasonably practicable on the Chichester Deviation project. It is not anticipated that there will be a shortfall in topsoil required to rehabilitate disturbed areas that are not required as part of ongoing operations. Topsoil recovery and management will be undertaken in accordance with the Construction Environmental Management Plan and PP-13-15 Land Disturbance procedure.	Executive Summary 8.3

Factor / Aspect	Agency	Comment	Response	Relevant Section
		should refer to a specific topsoil management procedure and borrow pit management procedure.		
Proposal Description	**Department of Mines and Petroleum - Minerals Environment Branch**	Should state what happens to old mainline, does it get rehabilitated once the two new lines are constructed or does it remain for operations or other reasons.	The existing mainline through the Chichester Range will continue to be used after construction of the Chichester Deviation.	2.1
	Department of Mines and Petroleum - Minerals Environment Branch	Approximate amount of disturbance is given as 400 ha in Table 2.1. The Mining Proposal document will require more defined categories to request the appropriate environmental bond amounts. The table should also show the amount of area in hectares that will be rehabilitated post construction (laydown, borrow pits, camp extensions, temporary access tracks etc).It would be beneficial to put a timeframe on the rehabilitation of the areas listed above.	The area of disturbance is broken down in Table 2.2. Cleared areas not required for permanent infrastructure (approximately 282 ha) will be rehabilitated. This includes borrow sources, temporary construction roads, fibre optic cable corridors and laydown areas. Rehabilitation will be carried out progressively with all other areas not required for ongoing operations rehabilitated at the completion of construction activities.	2.1
	Department of Mines and Petroleum - Minerals Environment Branch	Where is the blue metal listed sourced from? How is it delivered to site? Where is it stockpiled? Are there any environmental considerations with regards to haulage, delivery and stockpiling? In the Mining Proposal a section on the geotechnical suitability of that material as well as for the borrow material mined from L45/147 for the purpose intended will be required.	Ballast for the rail line is likely to be sourced from an existing quarry (Quarry 8) and will be transported to the proposal area by ballast train and/or truck. Stockpiling of ballast within the proposal area for construction of the rail will be minimised. These details will be addressed in the Mining Proposal that will be submitted to the Department of Mines and Petroleum for assessment.	2.5.1
Fibre Optic Cable	**Department of Mines and Petroleum - Minerals Environment Branch**	Egress ramps should be a minimum of 45 degrees where provided.	Where fauna egress ramps are required, these shall be placed at an angle no greater than 45 degrees.	2.11
	Department of Mines and Petroleum - Minerals Environment Branch	Fibre optic cable may be better attached to railway bridge or similar infrastructure to minimise disturbances to creekbanks. Beds and Banks permits will be required from DOW for trenching works.	There will be no bridges constructed along the Chichester Deviation. BHPBIO will obtain a Permit to Interfere with Bed and Banks under the *Rights in Water and Irrigation Act 1914*, for all watercourses intersected by the proposal.	2.11

Factor / Aspect	Agency	Comment	Response	Relevant Section
Water Supply	**Department of Mines and Petroleum - Minerals Environment Branch**	How will water be piped (above/underground pipeline) on L45/147, is that disturbance included in the disturbance table. What is the water quality like? Salinity?	Water will be piped by an overland pipeline from existing bores on the Newman to Port Hedland mainline to designated locations within the project area. There will be no additional clearing for the pipeline. Groundwater quality in existing bores is fresh to brackish (620 - 2800 mg/L TDS with neutral pH (6.9 - 7.0).	2.12 4.5
	Department of Mines and Petroleum - Minerals Environment Branch	DMP will need more geotechnical details with regards to the proposed location and construction of the turkeys nests mentioned. Turkeys nest need to be recorded as separate type of disturbance as they attract a higher bond rate and present more risks. What happens to all the bores/pipelines/turkeys nests mentioned post construction?	Additional geotechnical details will be provided in the Mining Proposal to be submitted to the Department of Mines and Petroleum. Existing bores will continue to be retained post-construction for operational use. Pipelines and turkeys nests shall be decommissioned and all infrastructure removed from site during demobilisation.	2.12
Figures	**Department of Environment and Conservation** - Environmental Management Branch	Vegetation maps referenced but not included in ERD.	Noted. Vegetation mapping has been included in Section 4.7 of the Environmental Referral Document.	4.7
	Department of Mines and Petroleum - Minerals Environment Branch	Figure 7.1. The location of the access track proposed should be shown as well as it is also a potential disruption to the sheetflow patterns indicated on the maps.	Noted. Figure 7.1 has been updated to include access tracks.	7.2

4 EXISTING ENVIRONMENT

4.1 CLIMATE

The proposal area is situated in the Pilbara region of Western Australia and experiences an arid-tropical climate with two distinct seasons, a hot summer from October to April and a mild winter from May to September.

Climatic data from the Bureau of Meteorology's Pilbara weather stations indicate that peak rainfall occurs in the summer months between January and March with a smaller peak in May and June. The mean annual rainfall at Redmont camp, which is approximately 15 km north of the proposal area, is 308.4 mm, with a monthly mean rainfall varying from 1.1 mm in September to 63.5 mm in December (Bureau of Meteorology, 2008).

Rainfall during summer months is strongly influenced by tropical cyclone systems that develop over the ocean north of Australia, and can move inland bringing heavy rainfall. Rainfall during May and June is the result of cold fronts moving across the south of the State that occasionally extend to the Pilbara.

Maximum temperatures of the Pilbara range between 39℃ to 40℃ in summer and 25℃ to 27℃ in winter.

Annual evaporation rates in the Pilbara are in the order of 3000 mm, greatly exceeding the mean annual rainfall (Bureau of Meteorology, 2009).

4.2 TOPOGRAPHY AND LANDFORMS

The topography of the proposal area is dominated by the undulating hills of the Chichester Range. The Chichester Range runs in a general east-west direction and forms a watershed between the north-flowing river systems and the westerly flowing Fortescue River (DEWHA, 2007).

South of the Chichester Range, the gently sloping plains descend into the Fortescue valley. Elevation ranges from approximately 400-450 m RL in the valley, to 500-600 m RL through the Chichester Range (Environ, 2005).

4.3 GEOLOGY AND SOILS

The Pilbara region comprises a portion of the ancient continental Western Shield, which dominates the geology of Western Australia. The Western Shield is comprised of pre-Cambrian Proterozoic and Archaean rocks. The Pilbara Craton dates back to the Archaean and is overlain by Proterozoic rocks deposited in the Hamersley and Bangemall Basins. Hamersley Basin rocks give rise to high, rounded hills, plateaus, and strike ridges (Thorne and Tyler, 1997). The Hamersley Basin, which occupies most of the southern part of the Pilbara Craton, can be divided into three stratigraphic groups: the Fortescue, Hamersley, and Turee Creek Groups (Beard, 1975). Of the three stratigraphic groups within the Hamersley Basin, the Hamersley and Fortescue Groups outcrop within the proposal area.

The Hamersley Group is generally 2.5 km thick and it contains both the Brockman Iron Formation and the Marra Mamba Iron Formation, which together provide most of the known major iron ore deposits in the Pilbara region. The Marra Mamba Iron Formation is represented in the proposal area, and is the lowest unit of the Hamersley Group and discontinuously overlies the Jeerinah Formation.

Fortescue Group rocks outcrop in the Chichester Range, are about 1.8 km thick and consist of low-grade metamorphosed volcanic and sedimentary rocks (Thorne and Tyler, 1997). The Jeerinah Formation is represented in the proposal area, and comprises a basal quartz sandstone (Woodiana Member) overlain by carbonaceous pelite, chert, and minor thin-bedded sandstone. The Chichester Range separates the Fortescue River and Shaw River drainage systems.

The geology of the region around the proposal area has been mapped and described by Thorne and Tyler (1997). The four main geological elements occurring within the proposal area are summarised below:

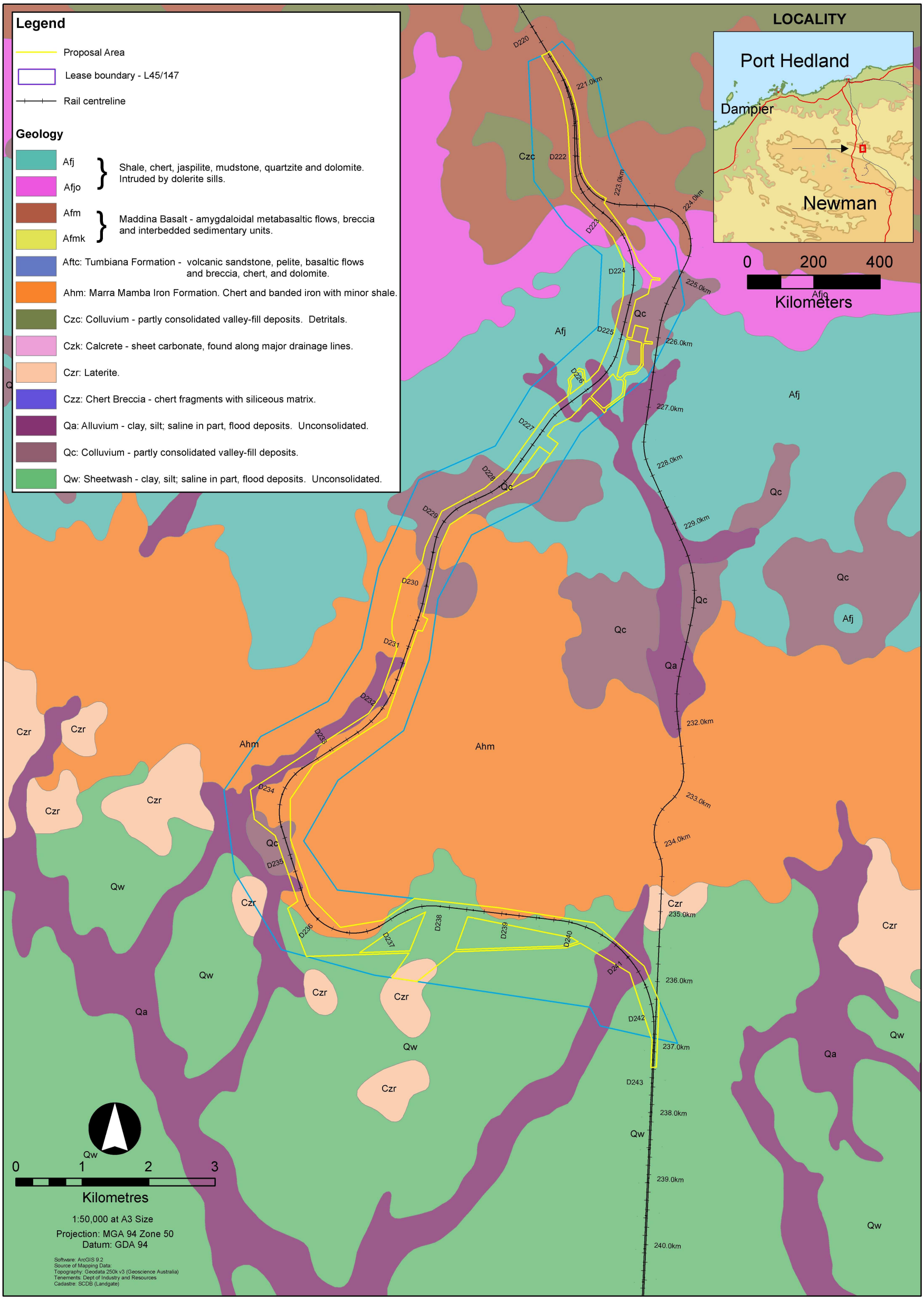
- The Jeerinah Formation of the Fortescue Group features to the north of Hesta Siding in the northern section of the Chichester Range. This Formation is composed of pelite, chert and thin-bedded meta-sandstone.
- The Marra Mamba Iron Formation of the Hamersley Group features to the south of Hesta Siding in the southern section of the Chichester Range. This Formation is composed of chert, banded iron formation and pelite.
- Extensive areas of Cainozoic sediment deposits of the Fortescue River Valley feature in the southern section of the proposal area, and also in the Shaw drainage system in the northern most section of the proposal area. These Formations comprise alluvium and colluvium, red-brown sandy and clayey soil on low slopes and sheetwash areas, colluvium, unconsolidated quartz and rock fragments in soil and alluvium, unconsolidated silt, sand, and gravel, in drainage channels and floodplains.
- Brecciated siliceous caprock over dolomitic rock features in the Fortescue River Valley in the southern part of the proposal area. This formation features angular chert fragments in a chert matrix and it overlies the Wittenoom Formation.

The regional geology is shown in Figure 4.1.

The proposal area lies with the Chichester Range soil-landscape zone as described by Tille (2006). The Chichester Range Zone features hills and dissected plateau (with some stony plains) on basalt and sedimentary rocks of the Hamersley Basin. Soils comprise stony soils with some red shallow loams and hard cracking clays.

As a consequence of the sparse vegetation cover and the erosive force of heavy summer cyclonic rains, much of the soil on the hill slopes tends to be transported down to the valleys and plains. This is an intermittent and slow process which occurs over a long period of time. Thus, species and associations of vegetation on the hills and slopes tend to be correlated to geology rather than soil type (Beard, 1975). Along drainage lines, superficial deposits influence the distribution of the vegetation, but the presence of surface and groundwater is also a major determining factor.

Figure 4.1 – Regional Geology



4.4 SURFACE WATER HYDROLOGY

The proposal is located within the Pilbara surface water area, proclaimed under the *Rights in Water and Irrigation Act 1914*. As such, BHPBIO will apply to the DoW for a Permit to interfere with the bed and banks for all prescribed watercourses intersected by the proposal.

The proposal area is located in the upper northwest sector of the Fortescue Marsh catchment. The Deviation crosses a number of drainage lines and creeks which drain in a southerly direction toward the Fortescue Marsh (Aquaterra, 2008).

Runoff from the Chichester Range drains as overland flow before concentrating in defined channels. In this process, surface detention, vegetation, seepage and other mechanisms absorb water from the runoff stream. In steep areas, the runoff processes are characterised by relatively low losses and defined drainage channels are typically in close proximity (Aquaterra, 2008).

Where defined drainage channels from steeper slopes enter the lower slope areas, the channels typically have a reduced discharge capacity and in many instances become less well defined and braided or may even completely disperse in flat areas. In these reducing slope channels, runoff tends to over spill the main channel flow zones and spread over a wider front (Aquaterra, 2008). In some of the lower slope areas, developed mulga communities may depend on this sheet flow.

The proposal does not cross any named creeks, however a number of minor drainage lines will be intercepted. Natural drainage lines within the proposal area typically cross the alignment perpendicularly and drain into relatively small catchments (up to 5 km^2), with the exception of the creek crossing at Ch D 241 which has a catchment area of 57 km^2.

There are no wetlands of National or subregional significance (Kendrick and McKenzie, 2001) within the proposal area. One permanent wetland, Bamboo Springs is located within the Miscellaneous Licence L45/147, however it is outside the proposal area. No impact on Bamboo Springs from the implementation of the proposal is anticipated.

4.5 GROUNDWATER

The proposal area lies within the Ashburton sub-area of the Pilbara Groundwater Area, proclaimed under the *Rights in Water and Irrigation Act 1914*. There are no Public Drinking Water Source Areas within the proposal area.

BHPBIO currently holds several 5C Licences under the *Rights in Water and Irrigation Act 1914* to take groundwater near the proposal area. Groundwater is currently used for ongoing rail operational and construction works, and water supply for line camps.

Water requirements for construction of the Chichester Deviation will be met by sourcing existing bores located adjacent to the Newman to Port Hedland Mainline. Abstraction from these bores is permitted under GWL 167113(1). Groundwater quality in the existing bores is fresh to brackish (620 – 3800 mg/L TDS) with neutral pH (6.9 – 7.0).

BHPBIO propose to construct an additional bore at approximately Ch 225 km to supply water for the proposal. The relevant licences under section 26D and 5C of the *Rights in Water and Irrigation Act 1914* will be obtained from the DoW for any additional bores required.

Groundwater occurrence within the Fortescue and Hamersley Groups is generally associated with faults and fracture zones, where locally increased permeability occurs (Aquaterra, 2007).

The depth to groundwater is likely to range from just below ground surface (in the area to the south of the proposal near the Fortescue Marsh and in the vicinity of major drainages), to in excess of 20 m below ground level (mbgl) through the Chichester Range (Aquaterra, 2007).

4.6 LAND SYSTEMS

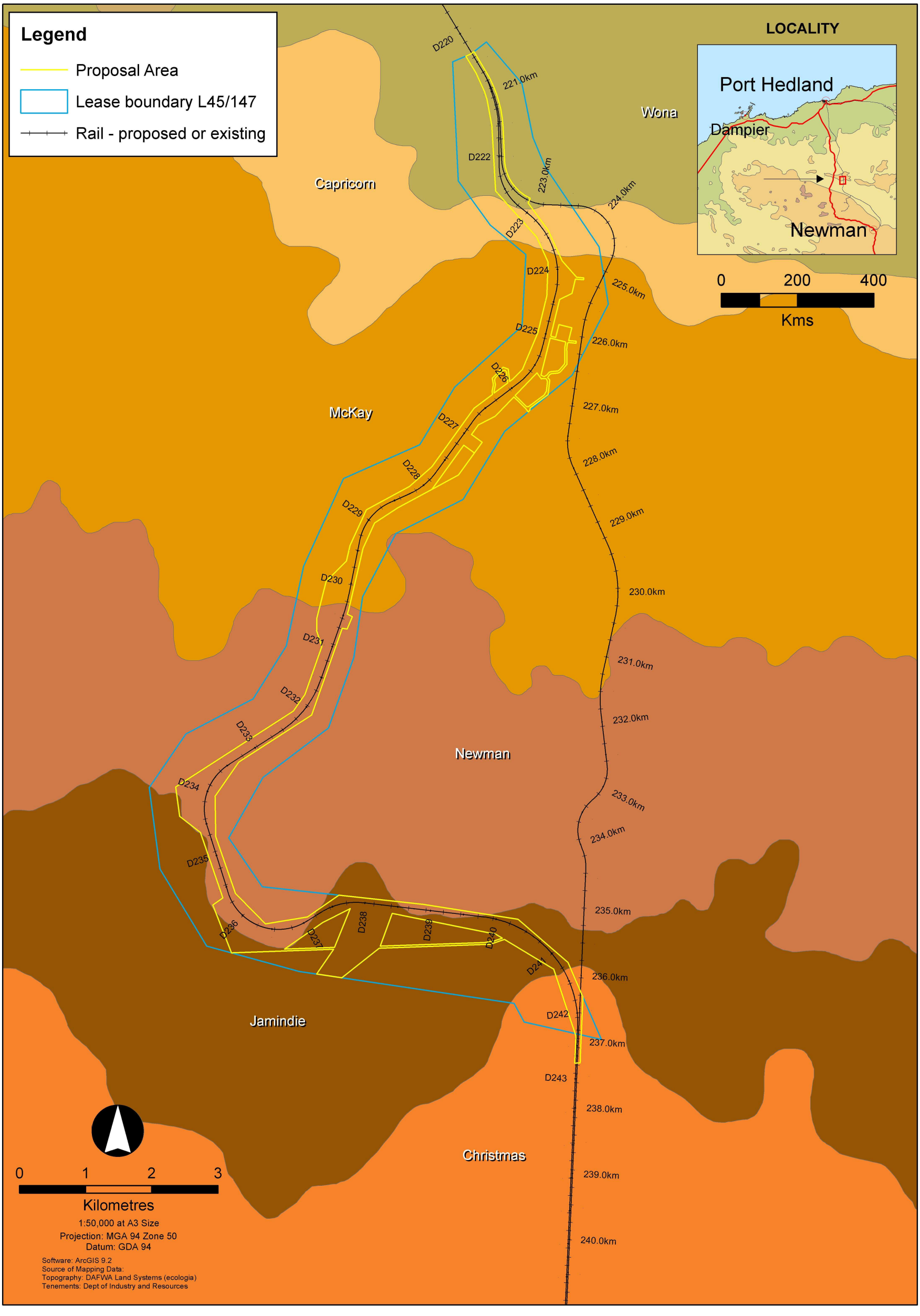
The proposal area lies in a region with a diversity of land types, represented by six land systems that have been mapped by Van Vreeswyk et al. (2004) (Figure 4.2). A description of the land systems and the extent of potential impact of the proposal are detailed in Table 4.1.

Table 4.1 – Land Systems and Associated Level of Impact

Land System	Description	Total area of Land System in WA (km^2)	Approx. length of rail corridor in each Land System (km)		Percentage of Land System area occurring in the proposal area[2]
Wona	Basalt upland Gilgai plains supporting tussock grasslands and minor hard Spinifex grasslands	1815	TOTAL	2.9	0.032
			Within existing Mainline corridor	1.5	0.017
			Within Chichester Deviation	1.4	0.015
Capricorn	Hills and ridges of sandstone and dolomite supporting shrubby hard and soft Spinifex grasslands	5296	TOTAL	0.9	0.003
McKay	Hills, ridges, plateaux remnants and breakaways of meta sedimentary and sedimentary rocks supporting hard Spinifex grasslands	4202	TOTAL	6.8	0.032
Newman	Rugged jaspilite plateaux, ridges and mountains supporting hard spinifex grasslands	14580	TOTAL	6.2	0.009
Jamindie	Stony hardpan plains and rises supporting groved mulga shrublands, occasionally with spinfex understory	2074	TOTAL	4.3	0.041
Christmas	Stony alluvial plains supporting snakewood and mulga shrublands with sparse tussock grasses	232	TOTAL	1.8	0.155
			Within existing Mainline corridor	0.7	0.057
			Within Chichester Deviation	1.1	0.098

[2] Based on a nominal 200 m wide corridor.

Figure 4.2 – Land Systems of the Project Area



4.7 VEGETATION

BHPBIO commissioned *ecologia* Environment (*ecologia*) to conduct a Level 2 vegetation and flora survey of the proposal area (Appendix F). Phase 1 of the flora survey was completed in October 2007, and Phase 2 completed in May 2008.

The Interim Biogeographic Regionalisation of Australia (IBRA) divides the Australian continent into 85 biogeographic regions based on their climate, faunal, vegetation, landform and geological features. The proposal area falls within the Pilbara region, which is further subdivided into the Hamersley, Fortescue Plains, Chichester and Roebourne subregions. The proposal area lies within the Chichester and Fortescue Plains subregions, which are described below:

- Chichester Subregion – undulating Archaean granite and basalt plains including significant areas of basaltic ranges. Typical vegetation of the area is shrub steppe on basalt plains characterised by *Acacia inaequilatera* over *Triodia wiseana* hummock grasslands, while *Eucalyptus leucophloia* tree steppes occur on basaltic ranges;
- Fortescue Plains Subregion – alluvial plains and river frontage, with extensive salt marsh, mulga-bunch grass and short grass communities on alluvial plains in the east. River gum woodlands fringe the drainage lines. It is also the northern limit of mulga (*Acacia aneura*) (*ecologia*, 2008a).

The footprint of the proposal covers approximately 0.0019% of the Chichester Subregion and 0.0239% of the Fortescue Plains Subregion.

4.7.1 Mapped Vegetation Descriptions

The southern portion of the Chichester plateau, which descends into the Fortescue valley, is marked by a belt of broken country described by Beard (1975) as having the following sequence:

- *Acacia aneura* (mulga) in groved patterns with an understorey of *Triodia pungens* on lower slopes;
- tree steppe of *Eucalyptus leucophloia* and *Triodia wiseana* hummock grasses on the hill slopes with an *Acacia aneura* (mulga) low woodland in the valleys;
- shrub steppe of *Acacia pyrifolia* (kanji) and mixed hummock grasses including *Triodia pungens* and *T. wiseana* on the gentler basalt slopes and flat; and
- short tussock grassland of mixed species on the gilgai plains of cracking clays.

4.7.2 Regional Vegetation Significance

A vegetation type is considered to be underrepresented if there is less than 30% of its original extent remaining. From a biodiversity perspective, and taking no account of any other land degradation issues, there are several key criteria applied to vegetation where clearing is still occurring (EPA Position Statement No. 2, 2000):

- the “threshold level” below which species loss appears to accelerate exponentially at an ecosystem level is regarded as being at a level of 30% of the pre-European extent of the vegetation type. Vegetation communities where less than 30% of the original vegetation extent remain are referred to as “Vulnerable”; and
- a level of 10% of the original vegetation extent is regarded as being a level representing an “Endangered” vegetation community. Clearing which would put a vegetation type into this category should be avoided.

Such vegetation community status can be delineated into five (5) classes, where:

Presumed extinct:	Probably no longer present in the bioregion
Endangered*:	<10% of pre-European extent remains
Vulnerable*:	10-30% of pre-European extent exists
Depleted*:	>30% and up to 50% of pre-European extent exists

Least concern: >50% pre-European extent exists and subject to little or no degradation over a majority of this area.

*or a combination of depletion, loss of quality, current threats and rarity gives a comparable status.

The extent of remnant native vegetation has been assessed by Shepherd (2002), based on vegetation association mapping undertaken by Beard (1975). The remaining extent of vegetation associations within the proposal area is close to 100% of the pre-European extent within the Fortescue Plains and Chichester subregions. Based on Shepherd's mapping, these vegetation types fall into a status category of 'Least Concern'.

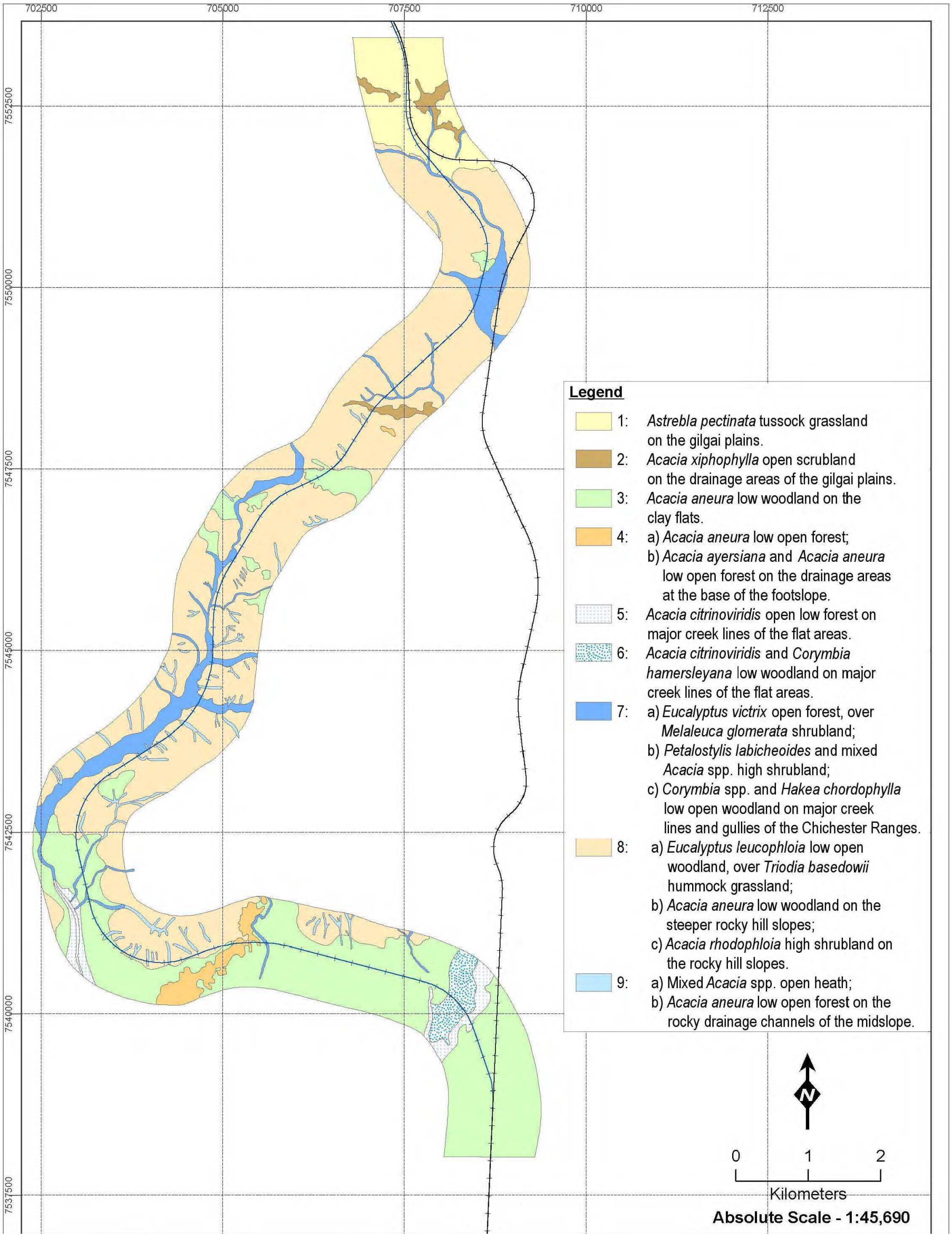
4.7.3 Project Area Vegetation Mapping

Vegetation within the proposal area was mapped into nine vegetation types, with some types further classified into subtypes based on structure and species composition (Table 4.2) (*ecologia*, 2008a). Vegetation classifications are shown in Figure 4.3.

Table 4.2 – Vegetation Units identified within the Proposal Area

Habitat	*ecologia* Vegetation Unit	Vegetation Description
Gilgai Plains: Red-Brown Cracking Clay	1	*Astrebla pectinata* tussock grassland
	2	*Acacia xiphophylla* open scrubland
Plain: Open bare areas of hard clay pans with common ferrous pebbles	3	*Acacia aneura* woodland
Drainage areas at the base of the footslope	4a	*Acacia aneura* low open forest
	4b	*Acacia ayersiana* and *Acacia aneura* low open forest
Major creek lines of the flat areas	5	*Acacia citrinoviridis* low open forest
	6	*Acacia citrinoveridis* and *Corymbia hamersleyana* low woodland
Major creek lines of the Chichester Ranges	7a	*Eucalyptus victix* open forest, over *Melaleuca glomerata* shrubland
	7b	*Petalostylis labicheoides* and mixed *Acacia* spp. high shrubland
	7c	*Corymbia* spp. and *Hakea chordophylla* low open woodland
Rocky hill slopes: stone and boulders of ironstone	8a	*Eucalyptus leucophloia* low open woodland, over *Triodia basedowii* hummock grassland
	8b	*Acacia aneura* low woodland
	8c	*Acacia rhodophloia* high shrubland
Drainage channel on rocky hill slopes: stones and bounders of ironstone	9a	Mixed *Acacia* spp. open heath
	9b	*Acacia aneura* low open forest

Figure 4.3 – Vegetation Classifications of the Project Area



Most of the habitats and associated species within the proposal area are well represented in the region and loss or modification of these habitats within the proposal area is unlikely to reduce regional biodiversity (*ecologia*, 2008a).

Three vegetation units were identified in the proposal area as having moderate to high local and regional conservation significance (*ecologia*, 2008a):

- mixed tussock grassland on the low lying flats/plains (Vegetation Unit 1);
- *Acacia xiphophylla* medium to tall scrubland (Vegetation Unit 2); and
- moderately dense *Acacia ayersiana* and *Acacia aneura* woodland (Vegetation Unit 4b).

Vegetation units 1 and 2 are associated with the gilgai plains of cracking clays.

Vegetation condition was assessed using the vegetation Condition Rating developed by Bush Forever (Government of WA, 2000). Due to the relative inaccessibility of the Chichester Range, vegetation condition within the proposal area is generally excellent (*ecologia*, 2008a).

4.7.4 Mulga Communities

Mulga (*Acacia aneura* and variants) represents a major vegetation type in the southern section of the proposal area (*ecologia*, 2008a). It also represents the northern limit of Mulga in Western Australia (Kendrick, 2001).

The Mulga root system is adapted for taking up water from thin surface soils and has adaptations that concentrate soil water near the plant and conserve water within the plant. The distribution and abundance of Mulga is therefore influenced by soil moisture and surface drainage patterns (Paczkowska and Chapman, 2000).

Mulga communities are vulnerable to altered surface water flow patterns and require appropriate management to ensure their sustainability (Section 7.2).

4.7.5 Weeds

Baseline flora surveys conducted within the project area identified six environmental weed species (*ecologia*, 2008a):

- *Aerva javanica* (Kapok Bush);
- *Bidens bipinnata* (Beggars Tick);
- *Cenchrus ciliaris* (Buffel Grass);
- *Cucumis melo subsp. agrestis* (Ulcardo Melon);
- *Malvastrum americanum* (Spiked Mavastrum); and
- *Vachellia farnesiana* (Mimosa Bush).

During baseline flora surveys, most weeds were observed within drainage lines and areas close to the existing Mainline. The spatial footprint of weeds is considered minimal, relative to the total project area. Specific locations of identified weed populations are included in the Weed Management Plan (Appendix C).

None of the weed species observed are declared under the *Agriculture and Related Resources Protection Act 1976*.

4.8 THREATENED ECOLOGICAL COMMUNITIES

Ecological communities are defined as ‘naturally occurring biological assemblages that occur in a particular type of habitat’ (English and Blythe, 1997). At a National level, threatened flora and ecological communities are protected under the EPBC Act. Threatened Ecological Communities (TECs) are listed under the EPBC Act as Critically Endangered, Endangered or Vulnerable. No EPBC Act listed TECs were identified within the proposal area.

The DEC maintains a list of TECs that are categorised as Presumed Totally Destroyed, Critically Endangered, Endangered or Vulnerable. No State-listed TECs occur within or close to the proposal area. Possible threatened ecological communities that do not meet survey criteria, or that are not adequately defined, are added to a list of Priority Ecological Communities (PECs). Communities are placed in this category while consideration can be given to their declaration as TECs.

A small proportion of the State listed Priority 3(iii) PEC "Plant assemblages of the Wona Land System" is located within the proposed project footprint between approximately Ch D220 – D223. Impact to this system is expected to be negligible as the proposal is in close proximity to the existing Mainline corridor in this area. A maximum 2.9 km of the rail corridor crosses this land system, accounting for 0.032% of the Wona Land System. Of this, approximately 1.5 km falls within the Mainline corridor which contains existing rail infrastructure and access tracks.

4.9 ENVIRONMENTALLY SENSITIVE AREAS

Environmentally Sensitive Areas (ESAs) are subject to definition under Section 51B of the EP Act and may include areas such as those requiring special management attention to protect important scenic values, fish and wildlife resources, historical and cultural values, and other natural systems or processes.

There are no ESAs within the proposal area. The nearest ESA is the Fortescue Marsh, located approximately 11 km south of the Chichester Deviation. The proposal is not expected to impact on the Fortescue Marsh.

4.10 FLORA

The two-phase vegetation and flora survey identified a total of 306 taxa within the proposal area, consisting predominantly of species from the Poaceae, Mimosaceae and Malvaceae families (*ecologia*, 2008a).

Ten Priority flora species have been recorded during flora and vegetation surveys associated with rail expansion projects in the vicinity of the proposal area (*ecologia,* 2003, 2007; Biota, 2004a, 2004b) (Table 4.3).

Table 4.3 – Priority Flora Species Previously Recorded within the Vicinity of the Proposal Area

Status	Species	Area Found	Non DEC Survey Record	DEC Database Record
P1	*Eremophila spongiocarpa*	Immediately north of Cowra Siding	Biota, 2004a	*
	Josephinia ?sp. Marandoo	5 km north of Cowra Siding	Biota, 2004a	
P2	*Ischaemum albovillosum*	Adjacent to Shaw Siding	Biota, 2004a	*
	Paspalidium retiglume	Adjacent to Shaw Siding	Biota, 2004a	
	Scaevola sp. Hamersley Range basalts	6 km west of the Chichester Deviation area	*ecologia*, 2005	
P3	*Goodenia nuda*	Near Chichester deviation area	Biota & Trudgen, 2002	
	Hibiscus brachysiphonius	Adjacent to Shaw Siding, Quarry 8	Biota, 2004a; *ecologia*, 2008f	*
	Polymeria sp. Hamersley	8 km north of Cowra Siding	Biota, 2004a	
	Themeda sp. Hamersley Station	Adjacent to Shaw Siding	Biota, 2004a	
P4	*Eremophila youngii* subsp. *lepidota*	2.5 km north-west of Cowra Siding	N/A	*

No Declared Rare Flora were recorded during surveys of the proposal area and records indicate that no Declared Rare Flora taxa have been collected within a 20 km buffer of the proposal area (*ecologia*, 2008a).

Five populations of *Goodenia nuda* (Priority 3) were identified within the proposal area (*ecologia*, 2008a). Populations at each of these sites were small, with less than 10% cover, and were located within creeklines and minor drainage channels (Figure 4.4). *G. nuda* is considered to have wide distribution range throughout the Pilbara (*ecologia*, 2008a).

No other rare or priority flora species were identified within the proposal area (*ecologia*, 2008a).

4.11 FAUNA

Information from a desktop review of previous surveys and database records indicate that 36 native mammal species, 139 bird species, 100 reptile species and 6 amphibian species have the potential to occur within the proposal area (*ecologia*, 2008b).

ecologia conducted a Level 2 biological survey of vertebrate fauna within the proposal area in October 2007 and April/May 2008 (Appendix G). Vertebrate fauna species recorded during the surveys included 20 mammal species (9 bats, 6 rodents and 5 dasyurids), 94 birds, 57 reptiles, 1 amphibian and 5 introduced species.

Four major terrestrial fauna habitats were identified within the proposal area (Table 4.4). In addition, 6 major avian fauna habitats were identified (*ecologia*, 2008b) (Table 4.5).

Table 4.4 – Terrestrial Fauna Habitats

Habitat Type	Land System
Mulga woodland over long unburnt dense grass hummocks	McKay, Jamindie
Open woodland over patchy to dense understory on rocky ground	Newman, Jamindie
Dense spinifex grassland on rocky scree slope	McKay
Regenerating vegetation after recent fire activity	McKay

Table 4.5 – Avian Fauna Habitats

Habitat Type	Land System
Mulga woodland over spinifex hummocks	McKay, Newman
Open woodland over dense grass hummocks	Jamindie
Regenerating rocky hill slope after fire	McKay
Open woodland over dense understory on rocky ground. Dense understory can be patchy	Jamindie, Newman
Rocky hill side with dense spinifex hummocks	McKay
Burnt mulga woodland, open canopy with regenerating spinifex	McKay

The conservation significant fauna recorded during surveys of the proposal area, and those species considered likely to occur within the proposal area, based on habitats, known distribution, database searches and results of previous biological surveys, are listed in Table 4.6. Additional species reported by *ecologia* (2008b) as having low likelihood of occurrence have been excluded from Table 4.6.

Figure 4.4 shows the locations of significant fauna species observations during the fauna surveys.

Figure 4.4 – Significant Species within the Proposal Area

(Sheet 1 of 2)

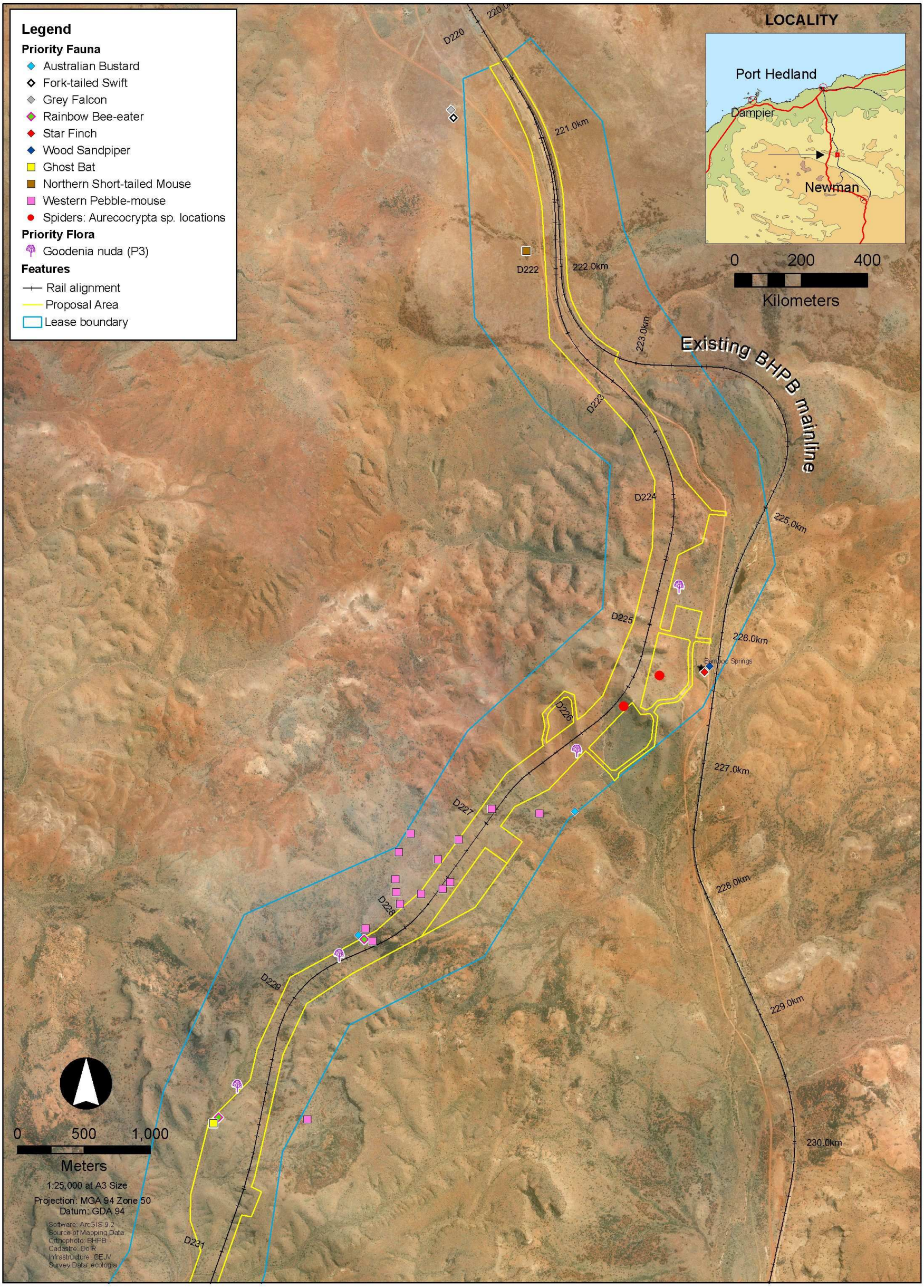


Figure 4.5 – Significant Species within the Proposal Area

(Sheet 2 of 2)

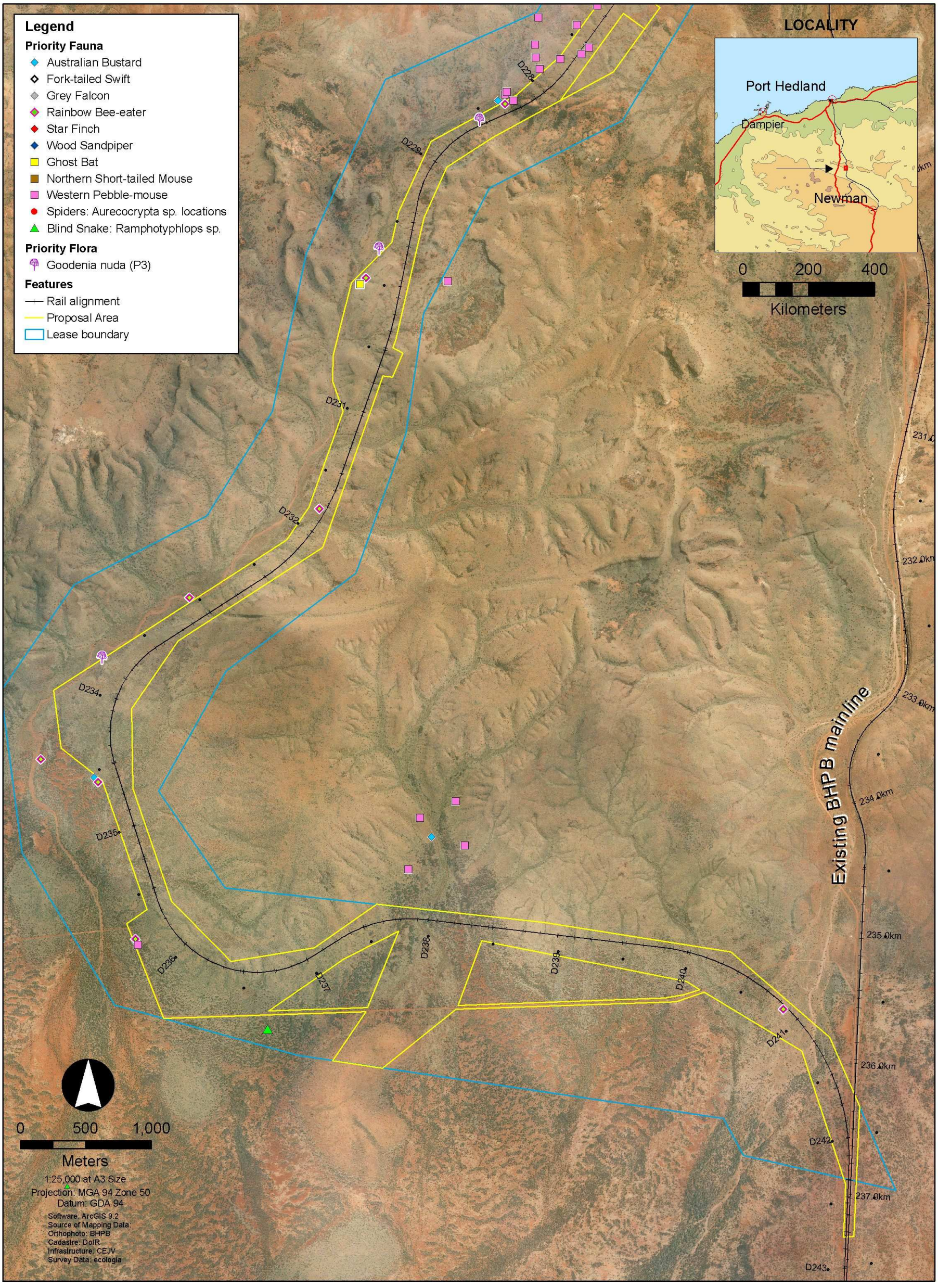


Table 4.6 – Fauna Species of Conservation Significance that Potentially occur in Proposal Area

Species	Common Name	Conservation Significance			Habitat	Previous Records	Likelihood of Occurrence	Regional Impacts
		EPBC Act	WCA	DEC				
Mammals								
Macroderma gigas	Ghost Bat			P4	Wide range of habitats; natural rockpiles in the local area.	A single call recorded within the proposal area (*ecologia*, 2008b).	HIGH – NON-RESIDENT Call recorded within proposal area. There were no potential roost caves or caverns in the rail corridor.	LOW No suitable roost locations recorded. Development will not significantly impact foraging habitat.
Leggadina lakedownensis	Northern Short-tailed Mouse			P4	Wide range of habitats, all on seasonally inundated red or white sandy-clay soils.	Recorded during baseline surveys and during a recent Level 1 survey to the north at Quarry 8, located adjacent to the Mainline at Ch 220 km (*ecologia*, 2008b).	HIGH – RESIDENT Recorded on cracking clays south of Shaw Siding.	LOW Extensive suitable habitat adjacent to proposal area. Low impact to habitat in propoasl area.
Pseudomys chapmani	Western Pebble-Mound Mouse			P4	Spurs and rocky hills with many small pebbles vegetated by hummocks of large Spinifex.	20 mounds recorded within the lease area during baseline surveys.	HIGH – RESIDENT Numerous active or recently active mounds were located suggesting the species is a resident.	LOW Suitable habitat common across Pilbara. Low impact from development on local populations.

Species	Common Name	Conservation Significance			Habitat	Previous Records	Likelihood of Occurrence	Regional Impacts
		EPBC Act	WCA	DEC				
Dasyurus hallucatus	Northern Quoll	EN	S1		Rocky areas, also eucalypt forest and woodland	Scats and tracks recorded approximately 18 km north of the proposal area at Quarry 4 (*ecologia*, 2008e). Also known from the Hamersley Range area approximately 30 km south of the proposal area (*ecologia*, 2008e).	MEDIUM Recent records from Abydos plain and Quarry 4 and also known from Hamersley Range to the south.	LOW Suitable habitat only recorded near Bamboo Spring. The Spring is located outside of the proposal area. Specimens recorded in surrounding areas.
Macrotis lagotis	Greater Bilby	VU	S1		Spinifex hummock grassland and acacia scrub.	Regional records from within 2.5 km of study area (DEC rare fauna database). Suitable habitat within the survey area.	MEDIUM Nearby records, but no burrows observed within the rail corridor.	LOW No suitable habitat located in the proposal area. Low likelihood of utilising proposal area due to fauna habitats present
Rhinonicteris aurantis (Pilbara form)	Pilbara Leaf-nosed bat	VU	S1		Roost in hot, humid caves	No records in the region. No suitable habitat within the survey area.	LOW No suitable roost sites within proposal area and no nearby records.	LOW No suitable habitat present. Low likelihood of occurrence in the proposal area.
Sminthopsis longicaudata	Long-tailed Dunnart			P3	Rocky habitat with Spinifex or open habitat with rocky mantle.	No previous records, but suitable habitat is present.	LOW No nearby records but potentially suitable habitat is present.	LOW Low likelihood of occurrence. Widespread populations across arid regions.

Species	Common Name	Conservation Significance			Habitat	Previous Records	Likelihood of Occurrence	Regional Impacts
		EPBC Act	WCA	DEC				
Dasycercus blythii	Brush-Tailed Mulgara			P4	Sandy areas with moderately dense Spinifex with 'runways' between clumps.	Not recorded within 50 km, but some suitable habitat exists.	LOW Not recorded and no nearby records, but some potential habitat.	LOW Suitable habitat in adjacent areas. Low likelihood of occurrence.
Birds								
Merops ornatus	Rainbow Bee-eater	Mig			Open country, most vegetation types, dunes and banks.	Recorded opportunistically along creeklines during baseline surveys of the proposal area.	HIGH – RESIDENT May breed within study area.	LOW Relatively common and abundant species. Nomadic and suitable habitat adjacent to proposal area.
Apus pacificus	Fork-tailed Swift	Mig			Almost entirely aerial lifestyle. Nomadic.	Recorded outside of the lease boundary at approximately 50 m east of the Mainline at Ch 221 km.	HIGH – OVERFLY VISITOR Will not use habitats present in the study area.	LOW Almost entirely aerial. Will not use habitat within proposal area.
Tringa glareola	Wood Sandpiper	Mig			Coastal wetlands, casual in interior.	No previous records, but recorded during baseline surveys of the proposal area at Bamboo Springs.	HIGH – VISITOR ON PASSAGE Species uses Bamboo Spring wetland on passage.	LOW Only suitable habitat is Bamboo Spring. The Spring is located outside of the proposal area.
Ardeotis asutralis	Australian Bustard			P4	Open grasslands, chenopod flats and low heathland.	Numerous individuals recorded during baseline surveys of the proposal area. Relatively common in the proposal area (*ecologia*, 2008b).	HIGH – NOMADIC VISITOR May breed within proposal area.	LOW Locally common. Suitable habitat adjacent to proposal area.

Species	Common Name	Conservation Significance			Habitat	Previous Records	Likelihood of Occurrence	Regional Impacts
		EPBC Act	WCA	DEC				
Burhinus grallarius	Bush Stone-curlew			P4	Lightly wooded country next to daytime shelter of thickets or long grass.	Recorded opportunistically approximately 6 km north of the proposal area.	HIGH – RESIDENT Species is likely to occur within proposal area.	LOW Suitable habitat adjacent to proposal area. Territory of individuals large enough to allow movement away from disturbance.
Neochmia ruficauda subclarescens	Star Finch			P4	Vegetation around watercourses.	Recorded at Bamboo Springs during baseline surveys of the proposal area.	HIGH – RESIDENT Resident and potentially breeds at Bamboo Spring.	LOW Bamboo Spring is located outside of the proposal area. Small proportion of population may be affected by the proposal.
Falco hypoleucos	Grey Falcon			P4	Lightly wooded coastal and riverine plains.	Recorded approximately 500 m west of the Mainline at Ch 220 km.	HIGH – HUNTING VISITOR Proximity of the breeding pair suggests it is likely that the area will be used for hunting on occasion.	LOW Foraging area much larger than area impacted by the proposal. Capable of moving away from disturbances.
Falco peregrinus	Peregrine Falcon		S4		Coastal cliffs, riverine gorges and wooded watercourses.	Recorded approximately 3 km north of the proposal area by DEC (*ecologia*, 2008b).	MEDIUM – HUNTING VISITOR Recorded just north of study area and may use proposal area for hunting.	LOW Foraging area much larger than area impacted by the proposal. Capable of moving away from disturbances.

Species	Common Name	Conservation Significance			Habitat	Previous Records	Likelihood of Occurrence	Regional Impacts
		EPBC Act	WCA	DEC				
Pezoporus occidentalis	Night Parrot	EN	S1	CR	*Triodia* hummock grassland or chenopod shrublands. Thick unburnt vegetation most suitable.	Three individuals observed at Minga Well, approximately 30 km from the proposal area (Bamford and Mahony 2005).	MEDIUM – RESIDENT Suitable habitat in some unburnt pockets of vegetation nearby.	LOW Impacts from proposed development will not disturb significant area of habitat. Suitable habitat nearby.
Reptiles								
Ramphotyphlops ganei	A blind snake			P1	Unknown. Previous record found in clay / loam with Spinifex.	Recorded approximately 500 m south of Ch D237 during a previous survey (*ecologia*, 2005).	HIGH – RESIDENT Species is likely to still be resident in the proposal area despite not being recorded during baseline surveys in 2007/2008.	LOW Suitable habitat (moist gorges) in adjacent areas. Limited records but widely dispersed.
Liasis olivaceus barroni	Pilbara Olive Python	VU	S1		Gorges and escarpments, areas of permanent water.	No records in the region.	MEDIUM – RESIDENT WITH RESTRICTED DISTRIBUTION Generally no suitable habitat for the species, except for permanent water, associated vegetation and rocky cliff at Bamboo Spring.	LOW Potential occurrence restricted to Bamboo Spring, which is located to the east of the proposal area. Suitable habitat in adjacent areas.

Key: EPBC Act – *Environment Protection and Biodiversity Conservation Act 1999*, WCA – *Wildlife Conservation Act 1950*, DEC – Department of Environment and Conservation Priority Fauna List, M – Migratory, EN – Endangered, VU – Vulnerable

4.11.1 Significant Fauna Habitat

The following habitat types with poor regional representation were recorded within the survey area:

- Bamboo Springs, located adjacent to chainage 226.2 on the Mainline, is a permanent wetland supporting thick vegetation and weed beds (*ecologia,* 2008b). The Spring is located outside of the proposal area, approximately 480 m east of the Deviation at chainage D225. The Spring is approximately 0.1 ha in area. The proposal will not impact on Bamboo Springs.
- The area of cracking clay habitat that will be disturbed is very small in relation to the extensive area of this habitat to the north (*ecologia*, 2008b). Shepherd (2002) identified 228,154 ha of Beard's "short tussock grassland of mixed species on the gilgai plains of cracking clays" within the Chichester Subregion. The proposal will impact on approximately 40 ha of cracking clay habitat. The proposal is not expected to significantly impact fauna associated with cracking clay habitats.
- Fire is a natural part of the landscape of the Pilbara region, with many wildfires started as a result of lightning strike. Fire has significantly altered many creeklines within the proposal area and surrounds. Consequently, many of these fauna habitats are lacking a well developed understory. The major creekline at chainage D241.5 has not been altered by fire and is considered a significant refuge for fauna species during regeneration of fire-affected areas (*ecologia,* 2008b).

4.11.2 Short Range Endemic Fauna

Endemism refers to the restriction of species to a particular area (Allen *et al*, 2002). Short range endemism refers to endemic species with restricted ranges, currently defined in Western Australia as less than 10,000 km^2 (100 km x 100 km) (Harvey, 2002). Short range endemic (SRE) species are generally invertebrates.

Previous studies show that the Pilbara region contains a large number of arid adapted invertebrate species such as Scorpions, Pseudoscorpions and Centipedes. Other SRE groups that are likely to be found in the proposal area in lesser numbers include Isopods, Mygalomorph spiders and snails (*ecologia*, 2008c).

The fauna surveys of the proposal area identified a number of specimens from groups containing SRE invertebrate fauna species. These included Scorpions (Scorpiones), Pseudoscorpians (Pseudoscorpionida), Trap-door spiders (Mygalomorphae), Harvestmen (Opiliones) and Centipedes (Chilopoda). Of the specimens collected during the surveys, only one species, *Aurecocrypta* sp., was considered to have a strong likelihood of being a short range endemic species (*ecologia*, 2008c). Four male specimens were recorded at two sites within the northern portion of the Chichester Deviation area (Figure 4.4).

Following identification of the *Aurecocrypta* species within the proposal area, BHPBIO commissioned *ecologia* to carry out targeted surveys over a wider survey area to determine the extent of this species outside of the immediate proposal area. Sampling efforts included five rounds of sampling, in which pitfall trap sites were placed in numerous habitats throughout the Chichester Range. Sampling uncovered two additional female specimens, one in close proximity to the original collection location, and one to the west of the proposal area.

Dr Robert Raven (Senior Curator (Arachnida), Queensland Museum) was engaged to assist *ecologia* in identifying populations and habitat of *Aurecocrypta* sp. The *Aurecocrypta* species occurring within the Chichester Range was found to be a new undescribed species (Raven, 2008; *ecologia*, 2008a).

Examination of WA Museum (WAM) records revealed that the species is widespread across the north of Western Australia and is not a short range endemic species (Raven, 2008; *ecologia*, 2008c). Previous records of this species held by WA Museum along with *ecologia*'s records of *Aurecocrypta* "Chichester" sp. are summarised in Table 4.7.

A copy of reports by *ecologia* and Dr Robert Raven are included in Appendix H and Appendix I respectively.

Table 4.7 – Records of *Aurecocrypta* "Chichester" sp. Specimens

Locality	Details	Longitude	Latitude
Chichester Range	3 males collected by *ecologia* pitfall trapping (Sept 2007)	708040.0	7549180.0
Chichester Range	1 male collected by *ecologia* pitfall trapping (Sept 2007)	708310.6	7549410.3
Chichester Range	1 female collected by *ecologia* foraging (Jun 2008)	661846.3	7554495.5
Chichester Range	1 female collected by R. Raven foraging with *ecologia* (Aug 2008)	706763.4	7555765.7
Robinson Range	1 male collected by *ecologia* pitfall trapping (Apr 08)	261638.3	7394826.8
Jack Hills	1 male collected by *ecologia* pitfall trapping (July 08)	514033.5	7120203.3
Weld Range	1 male collected by *ecologia* pitfall trapping (Aug 08)	579575.6	7029279.2
Weld Range	1 male collected by *ecologia* pitfall trapping (Aug 08)	562535.5	7019602.2
Hamersley Ranges	Collector Unknown, WAM Record	660758.8	7505926.4
22.1km W of Pannawonica	Collector Unknown, WAM Record	403653.5	7631758.4
West Turner Syncline	Collector Unknown, WAM Record	529965.9	7519215.7
Sulphur Springs	Collector Unknown, WAM Record	720309.4	7665826.1
Sulphur Springs	Collector Unknown, WAM Record	721846.2	7667267.5
Sulphur Springs	Collector Unknown, WAM Record	721846.2	7667267.5
Sulphur Springs	Collector Unknown, WAM Record	720652.3	7668158.4
Sulphur Springs	Collector Unknown, WAM Record	720309.4	7665826.1
Sulphur Springs	Collector Unknown, WAM Record	720309.4	7665826.1
Barlee Ra Nat Reserve	Collector Unknown, WAM Record	340687.9	7448991.2
Tanami, 89k W of Tanami Downs	Collector Unknown, WAM Record	448970.9	7840211.7
Mesa J, 16.6km SW of Pannawonica	Collector Unknown, WAM Record	410259.4	7627423.9
Waramboo, 52.1 k W of Pannawonica	Collector Unknown, WAM Record	343574.3	7633395.1
Waramboo, 50.5k W of Pannawonica	Collector Unknown, WAM Record	344575.0	7632840.1

4.12 SUBTERRANEAN FAUNA

A desktop review of the potential impacts of the Project on subterranean stygofauna and troglofauna was carried out by *ecologia* (2008d).

Based on aquifer geology, and the expected salinity and pH of the groundwater, it is possible that stygofauna may be found within the aquifers from which groundwater will be abstracted for the proposal (*ecologia*, 2008d). However, it is considered very unlikely that the proposal will have a significant impact to stygofauna due to measures to prevent aquifer dewatering and the short-term duration of increased abstraction rates (Section 1.1).

Troglofauna are understood to require a network of interconnecting cavities within rock formations. The Maddina Basalt flows are 5 m to 30 m thick and massive to amygdaloidal. Amygdales are mineral filled cavities in the basalt formed by gases escaping from the lava, and can range up to approximately 30 mm. Amygdales are often removed through weathering or solution activity, leaving a void in the parent rock. Inspections of the rail cuts through the Chichester basalts indicate small voids, however no open flow banding or vertical amygdule cylinders have been observed.

Similarly, the sedimentary rocks that overlie the basalts are metamorphosed sandstones, banded chert and shales. They form a distinctive ridge and dip slope where the proposal crosses the Chichester Range.

Troglofauna have been identified at Quarry 8, located adjacent to the Mainline at Ch 220 km. However, cuttings required for the proposal will be limited to shaving off small areas and will not intersect the watertable. As such, interconnectivity between voids will be maintained.

5 SOCIAL ENVIRONMENT

5.1 SOCIAL SETTING

The proposal is located within the Shire of Ashburton, approximately 90 km northwest of Newman and 205 km south of Port Hedland.

The region is sparsely populated, with a total population of approximately 40,000 people. The nearest sensitive receptor to the proposal is Redmont Camp, which accommodates personnel associated with BHPBIO's rail operations. Redmont Camp is located approximately 15 km north of the proposal area. The next closest receptor is Auski, located approximately 30 km south-west of the Chichester Deviation.

The proposal area passes through the Mulga Downs pastoral lease. The DEC has nominated 46,660 ha of the Mulga Downs pastoral lease to be set aside for conservation management when leases expire in 2015. The nominated area intersects the southern boundary of the Chichester Deviation. Approximately 0.75 ha of the proposal area and 5.7 ha of the lease area is within the conservation management area nominated by DEC.

5.2 ABORIGINAL HERITAGE

BHPBIO manages and protects Aboriginal heritage in compliance with the *Aboriginal Heritage Act (WA) 1972* (AH Act). Before ground disturbing activities proceed, BHPBIO completes an internal Project Environmental and Aboriginal Heritage Review (PEAHR). The objective of the PEAHR is to identify Aboriginal sites within the proposal area and provide methodologies for managing Aboriginal sites in accordance with the AH Act.

Ethnographic surveys of the area were undertaken in 2001 and 2003 with members of the MIB and Palyku Native Title Claims. No ethnographic sites were identified as a result of these surveys. Huonbrook Environment and Heritage (HEH) conducted archaeological fieldwork in 2008. Several archaeological sites were identified within the proposal area. BHPBIO will attempt to avoid all archaeological sites identified during the survey through engineering solutions. However, if this is not practical, BHPBIO will obtain approval to use the land under Section 18 of the AH Act.

The processes for the grant of tenure for the project include a consultation process with the MIB and Palyku native title claimants. BHP Billiton has been complying with its obligations to consult with these groups including by offering heritage surveys and site visits with the claimants' participation.

5.3 EUROPEAN HERITAGE

No sites on the Register of the National Estate, State Register of Heritage Places, World Heritage List or Commonwealth Heritage List occur within the proposal area.

6 ENVIRONMENTAL MANAGEMENT SYSTEM AND RISK ASSESSMENT

6.1 ENVIRONMENTAL MANAGEMENT SYSTEM

6.1.1 Summary of the Environmental Management System

BHPBIO's Environmental Management System (EMS) is designed to minimise the environmental impact of the Company's operations (including port, mine and rail operations) through policy, planning, implementation and monitoring and is certified to the international standard, ISO 14001.

The principal components of the BHPBIO EMS include:

- environmental policy, standards and procedures;
- planning;
- implementation and operation;
- monitoring and corrective action; and
- management review.

6.1.2 Environmental Policy, Standards and Procedures

BHP Billiton has an "overriding commitment to health, safety, environment, community responsibility and sustainable development". This is supported by the Sustainable Development Policy, which outlines a commitment to sustainable development and to continual improvement in performance, efficient use of natural resources and aspires to zero harm to people and the environment (Figure 6.1).

The framework is implemented via a series of Group Level Documents (GLDs), which outline relevant Standards and Procedures that must be adhered to. The implementation of the GLDs is measured through BHP Billiton's Assessment and Targets Reporting processes.

These GLDs form the basis for the development and application of HSEC Management Standards at BHPBIO's operations. The objectives of the GLDs are to:

- provide a risk-based management system framework, consistent with the BHP Billiton Enterprise-Wide Risk Management Policy, and with ISO 14001 and other internationally recognised standards, that support the implementation of the BHP Billiton Charter, and the Sustainable Development Policy across all BHP Billiton operations;
- set out and formalise expectations for the progressive development and implementation of detailed HSEC Management Systems at BHPBIO's operations;
- provide benchmarking, against which HSEC Management Systems across all BHP Billiton operations can be measured; and
- provide a basis from which to drive continuous improvement towards leading industry practice and sustainable development.

Standards are supported by a series of Procedures which are key components of BHPBIO's EMS.

Figure 6.1 – BHP Billiton's Sustainable Development Policy

OUR APPROACH TO HEALTH, SAFETY, ENVIRONMENT AND THE COMMUNITY

BHP BILLITON'S SUSTAINABLE DEVELOPMENT POLICY

At BHP Billiton our objective is to be the company of choice – creating sustainable value for our shareholders, employees, contractors, suppliers, customers, business partners and host communities.

We aspire to Zero Harm to people, our host communities and the environment and strive to achieve leading industry practice. Sound principles to govern safety, business conduct, social, environmental and economic activities are integral to the way we do business.

Wherever we operate we will develop, implement and maintain management systems for sustainable development that drive continual improvement and ensure we:

- do not compromise our safety values, and seek ways to promote and improve the health of our workforce and the community
- identify, assess and manage risks to employees, contractors, the environment and our host communities
- uphold ethical business practices and meet or, where less stringent than our standards, exceed applicable legal and other requirements
- understand, promote and uphold fundamental human rights within our sphere of influence, respecting the traditional rights of Indigenous peoples and valuing cultural heritage
- encourage a diverse workforce and provide a work environment in which everyone is treated fairly, with respect and can realise their full potential
- set and achieve targets that promote efficient use of resources and include reducing and preventing pollution
- enhance biodiversity protection by assessing and considering ecological values and land-use aspects in investment, operational and closure activities
- engage regularly, openly and honestly with people affected by our operations, and take their views and concerns into account in our decision-making
- develop partnerships that foster the sustainable development of our host communities, enhance economic benefits from our operations and contribute to poverty alleviation
- work with those involved through the lifecycles of our products and by-products to promote their responsible use and management
- regularly review our performance and publicly report our progress.

In implementing this Policy, we will engage with and support our employees, contractors, suppliers, customers, business partners and host communities in sharing responsibility for meeting our requirements.

We will be successful when we achieve our targets towards Zero Harm, are valued by our host communities, and provide lasting social, environmental and economic benefits to society.

Marius Kloppers
Chief Executive Officer

1 October 2007

SD ENGLISH V1.1

6.2 RISK ASSESSMENT METHODOLOGY

6.2.1 Background

The Risk Assessment methodology used to identify and rank the potential environmental impacts associated with the proposal is based on BHP Billiton's Risk Management Guidelines (BHPBIO, 2008). The identification and assessment of risk is embedded in BHPBIO's critical business processes and guides the implementation of activities to ensure consistency and comparability across operations.

6.2.2 Application to the proposal

The principles of sustainability and biodiversity have been applied to the proposal to help identify and avoid potential environmental impacts. These principles are integral to the impact assessment approach outlined in this ERD.

As outlined in Section 1 and Figure 1.2, a qualitative risk-based approach has been adopted to systematically determine the relevant environmental and social factors for the proposal. These factors have been identified through a review of existing information, findings of investigative studies, consultation with the EPA and other stakeholders.

To determine the 'Key' and 'Other' environmental factors, the inherent risk of each factor was assessed using BHP Billiton's risk assessment methodology, as detailed in Section 1.6.2.

The key environmental factors identified through the risk assessment were:

- terrestrial flora and vegetation;
- terrestrial fauna;
- weed management; and
- surface hydrology.

The other relevant factors for the proposal are:

- groundwater;
- subterranean fauna;
- rehabilitation;
- decommissioning of rail;
- greenhouse gas emissions;
- dust emissions;
- surface water quality;
- groundwater quality;
- waste management;
- noise and vibration;
- economic and social impacts;
- visual amenity; and
- recreational activity.

6.3 KEY AND OTHER FACTORS – RISK ASSESSMENT PROCESS

Key and other factors were identified through a risk assessment workshop attended by a multi-disciplinary team of BHPBIO's environmental and railway operations professionals. A further risk assessment process was then completed by BHPBIO's environmental team to determine the residual risk ranking for these factors following the implementation of management measures. The process included the following:

- setting the risk context, including objectives and the proposed activities;

- identification of potential impacts associated with the relevant environmental factors;
- determination of management measures for each of the identified potential impacts. Depending on the impact, these management measures were based on existing controls (e.g. the EMP) or were measures in addition to existing controls; and
- assignment of a severity and likelihood factor for each potential impact to determine the residual risk rating (residual risk rating = severity factor multiplied by the likelihood factor) and its significance as either low, minor, moderate, major or critical.

The severity factor (Table 6.1) is defined as a measure of the expected degree of gain, harm, injury or loss (impact) from the most severe event associated with a risk issue. The severity factor includes several impact types (including: health and safety, natural environment, social/cultural heritage, community/government/reputation/media and legal).

The likelihood factor (Table 6.2) is defined as a measure of the chance of an actual occurrence of an impact at that selected level of severity. The likelihood is assessed assuming reasonable effectiveness of existing and tested preventative controls. For the proposal, the severity factor was assigned after the consideration of the proposed management measures.

Table 6.1 – Severity Factor

Severity Level	Impact Types						Severity Factor
	Financial Impact	Health and safety	Natural environment	Social/cultural heritage	Community / Govt /Reputation / Media	Legal	
7	> US$1 billion	> 500 fatalities or very serious irreversible injury to ▸5000 persons.	Very significant impact on highly valued species, habitat or eco system.	Irreparable damage to highly valued items of great cultural significance or complete breakdown of social order.	Prolonged international condemnation.	Potential jail terms for executives and/or very high fines for company. Prolonged, multiple litigation.	1000
6	US$100 million – US$1 billion	>50 fatalities, or very serious irreversible injury to ▸500 persons.	Significant impact on highly valued species, habitat, or ecosystem.	Irreparable damage to highly valued items of cultural significance or breakdown of social order.	International multi-NGO and media condemnation.	Very significant fines and prosecutions. Multiple litigation.	300
5	US$10 million – US$100 million	Multiple fatalities, or significant irreversible effects to ▸50 persons.	Very serious, long-term environmental impairment of ecosystem function.	Very serious widespread social impacts. Irreparable damage to highly valued items.	Serious public or media outcry (international coverage).	Significant prosecution and fines. Very serious litigation, including class actions.	100
4	US$1 million – US$10 million	Single fatality and/or severe irreversible disability (▸30%) to one or more persons.	Serious medium term environmental effects.	On-going serious social issues. Significant damage to structures/ items of cultural significance.	Significant adverse national media/ public/ NGO attention.	Major breach of regulation. Major litigation.	30
3	US$100,000 – US$1 million	Moderate irreversible disability or impairment (<30%) to one or more persons.	Moderate, short-term effects but not affecting ecosystem function.	Ongoing social issues. Permanent damage to items of cultural significance.	Attention from media and/or heightened concern by local community. Criticism by NGOs.	Serious breach of regulation with investigation or report to authority with prosecution and/ or moderate fine possible.	10
2	US$10,000 – US$100,000	Objective but reversible disability requiring hospitalisation.	Minor effects on biological or physical environment.	Minor medium-term social impacts on local population. Mostly repairable.	Minor, adverse local public or media attention and complaints.	Minor legal issues, non-compliances and breaches of regulation.	3
1	< US$10,000	No medical treatment required.	Limited damage to minimal area of low significance.	Low-level repairable damage to commonplace structures.	Public concern restricted to local complaints.	Low-level legal issue.	1

Table 6.2 – Likelihood Factor

Study and Project Delivery Likelihood Factors	
Based on Company and Industry experience with similar Studies or projects, the event:	Likelihood Factor
Could be expected to occur more than once during the Study or Project Delivery	10
Could easily be incurred and has generally occurred in similar Studies or Projects	3
Incurred in a minority of similar Studies or Projects	1
Known to happen, but only rarely	0.3
Hasn't occurred in similar Studies or Projects, but could	0.1
Conceivable, but only in extreme circumstances	0.03

Each determined residual risk rating, was assigned a qualitative classification as Low, Minor, Moderate, Major or Critical as outlined in Table 6.3.

Table 6.3 – Residual risk rating classification

	Low
	Minor
	Moderate
	High
	Critical

LIKELIHOOD	SEVERITY FACTOR							
		1	**3**	**10**	**30**	**100**	**300**	**1000**
	0.03	0.03	0.09	0.3	0.9	3	9	30
	0.1	0.01	0.3	1	3	10	30	100
	0.3	0.3	0.9	3	9	30	100	300
	1	1	3	10	30	100	300	1000
	3	3	9	30	90	300	900	3000
	10	10	30	100	300	1000	3000	10000

Sections 7 and 8 provide a discussion on the following, for each of the identified key and other factors:

- EPA objective;
- potential impacts;
- management measures; and
- resulting residual risk rankings.

To ensure the risks for each of the key factors was reduced to 'As Low as Reasonably Practicable' (ALARP), management plans were developed during the risk assessment process. The management measures applied to the identified environmental factors have been selected with the objective of reducing the residual risks to the ALARP level. These management plans are provided in Appendix A through Appendix C.

7 KEY FACTORS IMPACT AND MANAGEMENT

7.1 INTRODUCTION

This section presents an overview of each of the key factors identified in the risk assessment, and details the environmental objectives, potential impacts, management measures adopted and environmental outcome BHPBIO is aiming to achieve. The avoidance principle has been applied to reduce impact wherever possible.

BHPBIO has prepared management plans for the proposal to address the key environmental factors:

- surface water management plan (see Appendix A);
- significant species management plan (Appendix B); and a
- weed management plan (see Appendix C).

A summary of the risk assessment, including inherent and residual risk ratings, is included in Table 7.1. The residual risk rating has been determined by taking into consideration the mitigating controls discussed in this section.

Table 7.1 – Summary of Inherent and Residual Risk of 'Key' Environmental Factors

Risk Details			Inherent Risk			Controls	Residual Risk		
Key Factor	**Event**	**Potential Impacts / Outcomes**	**Severity**	**Likelihood**	**Inherent Risk Rating**		**Severity**	**Likelihood**	**Residual Risk Rating**
BIOPHYSICAL									
Surface Hydrology	Vegetation clearing	• Increases / changes to surface water flow velocity; • soil erosion; • vegetation death and possible reduction of groundwater aquifer recharge; and • reduction in vegetation cover and increase in surface water flow velocity.	3	10	**30**	• Implementation of the Surface Water Management Plan, including the following measures: • placement of environmental culverts at 50 m intervals along the rail formation in areas where sheet flow must be maintained to sustain mulga vegetation; • visual inspection of culverts following the onset of wet season, and following significant rainfall events; • installation of scour protection structures (i.e. riprap pads) immediately upstream and downstream of culverts; • refinement of alignment design to preserve natural surface water flows; and • sizing of culverts for a 1 in 50 year rainfall event.	1	10	**10**
	Surface water flows altered by construction or operation of rail formation		10	3	**30**		10	1	**10**
	Fire		3	0.3	**0.9**		3	0.1	**0.3**
Terrestrial Fauna	Disturbance outside of approved areas	• Reduction of fauna habitat; • fragmentation of fauna habitat; • potential fauna death or injury; and • predation of native fauna by introduced species.	10	3	**30**	• Implementation of the Significant Species Management Plan, including species specific management measures.	10	0.3	**3**
	Fire		10	0.3	**3**		10	0.1	**1**
	Human interaction with fauna		3	1	**3**		3	0.3	**0.9**
	Fauna strike by vehicle		3	3	**9**		3	3	**9**
	Fauna falling into or entrapped in trenches/excavations		3	0.3	**0.9**		3	0.3	**0.9**
	Alteration of natural landscape		3	10	**30**		3	10	**30**
	Introduction or spread of feral animals		3	1	**3**		3	0.3	**0.9**
Flora and Vegetation	Disturbance outside of approved areas	• Loss of vegetation community; • loss of fauna habitat; • promotion of weeds; and • death of surface water dependent vegetation.	10	3	**30**	• Implementation of the Surface Water Management Plan to mitigate potential impacts on sheet flow sensitive mulga communities; and • implementation of the following management controls: • minimise vegetation clearing • internal Environmental & Aboriginal Heritage Review to be approved prior to commencement of clearing; • delineate the clearing area prior to commencement of vegetation removal; and • avoid disturbance of conservation significant flora and significant vegetation where practicable.	10	1	**10**
	Fire		10	0.3	**3**		10	0.1	**1**
	Alteration of natural drainage patterns		10	3	**30**		10	1	**10**
Weeds	Introduction/ spread of weeds	• Increased competition with native species leading to loss of biodiversity.	10	3	**30**	• Implementation of the Weed Management Plan, including weed hygiene procedures and ongoing monitoring of existing and potential new weed populations.	10	1	**10**

7.2 SURFACE HYDROLOGY

7.2.1 Overview

This section discusses the potential changes to surface hydrology associated with the proposal and the impacts those changes may have on environmental values of the surrounding area.

Key considerations with respect to surface hydrology for the proposal include:

- potential impacts to sheet flow dependent mulga communities; and
- alteration of natural surface water flows, including existing watercourses.

7.2.2 EPA Objectives

The EPA objective with regard to surface hydrology is to maintain the quantity of surface water so that existing and potential environmental values, including ecosystem maintenance, are protected.

7.2.3 Policy and Standards

The relevant policies and standards that have been considered in the environmental assessment process for surface hydrology and wetlands include the following:

- Environmental Water Requirements to Maintain Wetlands of National and International Importance;
- Australian and New Zealand Water Quality Guidelines;
- Position Statement No. 5, Environmental Protection and Ecological Sustainability of the Rangelands in WA (EPA, 2004); and
- Guidance Statement No. 33 Environmental Guidance for Planning and Development (EPA, 2008).

7.2.4 Potential Impacts

Potential impacts to surface water from the proposal include:

- alteration of surface water flow patterns;
- reduction of surface water runoff volume;
- impacts on downstream watercourse ecology; and
- impacts on downstream vegetation communities (particularly mulga communities).

Alteration of the terrain via cut and fill earthworks required for the construction of the rail has the potential to interrupt natural surface water drainage features. Changes to surface water flows may have localised impacts on water volumes within creeklines and on sheetflow dependent mulga communities.

BHPBIO commissioned GHD Pty Ltd to carry out a slope analysis to determine areas of mulga vegetation which are likely to be sheetflow sensitive. Previous studies indicate that sheetflow is typically generated in areas of less than 2% slope (Ludwig et al., 1997 and Mabutt and Fanning, 1987). Based on this criteria, vegetation mapping was overlain on a slope analysis model to determine areas of mulga vegetation within areas of sheetflow (<2% slope). This model identified sheetflow-dependent mulga communities intersecting the proposed railway at Chainage D228 and between Chainage D234 to D242 (Figure 7.1).

7.2.5 Management of Impacts

BHPBIO aims to implement preventative controls to mitigate impacts to surface hydrology flow patterns within the proposal area.

The rail alignment has been shifted as far upslope as possible (i.e. within the constraints of tenure) in areas of cut to mitigate potential impacts on down-slope mulga communities (Figure

7.1). Drainage shadow is likely to have the greatest impact on Mulga vegetation within 200 m of the rail formation. Designing the alignment as far up-slope as possible will facilitate sheetflow runoff between the rail formation and down-slope mulga vegetation, and minimise the need for clearing of Mulga vegetation.

A Surface Water Management Plan has been developed to manage the identified risks to surface hydrology (Appendix A). This management plan includes specific measures to mitigate impacts on natural surface water flows and sheet flow dependent Mulga communities, including the following:

- refinement of alignment design to maximise natural surface water flows;
- appropriate sizing of culverts to convey a 1 in 50 year rainfall event;
- placement of environmental culverts at 50 m intervals along the rail formation in areas of sheet flow sensitive Mulga communities;
- installation of low spur embankments on the upstream side of the rail line to direct surface water flows to culverts and preserve existing drainage patterns;
- installation of a shallow, cement-stabilized road based dip in the rail access road downstream of environmental culverts;
- installation of scour protection structures (i.e. riprap pads) immediately downstream of environmental culverts and railway access roads to disperse surface water runoff; and
- visual inspection of culverts and scour protection structures following the onset of the typical wet season, and following significant rainfall events.

BHPBIO does not intend to install additional culverts once the rail line is operational, however the effectiveness of sheetflow redistribution structures will be monitored as part of a Mulga monitoring program (to be developed in conjunction with the DEC). If these structures are found to be damaged or ineffective, additional engineering or maintenance measures will be undertaken.

The proposed Mulga monitoring program is outlined in the Surface Water Management Plan (Appendix A).

BHPBIO will undertake a baseline condition assessment of Mulga vegetation prior to the commencement of construction activities. The quadrats selected for the baseline assessment will be utilised for the ongoing monitoring program and will also include suitable reference sites.

Additional management controls include:

- education of personnel in the requirements of the Surface Water Management Plan through inductions and toolbox meetings;
- restrict vehicular access;
- fire prevention training including routine machine maintenance and enforcement of road safety rules;
- minimise clearing of vegetation; and
- progressively rehabilitate areas not supporting permanent infrastructure.

BHPBIO will obtain a Permit to Interfere with Bed and Banks under the *Rights in Water and Irrigation Act 1914*, for all watercourses intersected by the proposal.

7.2.6 Predicted Outcome

BHPBIO has incorporated mitigating controls into the design of the proposed rail Deviation to minimise impacts on surface flows. These controls are expected to minimise disruption to natural sheet flow patterns and prevent significant impacts on down-slope Mulga vegetation communities.

In areas of cut, it will not be possible to install environmental culverts. The potential for impact to surface water flows has been minimised by moving the alignment as far up-slope as possible in these areas (see Figure 7.1).

BHPBIO anticipate that impacts on sheetflow sensitive Mulga vegetation will be minimal in areas of cut. Cuts are typically in areas where the slope is greater than 2%, hence sheetflow is unlikely to occur.

BHPBIO does not anticipate that the identified impacts will differ post approvals. However, potential impacts will continue to be monitored and managed in accordance with the risk assessment methodologies outlined above and the Surface Water Management Plan.

Figure 7.1 – Location of Sheetflow Sensitive Mulga Vegetation

(Sheet 1 of 2)

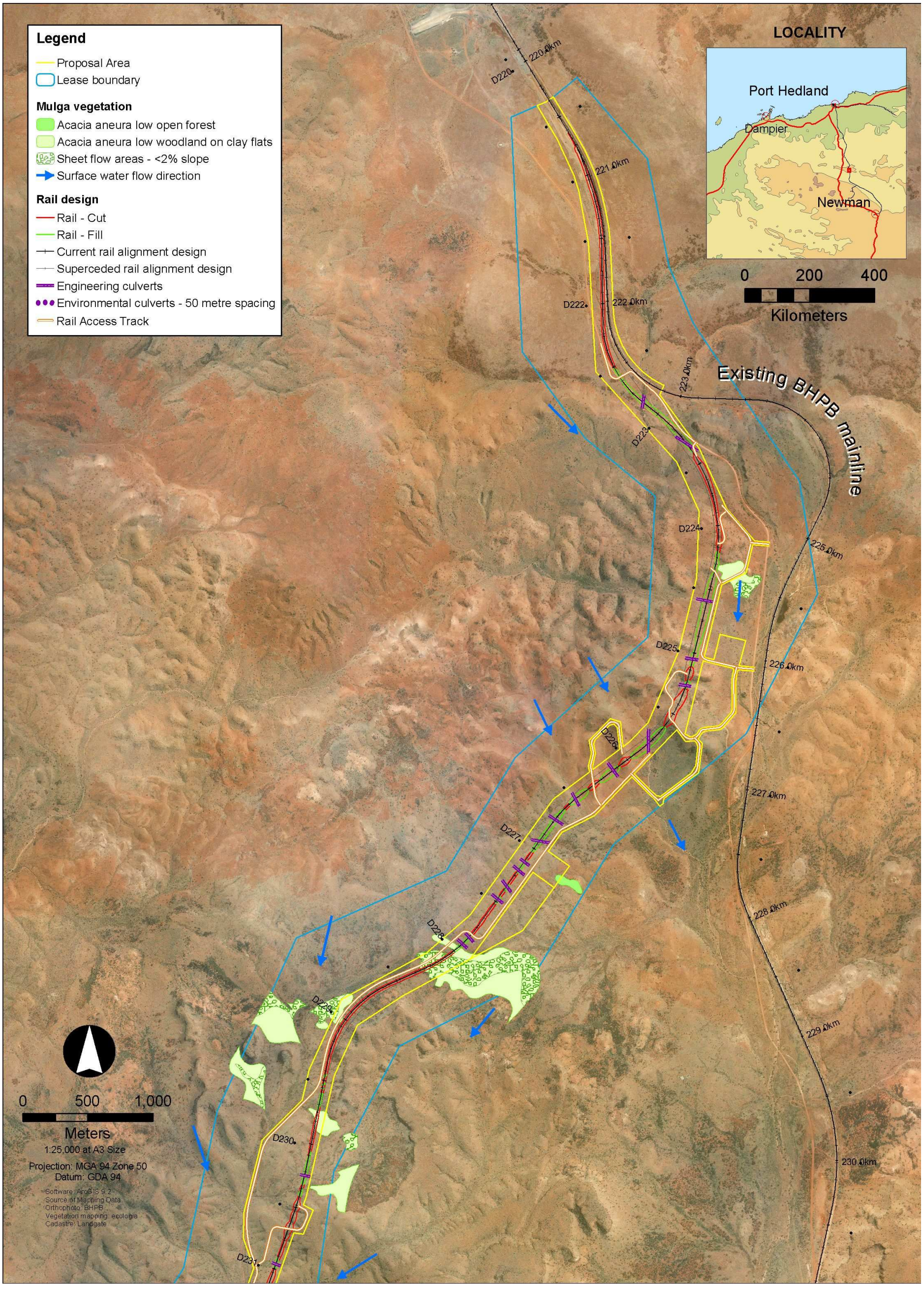
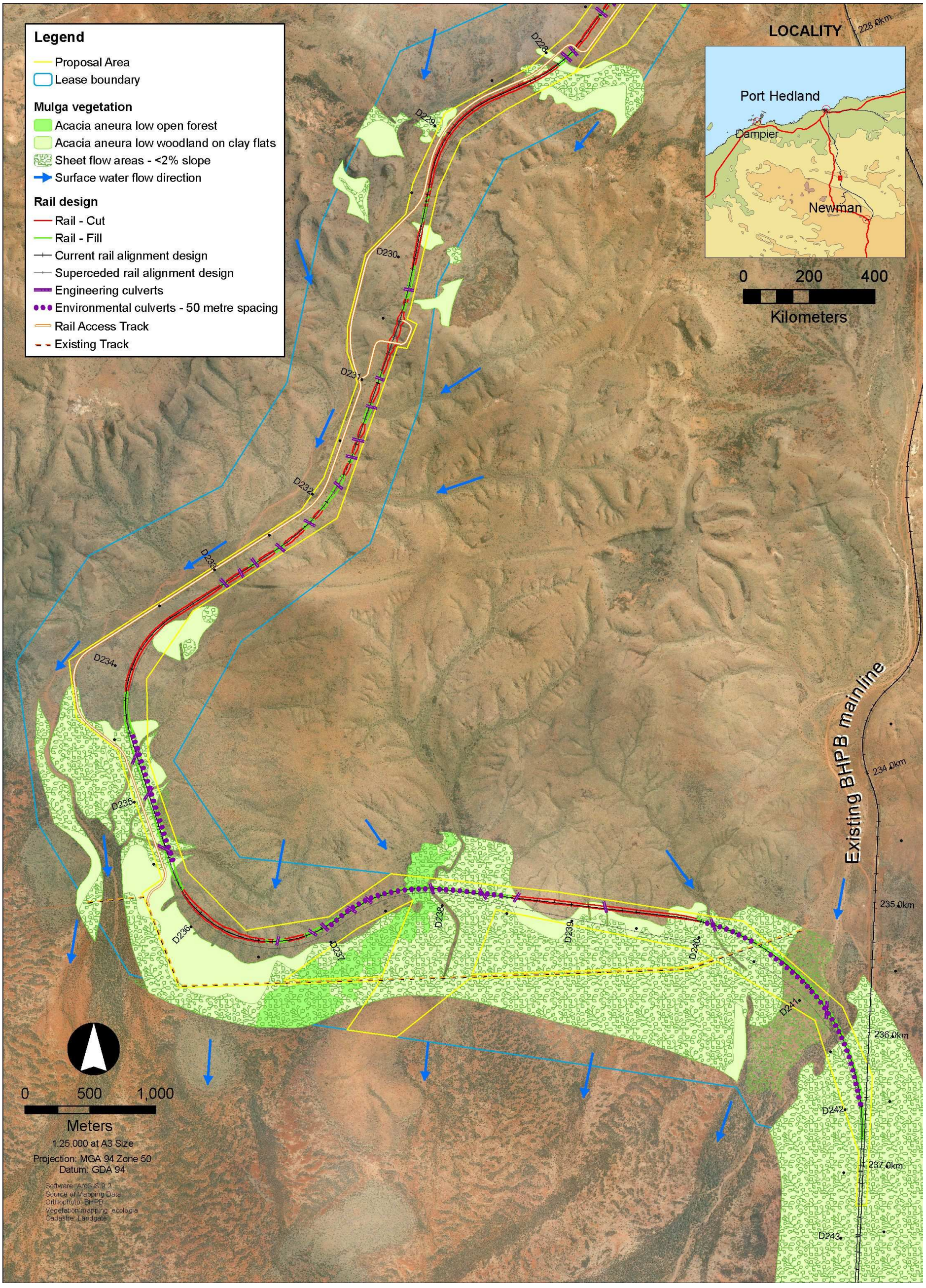


Figure 7.1 – Location of Sheetflow Sensitive Mulga Vegetation

(Sheet 2 of 2)



7.3 TERRESTRIAL FAUNA

7.3.1 Overview

7.3.1.1 Terrestrial Vertebrates

Baseline fauna surveys identified 177 species of vertebrate fauna have been recorded within the proposal area, comprising 20 native and five introduced species of mammals, 94 species of birds, 57 species of reptiles and 1 species of amphibian. Of these, 3 mammal and 2 bird species are listed as Priority 4 by the DEC, and 3 bird species listed as migratory under the EPBC Act 1999. In addition to those significant fauna species recorded during surveys, 2 species of significant mammals, 1 significant bird species and 2 significant reptile species are considered likely to occur within the proposal area.

Ghost Bat (*Macroderma gigas*)

While the Ghost Bat was not physically observed within the proposal area, a single call was recorded during fauna surveys. There are no suitable roost sites within the proposal area, hence Ghost Bats are not likely to be residents of the area. Ghost Bats are unlikely to be impacted by the proposal (*ecologia*, 2008b).

Northern Short-tailed Mouse (*Leggadina lakedownensis*)

Two individuals of the Northern Short-Tailed Mouse were recorded in the northern portion of the proposal area near sites of cracking clays. The species is thought to be reasonably widespread in the local area, favouring cracking clay habitats, which will remain largely unaffected by the proposal. The proposal is not expected to have a significant impact on the local population of Northern Short-tailed mouse (*ecologia*, 2008b).

Western Pebble-mouse (*Pseudomys chapmani*)

There were 20 active or recently active Western Pebble-mouse mounds recorded within the proposal area during baseline surveys, seven of which are within the nominated disturbance corridor, however not necessarily within the clearing footprint. Given the reasonably large adjacent areas of suitable habitat, the Western Pebble-mouse population is not expected to be impacted in the longer term (*ecologia*, 2008b).

Northern Quoll (*Dasyurus hallucatus*)

There are very few areas within the proposal area that provide suitable Northern Quoll habitat. No individuals were observed during baseline fauna surveys of the proposal area, however suitable habitat exists at Chainage D241.5 (*ecologia*, 2008b).

Greater Bilby (*Macrotis lagotis*)

The Greater Bilby is not likely to occur within the proposal area, as favoured habitat is mostly located in the mulga shrublands to the south (*ecologia*, 2008b).

Rainbow Bee-eater (*Merops ornatus*)

Rainbow Bee-eaters were recorded at eight locations within the proposal area during baseline surveys (*ecologia*, 2008b). Bird species are expected to disperse prior to disturbance. Some young may be impacted by clearing activities, however due to the species abundance the proposal is unlikely to have a significant effect on the local or regional population (*ecologia*, 2008b).

Fork-tailed Swift (*Apus pacificus*)

This species is almost entirely aerial and does not directly use habitats within the proposal area. Fork-tailed Swift populations will not be impacted by the proposal (*ecologia*, 2008b).

Wood Sandpiper (*Tringa glareola*)

Wood Sandpipers are likely to occur transiently whilst migrating, so are unlikely to be impacted by the proposal. Bamboo Springs may be an important stopover for this species, however is outside the proposal area (*ecologia*, 2008b). Bird species are expected to disperse prior to disturbance.

Australian Bustard (*Ardeotis australis*)

Suitable habitat for this species is widespread and common in the surrounding area, hence the proposal is not expected to impact on the local population (*ecologia*, 2008b). Bird species are expected to disperse prior to disturbance so are unlikely to be directly impacted by construction.

Bush Stone-curlew (*Burhinus grallarius*)

No Bush Stone-curlews have been recorded within the proposal area. Adult Bush Stone-curlews will disperse if forced, but will not easily leave their home range. The impact of the proposal is expected to be localised and unlikely to impact on the wider population of this species (*ecologia*, 2008b).

Star Finch (Western subspecies) (*Neochmia ruficauda subclarescens*)

The Star Finch prefers habitats consisting of long grasses and reeds beside permanent water. Suitable habitat within the lease area is limited to Bamboo Spring (*ecologia*, 2008b). The Springs are outside of the proposal area and will not be impacted.

Grey Falcon (*Falco hypoleucos*)

There are no potential breeding sites for this species within the proposal area. The Grey Falcon has a large hunting range and is unlikely to be impacted during the proposal construction phase (*ecologia*, 2008b).

Peregrine Falcon (*Falco peregrinus*)

There are no potential breeding sites for this species within the proposal area. As with the Grey Falcon, this species has a large hunting range and is unlikely to be impacted by the proposal (*ecologia*, 2008b).

Pilbara Olive Python (*Morelia olivacea barroni*)

Suitable habitat for Pilbara Olive Pythons is limited to Bamboo Springs. This shy species shelters in crevices, hollows or burrows and is unlikely to vacate if disturbed (*ecologia*, 2008b). There will be no disturbance to Bamboo Springs during construction or operation of the Chichester Deviation.

Unnamed Blind Snake (*Ramphotyphlops ganei*)

No individuals were recorded during surveys for the Project, however an individual was recorded within the proposal area during previous biological surveys. There is little known about the biology of this species however it is probably associated with moist gorges (*ecologia*, 2008b)

The dominant habitat that will be impacted from the proposed construction activities for the Chichester Deviation is 'open to very open woodland over spinifex on rocky soils' (*ecologia*, 2008b). This habitat type is widespread throughout the region and adverse impacts to regional biodiversity are not expected. Fauna habitats centred on drainage lines are generally common in the region, hence reductions to species diversity are expected to be localised only over a short time frame (*ecologia*, 2008b).

Three poorly represented habitat types were recorded within the lease area including a permanent wetland at Bamboo Springs, cracking clays located in the north at approximately chainage D223 and a major creekline at chainage D241.5.

Bamboo Springs is outside of the proposal area and no disturbance to this habitat is expected as a result of the proposal.

The area of disturbance to cracking clay habitat is very small in relation to the extensive area of this habitat to the north (*ecologia*, 2008b). Shepherd (2002) identified 228,154 ha of Beard's "short tussock grassland of mixed species on the gilgai plains of cracking clays" within the Chichester Subregion. The proposal will impact on approximately 40 ha of cracking clay habitat. The proposal is not expected to adversely impact fauna associated with cracking clay habitats.

Fire is a natural part of the landscape of the Pilbara region, with many wildfires started as a result of lightning strike. Fire has significantly altered many creeklines within the proposal area and

surrounds. Consequently, many of these fauna habitats are lacking a well developed understory. The major creekline at chainage D241.5 has not been altered by fire and is considered a refuge for fauna species during regeneration of fire-affected areas (*ecologia*, 2008b).

7.3.1.2 Short Range Endemics

The fauna surveys of the proposal area identified a number of specimens from groups containing short range endemic (SRE) invertebrate fauna species. Of the specimens collected during the surveys, only one species of trapdoor spider, *Aurecocrypta* sp., was considered to have a strong likelihood of being a short range endemic species (*ecologia*, 2008c).

Targeted surveys carried out within the Chichester Range identified a total of six specimens of this species. The *Aurecocrypta* species occurring within the Chichester Range was found to be an undescribed species. However, examination of WA Museum (WAM) records revealed that the species is widespread across the north of the Western Australian and is not a short range endemic species (Raven, 2008; *ecologia*, 2008c).

7.3.2 EPA Objectives

The EPA objective for management of terrestrial fauna is to maintain the abundance, diversity, geographic distribution and productivity of fauna at species and ecosystem levels through the avoidance or management of adverse impacts and improvement in knowledge.

7.3.3 Policy and Standards

The relevant policies and standards that have been addressed in the environmental assessment process for fauna include the following:

- Guidance Statement No. 33 Environmental Guidance for Planning and Development (EPA, 2008);
- Guidance Statement No. 56. Terrestrial fauna surveys for environmental impact assessment in WA (EPA, 2004);
- Position Statement No. 3. Terrestrial biological surveys as an element of biodiversity protection (EPA, 2002);
- *Environment Protection and Biodiversity Conservation Act* (1999); and
- *Wildlife Conservation Act* (1950).

7.3.4 Potential Impacts

The proposal may impact on terrestrial fauna through:

Direct impacts

- reduction or loss of fauna habitat;
- fragmentation of habitat and reduction of fauna corridors;
- potential for fauna to fall or become trapped in open excavations or trenches;
- vehicle strike; and
- fauna death resulting from clearing or ground disturbing activities.

Indirect impacts

- increased risk of fire associated with proposal activities;
- degradation of fauna habitat due to introduction or spread of weeds;
- disruption to resident fauna due to increased noise or vibration;
- potential for hydrocarbon spills resulting in contamination of water supply or habitat;
- human interaction resulting in death, injury, illness or dependence; and

- predation by feral animals introduced to the area by poor rubbish management, deliberate human interaction or pets brought on site.

7.3.5 Management of Impacts

A Significant Species Management Plan has been developed to minimise the impacts of the proposal on conservation significant fauna species. The management plan outlines general and specific management measures and monitoring requirements to manage conservation significant fauna species likely to occur within the proposal area. A copy of the Significant Species Management Plan is included in Appendix B.

In addition to those controls described in the Significant Species Management Plan, the following management measures will be implemented:

- approval of an internal Project Environmental & Aboriginal Heritage Review prior to commencement of works;
- survey and flagging of sensitive areas to avoid where possible;
- education of personnel through inductions and toolbox meetings;
- use of designated waste receptacles;
- no barbed wire fencing to be used in the propoal area;
- preventative controls for fire including routine machine maintenance and enforcement of road safety rules;
- restrictions on vehicular access;
- access road safety rules including reasonable speed limits and signage;
- night work will be avoided as far as practicable, however scheduling may require night works to occur;
- progressive rehabilitation of areas not supporting permanent infrastructure; and
- implementation of stop work procedures and incident reporting procedures.

Speed limits for driving activities will be subject to a risk-assessment and will take into account a number of factors including environment and safety.

7.3.6 Predicted Outcome

Although some local fauna losses are anticipated during the construction phase, the proposal is not expected to impact on the status of significant fauna or result in adverse impacts to fauna populations.

7.4 FLORA AND VEGETATION

7.4.1 Overview

A two-phase biological survey was carried out as part of the environmental impact assessment for the proposal. The survey assessed the significance of biota within the proposal area at the National, State, regional and local scales.

Most of the vegetation associations, habitats and landforms found in the proposal area are not considered to be of national, state, regional or local conservation significance and are well represented across the Pilbara Biogeographic Region (*ecologia*, 2008a). However, impact to mulga vegetation, short tussock grassland and the *Acacia xiphophylla* scrubland on the cracking clay plains has the potential to contribute to a loss of biodiversity (*ecologia*, 2008a).

Five populations of the Priority 3 flora species *Goodenia nuda* were recorded within the proposal area. Given the widespread distribution of this species within the Pilbara region, *G. nuda* is deemed to have low to moderate regional conservation value (*ecologia*, 2008a).

7.4.2 EPA Objective

The EPA's objective with regard to flora and vegetation management is to maintain the abundance, species diversity, geographic distribution and productivity of vegetation communities through the avoidance or management of adverse impacts and improvement in knowledge.

7.4.3 Policy and Standards

The relevant policies and standards that have been addressed in the environmental assessment process for flora and vegetation include the following:

- EPA Position Statement No. 2: Environmental Protection of Native Vegetation in WA (2000);
- EPA Position Statement No. 3: Terrestrial Biological Surveys as an Element of Biodiversity Protection (2002);
- EPA Position Statement No. 9 Environmental Offsets (2006);
- Guidance Statement No. 33 Environmental Guidance for Planning and Development (EPA, 2008);
- EPA Guidance Statement No. 51: Terrestrial flora and vegetation surveys environmental impact assessment in WA (2004);
- EPA Guidance Statement No. 56: Terrestrial Fauna Surveys for Environmental Impact Assessment in Western Australia (2004);
- CALM Policy statement No. 9: Conserving Threatened Species and Ecological Communities (2003);
- *Environment Protection and Biodiversity Conservation Act* (1999); and
- *Wildlife Conservation Act* (1950).

7.4.4 Potential Impacts

The main potential impacts of the proposal on flora species and vegetation communities are the loss of significant flora species and vegetation communities.

Up to 400 ha of vegetation clearing will be required, of which approximately 282 ha will be rehabilitated following completion of construction. Clearing of vegetation will be required for the following purposes:

- construction of rail formation and rail line;
- construction of a maintenance access track and construction access track associated with the Deviation;
- borrow pits;
- lay down areas;
- topsoil stockpiles; and
- drainage controls.

Potential impacts on flora and vegetation resulting from the proposal are listed below.

Direct Impacts

The proposal will include clearing of 400 ha of vegetation, with the potential to cause:

- reduced representation of significant species; or
- loss of conservation significant flora.

Indirect Impacts

The proposal may indirectly impact flora and vegetation within the proposal area through:

- fragmentation of vegetation communities;
- alteration of surface water flows resulting in loss of sheetflow dependent vegetation (mulga);
- vegetation death from flooding or excess scouring;
- increased risk of wildfire associated with proposal activities;
- degradation of vegetation due to introduction or spread of weeds; and
- potential for hydrocarbon spills resulting in death of vegetation.

7.4.5 Management of Impacts

To minimise impacts on flora and vegetation, the following controls will be implemented:

- minimise clearing of vegetation;
- approval of an internal Project Environmental & Aboriginal Heritage Review prior to commencement of ground disturbing activities;
- flagging of the clearing area prior to commencement of clearing activities;
- education of personnel in the requirements of the Significant Species Management Plan through inductions and toolbox meetings;
- restrictions on vehicular access from off-road activities;
- preventative controls for fire including routine machine maintenance and enforcement of road safety rules; and
- carry out progressive rehabilitation of areas not supporting permanent infrastructure.

Additional management controls relating to the protection of significant flora species are included in the Significant Species Management Plan. Conservation significant flora and vegetation will be shown on construction plans and marked in the field with temporary flagging (where possible) to prevent accidental disturbance.

A Surface Water Management Plan has been developed which outlines preventative controls to minimise impacts on sheetflow sensitive mulga communities (Appendix A). Appropriate surface water management measures, including environmental culverts and rip rap rock protection, will be incorporated into the drainage design to maintain natural surface water regimes (Section 7.2).

7.4.6 Predicted Outcome

The Project is not expected to have a detrimental impact on the distribution or abundance of flora species or vegetation with conservation significance.

7.5 WEEDS

7.5.1 Overview

This section discusses the potential for the introduction or spread of weeds through construction and operational activities and the impact of this on the surrounding environment.

Six environmental weed species (Table 7.2) were recorded within the proposal area during baseline flora surveys (*ecologia*, 2008a). None of the weed species observed are declared under the *Agriculture and Related Resources Protection Act 1976.*

Table 7.2 – Weeds Occurring in the Proposal Area

Species	Common Name
Aerva javanica	Kapok Bush
Bidens bipinnata	Bipinnate Beggartick
Cenchrus ciliaris	Buffel-Grass
Cucumis melo subsp. agrestis	Ulcardo Melon
Malvastrum americanum	Spiked Malvastrum
Vachellia farnesiana	Mimosa Bush

There is a low abundance of weeds within the proposal area. Weeds are generally limited to drainage lines and areas close to the existing Mainline. Weeds are commonly spread through the transfer of seeds via tyres and tracks, inadequate vehicle hygiene, use of non-designated tracks and roads and uncontrolled personnel and vehicle access to site. Once established, weed seeds can also be spread by feral and native animal species.

7.5.2 EPA Objective

The EPA's objective with regard to weed management is to maintain the abundance, species diversity, geographic distribution and productivity of vegetation communities through the avoidance or management of adverse impacts and improvement in knowledge.

7.5.3 Policy and Standards

The relevant policies and standards that have been addressed in the environmental assessment process include the following:

- the National Weeds Strategy (ARMCANZ, ANZECC);
- Guidance Statement No. 33 Environmental Guidance for Planning and Development (EPA, 2008);
- Environmental weed strategy for Western Australia (CALM, 1999); and
- A Weed Plan for Western Australia (State Weed Plan Steering Group, 2001).

7.5.4 Potential Impacts

The proposal has the potential to spread existing weed infestations or introduce current and/or new weeds into previously weed-free areas.

Weeds can impact the ecology and biodiversity of natural systems through out-competing native species for space, nutrients and water. Once established, weeds can also alter the composition and structure of vegetation communities.

7.5.5 Management of Impacts

A Weed Management Plan has been developed to minimise the risk of spreading or introducing weeds within the proposal area. A copy of this Plan is included in Appendix C.

Management controls stipulated in the Weed Management Plan, include:

- washdown facilities will be located at entry points to the proposal area and mobile machinery and equipment will be washed down prior to entry to the proposal area;
- a Weed Hygiene Certificate is to be approved following washdown and inspection;
- mobile washdown facilities will be used in areas of known weed infestations;
- equipment and vehicles to be washed down prior to leaving a known weed infested site;
- quarantine of topsoil infested with weeds; and

- access to known weed infested areas is to be limited by signage and information provided to personnel during the induction.

BHPBIO will conduct baseline weed mapping prior to commencement of construction to identify existing weed populations. Regular weed inspections will be conducted to identify new weed infestations. Weed management strategies will be implemented to contain and where possible, eradicate any new weed infestations within the proposal area, including borrow pit locations.

BHPBIO will ensure that all ballast is weed free (particularly from Ruby Dock) prior to transport to the proposal area.

BHPBIO is committed to monitoring and managing weeds along the rail deviation and will undertake quarterly monitoring during construction and annual monitoring once operational.

7.5.6 Predicted Outcome

Weed hygiene measures will minimise this risk of introduction or spread of weeds within the proposal area. Any new weed species or weed populations identified within the proposal area will be treated and controlled, and where possible, eradicated.

8 OTHER RELEVANT FACTORS AND MANAGEMENT

A summary of the risk assessment, including inherent and residual risk ratings, is included in Table 8.1. The residual risk rating has been determined by taking into consideration the management controls detailed throughout this section. 'Other' relevant environmental factors will be managed in accordance with existing BHPBIO management plans and procedures.

Table 8.1 – Inherent and Residual Risk of 'Other' Environmental Factors

Risk Details			Inherent Risk			Controls	Residual Risk		
Key Factor	**Event**	**Impacts / Outcomes**	**Severity**	**Likelihood**	**Inherent Risk Rating**		**Severity**	**Likelihood**	**Residual Risk Rating**
BIOPHYSICAL									
Groundwater	Reduction in groundwater quality and/or quantity	• Reduction of future water supply.	10	0.3	**3**	• All groundwater abstraction bores are to be licensed and operated in accordance with the approved Groundwater Licence Operating Strategy.	1	0.3	**0.3**
Subterranean Fauna	Groundwater abstraction	• Fauna death; and • pollution or disruption of fauna habitat.	10	0.1	**1**	• Operation of all groundwater bores in accordance with the approved Groundwater Licence Operating Strategy; • minimise the depth of cuttings; and • appropriate transport and handling, storage and disposal of hydrocarbons and hazardous materials.	10	0.1	**1**
	Vibrations due to blasting		10	0.3	**3**		10	0.1	**1**
	Hydrocarbon spill		3	1	**3**		3	0.3	**0.9**
	Removal of habitat		3	1	**3**		3	1	**3**

Rehabilitation	Fire	• Death of rootstock and seed stores;
		• poor seed store retention;
		• erosion;
		• weed invasion.
			10	0.3	**3**	• Areas not required for ongoing operations will be progressively rehabilitated;
						• The rehabilitation procedure will include:
						  • respreading of available topsoil and vegetative matter, either directly from areas undergoing disturbance, or from stockpiled material;
						  • scarification of compacted surfaces to a depth of approximately 300 mm, along contour lines where ground conditions and hydrology allow;
						  • implementation of erosion control methods where required; and
						  • ongoing monitoring and corrective actions until completion criteria are met.
							3	0.3	**0.9**

	Ineffective storage of topsoil		3	3	**9**		3	1	**3**
	Unsuccessful rehabilitation		3	3	**9**		3	1	**3**
Decommissioning of Rail	Inadequate planning and/or implementation of closure plan	• Culvert failure resulting in altered surface water flows; • negative visual amenity; and • permanent barrier for land access.	10	1	**10**	• Development of a detailed closure plan in accordance with relevant legislation and standards at the time of decommissioning.	3	0.1	**0.3**
POLLUTION MANAGEMENT									
Greenhouse Gas Emissions	General vehicle/plant emissions excessive	• Generation of carbon dioxide emissions; and • atmospheric pollution.	1	0.03	**0.03**	• Regular machinery maintenance to maintain engine efficiency; and • reduce the rail gradient to increase efficiency of rail operations.	1	0.03	**0.03**
	Emissions from operating locomotives		1	10	**10**		1	0.03	**0.03**

Dust	Generation of dust	• General nuisance.	1	3	**3**	• Implementation of the following management measures:
						  • use of water to suppress dust emissions;
						  • reduction of vehicle speed limits; and
						  • visual monitoring to identify and mitigate excessive dust events.
							1	3	**3**

Surface Water Quality	Hydrocarbon spill	• Fauna death/injury/illness;
		• downstream pollution and potential impacts on flora or fauna;
		• increased turbidity in waterways; and
		• adverse impacts to human or fauna health.
			3	3	**9**	• Implementation of the Surface Water Management Plan, including the following controls:
						  • procedures for transport and handling, storage and disposal of hydrocarbons and hazardous materials;
						  • containment and control of spills to reduce the extent of impact;
						  • minimising potential for erosion of stockpiles during heavy rainfall through consideration of stockpile locations, use of hydromulch and bunding where required; and
						  • visual monitoring to identify elevated turbidity in runoff.
							1	1	**1**

	Increased turbidity in waterways		3	3	**9**		3	1	**3**
	Minor septic spill		3	0.3	**0.9**		3	0.3	**0.9**
Groundwater Quality	Hydrocarbon spill	• Reduced groundwater quality.	10	0.3	**3**	• Implementation of hydrocarbons and chemicals procedures detailed in the construction EMP.	1	0.3	**3**

Risk Details			Inherent Risk			Controls	Residual Risk		
Key Factor	**Event**	**Impacts / Outcomes**	**Severity**	**Likelihood**	**Inherent Risk Rating**		**Severity**	**Likelihood**	**Residual Risk Rating**
Waste Management	Incorrect disposal of waste	• Injury, illness or death of fauna.	3	3	**9**	• Adoption of the waste management hierarchy of elimination, reduction, reuse, recycling, treatment and disposal; and • adoption of best practice waste management procedures.	3	1	**3**
Noise and Vibration	Excessive noise event	• Disturbance to fauna.	3	1	**3**	• Management of all activities in accordance with the Environmental Protection (Noise) Regulations 1997 and ADP Health and Safety Management Plan (PP-09-100); • Routine vehicle and machinery maintenance; and • use of noise reduction devices on equipment if necessary.	1	1	**1**
	Excessive vibration event		3	1	**3**		1	1	**1**
SOCIAL									
Economic and Social	Fire	• Negative community response; • reduction in pastoral productivity; • restrictions to transport of goods and services to stations; and • damage to public vehicles.	10	1	**10**	• Regular communication with surrounding landholders.; and • implementation of fire management controls.	10	0.3	**3**
	Loss of productivity of pastoral stations		3	0.3	**0.9**		1	0.1	**0.1**
	Vehicular accident		3	1	**3**		1	0.3	**0.3**
Visual Amenity	Poorly designed or located borrow pits	• Negative community or stakeholder response to proposal.	3	3	**9**	• Implementation of progressive rehabilitation in all areas not required during ongoing operations; • consideration of visual amenity in the planning, design and location of borrow pits; and • use of endemic species in rehabilitation.	1	1	**1**
	General clearing and/or poor rehabilitation		3	3	**9**		1	1	**1**
Recreational Activity	Temporary impacts on public access	• Negative community response.	1	3	**3**	• Regular communication with surrounding landholders regarding the timing and location of construction activities.	1	0.3	**0.3**

8.1 GROUNDWATER

8.1.1 Overview

The proposal will require construction water for a variety of purposes, including conditioning of fill material and dust suppression. Approximately 365 ML of water per annum is expected to be required during the construction phase.

Water will also be required for ongoing rail operations and maintenance. BHPBIO propose to use groundwater to meet the proposal's water requirements, which would be sourced from existing bores located along the Newman to Port Hedland Mainline.

8.1.2 EPA Objectives

The EPA's objectives with regards to groundwater management are to maintain the quantity of water so that existing and potential environmental values, including ecosystem maintenance, are protected.

8.1.3 Policy and Standards

The relevant policies and standards that have been addressed in the environmental assessment process include the following:

- the National Water Quality Management Strategy (NRMMC); and
- State Water Quality Management Strategy (Government of WA).

8.1.4 Potential Impacts

Groundwater abstraction has the potential to impact on groundwater aquifers and groundwater dependent ecosystems (vegetation and stygofauna) due to excessive drawdown and aquifer dewatering, if groundwater is abstracted at unsustainable rates. The closest groundwater bore to Bamboo Springs (Bore T226) is located approximately 170 m to the south-east of the proposal area.

8.1.5 Management of Impacts

Operation of groundwater abstraction bores will be in accordance with the relevant groundwater abstraction licences and BHPBIO's existing Groundwater Licence Operating Strategy, including:

- installation of flow meters on bores;
- monitoring of abstraction volumes, rates and groundwater levels; and
- field and laboratory analysis of groundwater samples.

Prior to abstraction of groundwater from any bore within 200 m of Bamboo Springs, monitoring bores will be established between Bamboo Springs and the bore to monitor the extent of drawdown.

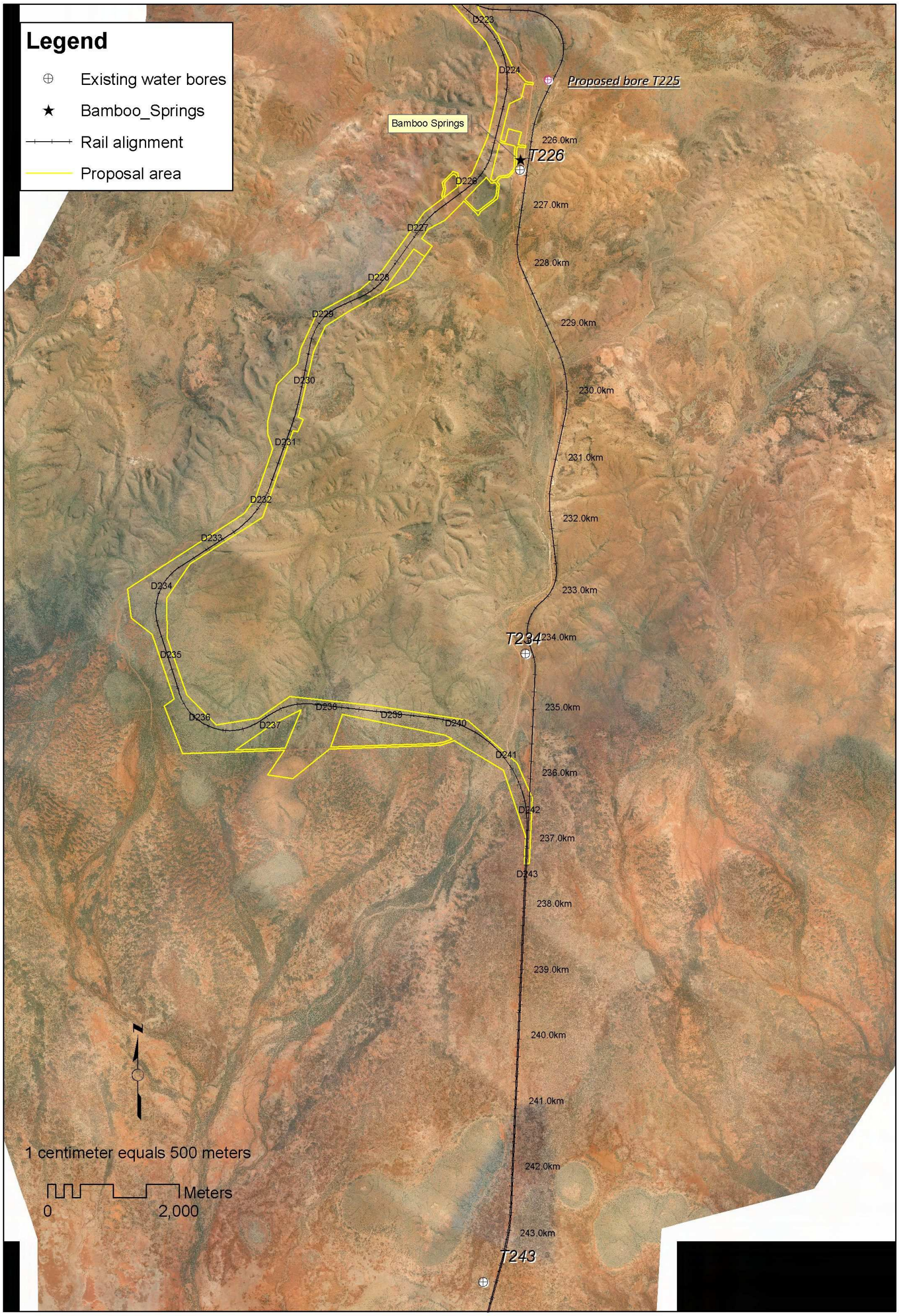
Sustainable yields for each bore will be confirmed prior to use. The sustainable yield will not be exceeded and will ensure that groundwater drawdown remains localised and temporary. BHPBIO anticipate that groundwater abstraction will have negligible impact on Bamboo Springs.

For construction purposes a new bore may be drilled approximately 1 km north of Bamboo Springs (approximate Ch 225 km) if abstraction from bore T226 is likely to impact on Bamboo Springs (Figure 8.1).

8.1.6 Predicted Outcome

Groundwater abstraction will be carried out in accordance with the management controls and contingencies described in the Groundwater Licence Operating Strategy. The proposal is expected to have negligible impacts on groundwater dependent ecosystems given the short duration of increased groundwater abstraction due to construction of the proposal.

Figure 8.1 – Groundwater Bores Within the Vicinty of the Proposal Area



8.2 SUBTERRANEAN FAUNA

8.2.1 Overview

The findings of *ecologia*'s desktop study indicate that stygofauna may be present within the proposal area. It is unlikely the proposal will impact stygofauna due to measures to prevent excessive drawdown and the short-term duration of groundwater abstraction. Abstraction of groundwater will be carried out in accordance with the Groundwater Operating Strategy and will not exceed approved trigger levels.

Since the proposal area has unfavourable geological characteristics for troglofauna, it is unlikely that troglofauna populations will be impacted (*ecologia,* 2008d). Removal of material for the proposal will be completed using shallow cuttings, which are not expected to impact on interconnectivity between voids.

8.2.2 EPA Objective

The EPA's objective with regard to subterranean fauna management is to maintain the abundance, diversity and geographic distribution of subterranean fauna.

8.2.3 Policy and Standards

The relevant policies and standards that have been addressed in the environmental assessment process for subterranean fauna include the following:

- Guidance Statement no. 54. Consideration of subterranean fauna in groundwater and caves during EIA in WA (EPA, 2003);
- Guidance Statement no. 33 Environmental Guidance for Planning and Development (EPA, 2008); and
- *Wildlife Conservation Act* (1950).

8.2.4 Potential Impacts

The proposal has the potential to impact on subterranean fauna communities through:

- changes to groundwater quantity and quality as a result of groundwater abstraction;
- surface and groundwater contamination (e.g. hydrocarbon spills);
- sealing of the surface thereby reducing rainfall and nutrient inputs; and
- removal of geological strata for rail cuttings.

8.2.5 Management of Impacts

Controls to minimise impacts on subterranean fauna are described below:

- procedures for the transport and handling, storage and disposal of hydrocarbons and hazardous materials;
- conduct routine machinery and fuel hose maintenance;
- contain and control any spills to restrict the extent of impact;
- maintaining emergency spill kits on site; and
- minimise the depth of cuttings.

Further, all groundwater abstraction bores will be operated in accordance with the approved Groundwater Licence Operating Strategy. The Groundwater Licence Operating Strategy assigns a pumping water trigger level to each bore to limit drawdown and prevent aquifer dewatering.

8.2.6 Predicted Outcome

The proposal is expected to have negligible impacts on subterranean fauna given the short duration of groundwater abstraction, and minimal removal of geological strata.

8.3 REHABILITATION

8.3.1 Overview

Minimisation of clearing and land disturbance is a key objective of the proposal. The proposal will involve clearing of up to 400 ha of vegetation, with approximately 118 ha (30%) of this being required for permanent infrastructure. Where disturbance has taken place during construction in areas not required for ongoing operations (approximately 282 ha), these areas will be progressively rehabilitated using topsoil reinstatement techniques. Rehabilitation activities will be completed prior to demobilisation of contractors.

The objective of progressive rehabilitation and final rehabilitation is to establish stable, non-erodible landforms that support self-sustaining native vegetation and land uses similar to those prior to disturbance.

8.3.2 EPA Objectives

The EPA's objectives with regards to rehabilitation are:

- to ensure, as far as practicable, that rehabilitation achieves a stable and functioning landform which is consistent with the surrounding landscape and other environmental values;
- to ensure that rehabilitation achieves an acceptable standard compatible with the intended land use, and consistent with appropriate criteria; and
- to maintain the integrity, ecological functions and environmental values of the soil and landform.

8.3.3 Policy and Standards

The relevant policies and standards that have been addressed in the environmental assessment process include the EPA Guidance Statement No. 6: Rehabilitation of Terrestrial Ecosystems (2006).

8.3.4 Potential Impacts

There are a number of factors which could limit the success of rehabilitation, including:

- low resilience to fire disturbance, particularly in the early phases of vegetation re-establishment where soil seed stores are low;
- ineffective topsoil stripping and storage, leading to:
    - poor seed store retention;
    - insufficient topsoil quality;
    - insufficient quantities of topsoil;
    - loss of soil stockpiles due to rain or wind erosion; and
    - weed infestation of soil stockpiles.

Unsuccessful rehabilitation may result in impacts on future land use, poor land stability, erosion and changes to vegetation composition.

8.3.5 Management of Impacts

Potential factors limiting the success of rehabilitation will be managed through the implementation of the following management controls:

- education of personnel through inductions and toolbox meetings;

- use of designated waste receptacles;
- restrictions on vehicular access from off-road activities;
- topsoil to be conserved for rehabilitation;
- topsoil stockpiles to be limited to a maximum 1.5 m in height;
- minimisation of topsoil storage times where possible;
- placement of stockpiles outside of drainage areas and watercourses; and
- quarantine of weed infested topsoil stockpiles and use of appropriate signage.

Of particular importance to progressive rehabilitation is preservation and re-use of disturbed topsoil and vegetation. In general, the procedure for rehabilitation will consist of:

- removal of temporary infrastructure and materials;
- visual identification and removal of contaminated soil if present;
- respreading of available topsoil and vegetative matter, either directly from areas undergoing disturbance, or from stockpiled material;
- scarification of compacted surfaces to a depth of approximately 300 mm, along contour lines where ground conditions and hydrology allow;
- construction of erosion control where required; and
- ongoing monitoring and corrective actions until completion criteria are met.

Vegetation and topsoil will be recovered and preferably, directly placed on disturbed areas. It is likely that some material will need to be stockpiled. These stockpiles will be placed in designated areas and will be no more than 1.5 m in height for topsoil and 2 m in height for vegetation stockpiles to allow for preservation of viable residual soil seed.

Topsoil and vegetation stockpiles will be preferentially located to avoid drainage lines, low lying and sheetflow dependent areas.

Borrow pits shall be rehabilitated progressively when they are no longer in use. Borrow pits shall be rehabilitated according to the Construction Environmental Management Plan to ensure that they are self-draining.

Rehabilitation will be carried out in accordance with the existing BHPBIO Asset Development Projects Rehabilitation and Demobilisation Procedure.

8.3.6 Predicted Outcome

The quality of rehabilitation will be assessed as part of the site demobilisation process to ensure stable landforms that support self sustaining native vegetation are achieved. Should rehabilitation not meet the project criteria, BHPBIO will undertake additional rehabilitation activities within the proposal area.

8.4 DECOMMISSIONING OF RAIL

8.4.1 Overview

This section outlines the potential impacts associated with decommissioning of rail infrastructure. The operating life of the rail line is unknown, and will depend on demand from existing and potential future mining operations in the Pilbara region.

8.4.2 EPA Objectives

The EPA's objectives with regards to decommissioning are:

- to ensure, as far as practicable, that rehabilitation achieves a stable and functioning landform which is consistent with the surrounding landscape and other environmental values;

- to ensure that rehabilitation achieves an acceptable standard compatible with the intended land use, and consistent with appropriate criteria; and
- to maintain the integrity, ecological functions and environmental values of the soil and landform.

8.4.3 Potential Impacts

Closure planning will be required to mitigate any potential impacts associated with rail infrastructure following cessation of railway operations by BHPBIO and in the event that infrastructure is not required by another party. Potential impacts resulting from inadequate closure planning include:

- culvert failure due to age and lack of maintenance leading to altered surface water flows;
- negative visual amenity; and
- permanent barrier for land access.

8.4.4 Management of Impacts

In the event that the railway is no longer required by BHPBIO or another party, the infrastructure associated with the rail line will be decommissioned. Decommissioning will involve removal of all infrastructure and compliant disposal of waste materials. Following decommissioning the site will be rehabilitated. If removal of non-visible infrastructure is likely to cause more environmental damage than if left in-situ, BHPBIO will liaise with the relevant authorities to determine management options.

The Chichester Deviation will be incorporated into BHPBIO's Conceptual Closure Plan for the Mt Newman Rail Line.

8.4.5 Predicted Outcome

At the completion of operations, equipment and infrastructure, with the exception of those still required by the State or another third party, will be removed from the site or buried. Closure planning will be undertaken in consultation with the relevant authorities.

8.5 GREENHOUSE GAS EMISSIONS

8.5.1 Overview

Construction and operation of the rail line will result in the generation of greenhouse gas emissions. Construction of the Deviation will allow improved efficiency due to a lower transport gradient, and is anticipated to improve the efficiency of BHPBIO Pilbara operations.

The current fuel consumption of rail operations is 1.044L / tonne per kilometre, equating to approximately 3.13 kg CO_2e / tonne per km. The proposal is expected to reduce the overall fuel consumption required for transport of ore by approximately 6%. Lowering the gradient through the Chichester Deviation is therefore estimated to provide a reduction of approximately 0.19 kg CO_2e / tonne per kilometre.

Greenhouse gas emissions associated with the construction of the Chichester Deviation have been calculated using the DEWHA Greenhouse Gas Emissions Calculator (2008b). Based on the estimated diesel consumption, approximately 15,156 tonne CO_2e will be generated during the construction phase.

8.5.2 EPA Objectives

The EPA's objectives with regards to greenhouse gas emissions are to minimise emissions to levels as low as practicable on an on-going basis and consider offsets to further reduce cumulative emissions.

8.5.3 Policy and Standards

The relevant policies and standards that have been addressed in the environmental assessment process include the following:

- Western Australian Greenhouse Strategy (Western Australian Greenhouse Task Force, 2004); and
- EPA Guidance Statement No. 12: Minimising Greenhouse Gases.

8.5.4 Potential Sources

Potential sources of greenhouse gas emissions from the proposal include:

- the use of diesel power vehicles and plant during construction and operation;
- use of explosives for blasting of railway cuttings; and
- locomotives used to transport iron ore during the operation phase.

8.5.5 Management of Impacts

Regular maintenance will be conducted on machinery, vehicles and locomotives to maintain efficiency and reduce emissions.

The lower gradient delivered by the proposal will reduce fuel consumption associated with the transportation of ore to Port Hedland.

Rehabilitation will be carried out in areas not required for ongoing operations (approximately 280 ha) to emulate the pre-clearing vegetation biomass.

8.5.6 Predicted Outcome

The proposal is not expected to result in significant greenhouse gas emissions.

8.6 DUST

8.6.1 Overview

Construction activities including clearing of vegetation, stripping of topsoil and blasting have the potential to generate dust, which may impact on people or the surrounding environment. The nearest sensitive receptors to the proposal are BHPBIO's Redmont Camp, located adjacent to the Mainline approximately 15 km north of the Chichester Deviation. Dust suppression measures will be implemented to minimise any potential dust emissions.

8.6.2 EPA Objectives

The EPA's objectives with regards to dust are to ensure that air emissions do not adversely affect environmental values or the health, welfare and amenity of people and land uses by meeting statutory requirements and acceptable standards.

8.6.3 Policy and Standards

The relevant policies and standards that have been addressed in the environmental assessment process include the following:

- EPA Guidance Statement No. 18: Prevention of Air Quality Impacts from Land Development Sites (2000); and
- *Occupational Safety Regulations (1996).*

8.6.4 Potential Impacts

Due to the lack of nearby sensitive receptors, the potential impacts arising from dust emissions are limited.

8.6.5 Management of Impacts

The general principles for managing dust include:

- minimise requirements for clearing;
- dust emissions from unsealed roads, topsoil stockpiles and work areas shall be suppressed with water. Where this is not possible alternative dust management procedures will be created between BHPBIO and the contractor;
- vehicle speeds are to be immediately reduced if dust emissions from roads are visually excessive; and
- if dust levels are deemed excessive, the frequency of dust suppression using water will be increased as required.

Visual monitoring of dust will be conducted during daily construction activities, particularly during dry and windy weather conditions.

8.6.6 Predicted Outcome

Dust management controls will be implemented as required. Impacts on visual amenity or health resulting from dust events are not expected.

8.7 SURFACE WATER QUALITY

8.7.1 Overview

This section discusses the potential impacts on surface water quality associated with the proposal and the impacts that changes to surface water quality may have on environmental values of the surrounding area.

Key considerations regarding impacts to surface water quality for the Project include:

- hydrocarbon spills resulting in illness or death of terrestrial or aquatic fauna;
- seepage of hydrocarbon spills into the groundwater aquifer;
- minor septic spills causing potential impacts on human or faunal health; and
- increased turbidity due to erosion and sediment-laden runoff.

8.7.2 EPA Objectives

The EPA objective with regards to surface water quality is to ensure that emissions do not adversely affect environmental values or the health, welfare and amenity of people and land uses by meeting statutory requirements and acceptable standards.

8.7.3 Policy and Standards

The relevant policies and standards that have been considered in the environmental assessment process for surface hydrology and wetlands include the following:

- Environmental Water Requirements to Maintain Wetlands of National and International Importance;
- Australian and New Zealand Water Quality Guidelines; and
- EPA Position Statement 4: Environmental Protection of Wetlands (2004).

8.7.4 Potential Impacts

Potential impacts to surface water quality from construction of the proposed Chichester Deviation include:

- increased risk of erosion and sedimentation;
- reduction of surface water runoff quality;

- contamination of groundwater aquifer;
- impacts on downstream watercourse ecology or vegetation communities resulting from spills or increased turbidity.

8.7.5 Management of Impacts

Erosion and sedimentation impacts are expected to be localised and short term. BHPBIO will adopt the following controls to manage potential sources of contamination during the Project:

- hydrocarbons shall be stored and distributed in above ground tanks and pipelines in accordance with the *Dangerous Goods Safety (Storage and Handling for Non-explosives) Regulations 2007* and AS1940, Storage and Handling of Flammable and Combustible Liquids;
- environmentally hazardous goods will be stored in containment areas designed to prevent and contain releases of environmentally hazardous chemicals and in accordance with separation and compatibility requirements;
- secondary containment facilities shall ensure 110% containment of material and prevention of pollution in the event of breach of primary containment;
- re-fuelling bays at bulk fuel storage facilities will be equipped with concrete aprons or suitable lining (e.g. heavy duty plastic);
- hydrocarbon contaminated material will be disposed of at a licensed facility;
- spill clean up material shall be readily available at work sites and on mobile service trucks of vehicles, where hydrocarbons and chemicals are stored and/or used;
- hydrocarbon and chemical handling activities shall not be conducted in the vicinity of drainage lines without prior authorisation from the site environmental representative. Where such activities are necessary to the Scope of Works, a pre-task Job Hazard Analysis shall be a part of the approval process;
- no refuelling shall be allowed within 50 m of a watercourse;
- erosion control measures shall be implemented to minimise erosion of stockpiles prior to forecasted heavy rainfall;
- topsoil stockpiles shall be bunded; and
- a minimum 50 m buffer shall be maintained between watercourses and hardstand areas and borrow pits.

Surface water quality monitoring and inspection requirements are detailed in the Surface Water Management Plan developed for the proposal.

Monitoring will include visual inspection of land stability and erosion in areas of rehabilitation.

8.7.6 Predicted Outcome

The proposal is expected to minimally impact on surface water quality. Increased turbidity loading could be expected during high rainfall events during the construction phase, however these impacts will be mitigated by erosion and sedimentation control procedures. BHPBIO will monitor and manage surface water to minimise impacts associated with the Project.

8.8 GROUNDWATER QUALITY

8.8.1 Overview

Groundwater within the Chichester Range is expected to be in excess of 20 m below ground level (Aquaterra, 2007). Hydrocarbons and some chemicals will be required for construction-related activities. Spillages of hydrocarbons or chemicals could result in contamination of groundwater.

8.8.2 EPA Objectives

The EPA's objective with regards to groundwater quality is to ensure that emissions do not adversely affect environmental values or the health, welfare and amenity of people and land uses by meeting statutory requirements and acceptable standards.

8.8.3 Policy and Standards

The relevant policies and standards that have been addressed in the environmental assessment process include the following:

- the National Water Quality Management Strategy (NRMMC); and
- State Water Quality Management Strategy (Government of WA).

8.8.4 Potential Impacts

Construction activities have the potential to impact on groundwater quality as a result of:

- hydrocarbon releases due to breakage of machinery components;
- releases of fuel during equipment refuelling;
- leakage of stored fuel or other hazardous materials; and
- loss of fuel or other hazardous materials during transport.

8.8.5 Management of Impacts

The following management actions will be implemented to ensure appropriate management of hydrocarbons and hazardous goods during the Project:

- hydrocarbons shall be stored and distributed in above ground tanks and pipelines in accordance with the *Dangerous Goods Safety (Storage and Handling for Non-explosives) Regulations 2007* and AS1940, Storage and Handling of Flammable and Combustible Liquids;
- environmentally hazardous goods will be stored in containment areas designed to prevent and contain releases of environmentally hazardous chemicals and in accordance with separation and compatibility requirements;
- secondary containment facilities shall ensure 110% containment of material and prevention of pollution in the event of breach of primary containment;
- re-fuelling bays at bulk fuel storage facilities will be equipped with concrete aprons or suitable lining (e.g. heavy duty plastic);
- hydrocarbon contaminated material is to be disposed of at a licensed facility;
- spill clean up material shall be readily available at work sites and on mobile service trucks of vehicles, where hydrocarbons and chemicals are stored and/or used; and
- hydrocarbon and chemical handling activities shall not be conducted in the vicinity of drainage lines without prior authorisation from the site environmental representative. Where such activities are necessary to the Scope of Works, a pre-task Job Hazard Analysis shall be a part of the approval process.

8.8.6 Predicted Outcome

Management controls shall be implemented to minimise the potential for contamination of groundwater. The risk of groundwater contamination resulting from Project related activities is considered low.

8.9 WASTE MANAGEMENT

8.9.1 Overview

Solid and liquid wastes generated during the proposal construction activities have the potential to negatively impact on the surrounding environment if not managed and disposed of in an appropriate manner.

Wastes that may be generated by the proposal include:

- packaging material (plastic wrapping, pallets etc);
- scrap metal;
- drilling muds;
- green waste;
- construction wastes (e.g. spoil material, ballast);
- waste oil, hydrocarbons and hazardous materials;
- food packaging and scraps; and
- domestic sewage.

8.9.2 EPA Objectives

The EPA's objective with regards to waste are:

- to maintain the integrity, ecological function and values of the environment; and
- to ensure that emissions do not adversely affect the health, welfare and amenity of people and land uses.

8.9.3 Policy and Standards

The relevant policies and standards that have been addressed in the environmental assessment process include the following:

- *Environmental Protection (Controlled Waste) Regulations 2004*;
- *Litter Regulations 1981*; and
- Review of Waste Classification and Waste Definitions 1996 (as amended) (DoE 2005).

8.9.4 Potential Impacts

Improper management or treatment of solid and liquid wastes, including controlled and non-controlled wastes, has the potential to adversely affect soil, surface and ground water, impact on native fauna and pose a risk to human health. BHPBIO will ensure that the generation of waste is minimised and that any waste products are handled and disposed of in an acceptable manner.

8.9.5 Management of Waste Impacts

The general guiding principles for managing waste within the Chichester Deviation are:

- to observe the waste management hierarchy of elimination, reduction, reuse, recycling, treatment and disposal;
- to manage waste in a manner that minimises potentially detrimental effects to the environment; and
- disposal of waste in accordance with regulatory and legislative requirements.

Waste management practices are summarised below:

- waste stations, which include various bin types required for segregation of waste types generated (e.g. green waste, general rubbish, recycling), will be established around the project site;

- scrap metal, such as track materials, will be recycled;
- hydrocarbons and oily wastes will be contained in designated storage drums, stored on bunded pallets or within a bunded containment, and disposed of at a licensed facility; and
- spoil material will be temporarily stockpiled in an appropriate location before being used to backfill borrow locations.

8.9.6 Predicted Outcome

Waste associated with the proposal will be managed to ensure that it does not detrimentally impact on the physical or social environment. Waste generated from the proposal will be trucked via road to a licensed disposal site at Port Hedland.

8.10 NOISE AND VIBRATION

8.10.1 Overview

Blasting and excavation activities have the potential to result in noise and vibration impacts during construction of the Project.

The proposal area passes through Mulga Downs pastoral station, however it is relatively remote from any buildings. The only affected premises is an outcamp located on Mulga Downs station, approximately 10 km south of the proposed deviation. The outcamp is utilised as temporary accommodation by stockmen during mustering in the area. Construction and operational noise is considered unlikely to impact on the outcamp (Lloyd George Acoustics, 2008a).

Redmont camp, which accommodates BHPBIO personnel, is located approximately 15 km north of the Chichester Deviation. Noise levels at this location are below the level predicted at the Mulga Downs outcamp and are unlikely to be audible (Lloyd George Acoustics, 2008a).

8.10.2 EPA Objective

The EPA's objective with regards to noise and vibration is to protect the amenity of nearby residents from noise impacts resulting from activities associated with the proposal by ensuring the noise levels meet statutory requirements and acceptable standards.

8.10.3 Policy and Standards

The relevant policies and standards that have been addressed in the environmental assessment process include the following:

- *Environmental Protection (Noise) Regulations* (1997);
- Draft Statement of Planning and Policy: Road and Rail Transportation Noise; and
- Draft EPA Guidance for the Assessment of Environmental Factors No 14 (Version 3) Road and Rail Transportation Noise.

8.10.4 Potential Impacts

The proposal has the potential to cause disturbance to terrestrial fauna as a result of excessive noise or vibration events. Likely sources of noise and vibration include:

- blasting;
- earthworks related to construction of the rail formation, access roads and associated infrastructure;
- use of poorly maintained machinery;
- general construction traffic; and
- rail operations.

Noise modelling indicates that noise from construction and blasting are unlikely to impact on any noise sensitive premises (Lloyd George Acoustics, 2008a). Operational noise levels at the Mulga

Downs Outcamp are projected to be within acceptable levels under the draft *Statement of Planning and Policy: Road and Rail Transportation Noise* and conditional (N2 Rating) under the *EPA Statements for EIA No 14 (Version 3) – Road and Rail Transport Noise.* However, as this is not a residential property and is used only on occasions as a temporary shelter, noise is not expected to be an issue (Lloyd George Acoustics, 2008a).

Terrestrial fauna are not expected to be adversely impacted by noise and vibration impacts. Although research into the effects of noise on animals is relatively scarce, previous studies indicate that many animals are able to quickly adapt to the presence of human-generated noise if other sensory systems are stimulated (Environ 2005; Lloyd Acoustics 2004).

A vibration impact assessment conducted for the proposal area, suggested that *Aurecocrypta* sp. may be disturbed within a distance of 30 m from the railway. However, outside of this distance, the vibration levels are unlikely to be detected (Lloyd George Acoustics, 2008b).

8.10.5 Management of Noise and Vibration Impacts

The following management measures will be implemented to manage noise and vibration associated with construction activities:

- activities will be conducted in accordance with the *Environmental Protection (Noise) Regulations 1997*;
- equipment shall be appropriately fitted, maintained or substituted with noise reduction devices if necessary; and
- routine maintenance will be carried out on all vehicles and machinery.

8.10.6 Predicted Outcome

Noise and vibration impacts will be short-term during the construction phase. Given that there are no sensitive receptors within the vicinity of the proposal area, noise and vibration impacts are considered minor.

8.11 ECONOMIC AND SOCIAL

8.11.1 Overview

BHPBIO has commenced consultation with both landholders and government agencies.

The proposal area passes through the Mulga Downs pastoral lease.

8.11.2 EPA Objectives

The EPA's objectives with regards to social surrounds are to ensure that risk from the proposal is as low as reasonably achievable and complies with acceptable standards and EPA criteria.

8.11.3 Potential Impacts

Given the surrounding land use, social and economic impacts are expected to be minimal. Although considered unlikely, potential impacts may include:

- increased risk of fire from construction activities impacting on pastoral lands; and
- increased traffic on access roads during construction resulting in potential for greater interaction between construction, recreational and pastoral road users (e.g. vehicle accidents).

8.11.4 Management of Impacts

BHPBIO will maintain regular communication with surrounding landholders to ensure they are informed of the timing and location of construction activities.

To minimise the potential for fire resulting from construction activities to impact on pastoral lands, BHPBIO will implement the following fire management controls:

- fire fighting equipment will be maintained on site, and personnel will be trained in the use of such equipment; and
- personnel shall be made aware of fire starting risks through the environmental induction.

8.11.5 Predicted Outcome

The proposal is not expected to adversely affect local landholders within the region. The proposal will provide significant opportunity for local, including indigenous, employment during construction, with a peak workforce of approximately 220 personnel required.

8.12 VISUAL AMENITY

8.12.1 Overview

The proposed construction of the Chichester Deviation and associated infrastructure has the potential to impact on visual amenity within the surrounding area. However, given that there are few sensitive receptor locations within the surrounding area, impacts to visual amenity values are considered to be minor.

8.12.2 EPA Objectives

The EPA's objective with regards to visual amenity is to ensure that aesthetic values are considered and measures are adopted to reduce visual impacts on the landscape as low as reasonably practicable.

8.12.3 Policy and Standards

The relevant policies and standards that have been addressed in the environmental assessment process include the following:

- Visual Landscape Planning in Western Australia (WAPC, 2007).

8.12.4 Potential Impacts

The physical presence of the rail formation, infrastructure and associated changes to the natural landscape has the potential to affect the visual amenity of the proposal area from publicly accessible locations.

Poor design, location and rehabilitation of borrow pits may also impact on visual amenity and cause negative response from the community and other stakeholders.

8.12.5 Management of Impacts

To minimise impacts to visual amenity, borrow pits will be will be offset from public access tracks by a minimum of 150 m where possible.

Where possible, borrow will be sourced by widening cuttings rather than creating defined borrow pits.

Progressive rehabilitation will be carried out in all areas not required for ongoing operations, in accordance with Section 8.3.

8.12.6 Predicted Outcome

The proposal is not considered likely to cause adverse impacts on visual amenity.

8.13 RECREATIONAL ACTIVITY

8.13.1 Overview

Construction of the Chichester Deviation has the potential to impact on recreational uses within the surrounding area by the local community.

8.13.2 EPA Objective

The EPA's objective with regards to recreation is to ensure that existing and planned recreational uses are not compromised.

8.13.3 Potential Impacts

There are no known regular recreational activities which take place in the vicinity of the proposal. Potential impacts to recreational activity resulting from the proposal are likely to be limited to short-term restrictions on thoroughfare access only. During construction, access to some areas may be blocked by construction machinery or vehicles. Access tracks may be temporarily removed during construction until a replacement access track has been established.

8.13.4 Management of Recreational Activity

Regular communication will be maintained with surrounding landholders to ensure they are informed of the timing and location of construction activities.

8.13.5 Predicted Outcome

BHPBIO will plan and manage construction activities to ensure minimal disruptions to recreational land users.

9 ENVIRONMENTAL MANAGEMENT COMMITMENTS AND CONCLUSIONS

9.1 ENVIRONMENTAL MANAGEMENT COMMITMENTS

BHPBIO's environmental commitments for the proposal are listed in Table 9.1. In the event that the Minister for the Environment considers the proposal to be environmentally acceptable, then some of these may become Ministerial Conditions under the EP Act.

Table 9.1 – Environmental Management Commitments for the Proposal

Commitment	Objective	Action	Timing	Outcome
Compliance reporting	To report environmental compliance.	BHPBIO will submit an annual environmental compliance report relating to the previous twelve-month period. The first report will be submitted within 15 months after the commencement of construction activities and thereafter annually to coincide with the current annual reporting period ending June 30 with reports submitted no later than 30 September. The environmental compliance reports will address each element of an audit program approved by the CEO and will be prepared and submitted in a format acceptable to the CEO.	Construction and for the first three years of operation.	Annual environmental compliance reporting including an environmental audit program.
Construction Environmental Management - Implementation	To minimise environmental impacts from construction activities.	The following management protocols within the construction EMP will be implemented: • hydrocarbons and chemicals management; • solid waste management; • clearing and topsoil management; • weed management; • flora and fauna management; • rehabilitation and demobilisation; • surface water and drainage management; • groundwater management; • air quality management; • Aboriginal heritage sites; • fire management; • sewage management; • remediation works; • noise and vibration management; and • management of borrow pits.	During mobilisation, construction and operation	Minimal environmental impacts with the implementation of the construction EMP and the management plans therein.

Commitment	Objective	Action	Timing	Outcome
Surface Hydrology	To minimise alteration of natural surface water flows.	BHPBIO will design and construct the rail formation and associated infrastructure in accordance with the Surface Water Management Plan. Environmental culverts (minimum 300 mm diameter) will be installed at 50 m intervals along the rail formation in areas identified as supporting sheetflow sensitive mulga. Minimum culvert specifications are based on advice from the Department of Environment and Conservation (Environmental Management Branch). Scour protection structures (i.e. riprap pads) will be installed opposite culvert locations to disperse runoff. BHPBIO will visually inspect culverts and scour protection structures prior to the onset of the typical wet season, and as required following significant rainfall events.	Construction	Minimal alteration to surface water regimes outside of the 200 m rail corridor.
Groundwater	To ensure no long term impacts on groundwater drawdown.	BHPBIO will operate groundwater abstraction bores in accordance with the Groundwater Licence Operating Strategy. Monitoring bores will be established between Bamboo Springs and the nearest abstraction bore prior to abstraction of groundwater within 200 m of Bamboo Springs.	During construction and operation	Minimal short-term impacts on groundwater drawdown.
Terrestrial fauna	To minimise impacts on conservation significant fauna and their habitat.	BHPBIO will minimise disturbance to significant fauna and significant fauna habitats and implement management controls outlined in the Significant Species Management Plan. There will be no adverse impact to Bamboo Springs.	During mobilisation and construction	No long-term impacts on significant fauna populations within the region.
Flora and vegetation	To have no detrimental impact on the distribution or abundance of significant vegetation and flora.	The total clearing area will not exceed 400 ha.	During mobilisation and construction	No detrimental impact on the distribution or abundance of significant flora species or poorly represented vegetation.
Weeds	To prevent the introduction or spread of weed species within the proposal area.	BHPBIO will implement weed hygiene protocols, monitoring and management controls outlined in the Weed Management Plan.	During mobilisation and construction	No new weed infestations or new weed species as a result of construction activities.
Surface Water Quality	To ensure no detrimental impact on surface water quality.	BHPBIO will construct the rail formation and associated infrastructure in accordance with the Surface Water Management Plan.	During construction	Minimal short-term impacts to surface water quality.
Economic and Social	To minimise impacts on surrounding landholders and land users.	BHPBIO will maintain communications with surrounding landholders to ensure traffic thoroughfare is maintained as far as practicable.	During construction	Minimal short term impacts on access and no economic loss for surrounding landholders.

Commitment	Objective	Action	Timing	Outcome
Rehabilitation	To ensure successful rehabilitation in areas not required for ongoing use or permanent infrastructure.	Where disturbance has taken place in areas not required for ongoing operations, BHPBIO will carry out progressive rehabilitation, including monitoring and maintenance plans.	Post construction	Rehabilitation of all areas not required for ongoing operations.
Decommissioning of rail	To avoid environmental impacts after cessation of railway operations by BHPBIO.	BHPBIO will establish decommissioning procedures, closure plans and completion criteria in accordance with the relevant legislation and standards.	Closure	No environmental impacts resulting from the rail line or associated infrastructure after cessation of railway operations by BHPBIO.
Recreational activity	To minimise disruption to land users.	BHPBIO will maintain communications with surrounding landholders to ensure traffic thoroughfare is maintained as far as practicable.	During construction.	Minimal short-term disruptions to recreational activity.

9.2 CONCLUSIONS

BHPBIO considers that the proposal, as described in this ERD, has been designed to avoid, minimise, manage or mitigate environmental impacts. Some decisions made early in the project planning stage which reduce both environmental and social impacts are as follows:

- the proposal will reduce the gradient of the rail formation through the Chichester Range and thereby reduce the overall fuel consumption required for transport of ore to Port Hedland;
- best practice surface water management practices have been adopted to preserve natural drainage patterns and minimise impacts on mulga vegetation;
- baseline biological surveys enabled refinement of the rail alignment to minimise disturbance to sensitive areas.
- cut and fill requirements have been balanced to minimise waste spoil material and the requirement for establishing new borrow pits;
- redesign of the rail formation to avoid Aboriginal heritage sites; and
- design of rail infrastructure as far upslope as possible in areas of sheet flow dependent mulga vegetation.

This document describes the impacts of the proposal, and for each factor discusses:

- the EPA objective for that factor;
- the potential impact;
- the management of impacts; and
- the outcome.

The following environmental factors were considered:

- terrestrial flora and vegetation (key);
- terrestrial fauna (key);
- weed management (key);
- surface hydrology (key);
- groundwater (other);
- subterranean fauna (other);
- rehabilitation (other);
- decommissioning of rail (other);
- greenhouse gas emissions (other);
- dust emissions (other);
- surface water quality (other);
- groundwater quality (other);
- waste management (other);
- noise and vibration (other);
- economic and social impacts (other);
- visual amenity (other); and
- recreational activity (other).

‘Other’ environmental factors will be managed in accordance with the construction EMP.

BHPBIO has developed the following management plans to specifically address environmental impacts associated with key factors which could not be adequately managed through existing BHPBIO procedures:

- Surface Water Management Plan (Appendix A);
- Significant Species Management Plan (Appendix B); and
- Weed Management Plan (Appendix C).

BHPBIO considers the EPA objectives can be met through the implementation of the proposed management and mitigation measures.

10 ABBREVIATIONS, DEFINITIONS AND REFERENCES

10.1 GLOSSARY, ACRONYMS AND ABBREVIATIONS

Acronym	Full Text
AHD	Australian Height Datum
ALARP	As Low As Reasonably Practicable
ANZECC	Australian and New Zealand Environmental and Conservation Council
ARI	Assessment on Referral Information
ARMCANZ	Agricultural and Resource Management Council of Australia and New Zealand
BHPBIO	BHP Billiton Iron Ore
BoM	Bureau of Meteorology
CAMBA	China-Australia Migratory Bird Agreement (1986)
Ch	Chainage
DEC	Department of Environment and Conservation (WA)
DEWHA	Department of the Environment, Water, Heritage and the Arts (Commonwealth)
DIA	Department of Indigenous Affairs (WA)
DMP	Department of Mines and Petroleum
DoIR	Department of Industry and Resources
DoW	Department of Water
DRF	Declared Rare Flora
EIA	Environmental Impact Assessment
EMP	Environmental Management Plan
EMS	Environmental Management System
EPA	Environmental Protection Authority (WA)
EP Act	Environmental Protection Act 1986 (WA)
EPBC Act	Environment Protection and Biodiversity Conservation Act 1999 (Commonwealth)
ERD	Environmental Referral Document
ESA	Environmentally Sensitive Area
FMG	Fortescue Metals Group Ltd
GWL	Groundwater Licence
Ha	Hectares
HSEC	Health, Safety, Environment and Community
IBRA	Interim Biogeographic Regionalisation for Australia
JAMBA	Japan-Australia Migratory Bird Agreement (1974)
MPDJV	Mine and Port Developments Joint Venture
Mt	Million tonnes
Mtpa	Million tonnes per annum
NES	National Environmental Significance
P1	Priority 1
P2	Priority 2
P3	Priority 3
P4	Priority 4
PEAHR	Project Environmental and Aboriginal Heritage Review

Acronym	Full Text
PEC	Priority Ecological Community
RGP5	Rapid Growth Project 5
SIA	Social Impact Assessment
SRE	Short Range Endemic (Fauna)
TEC	Threatened Ecological Community
VDA	Vegetation Disturbance Approval

10.2 DEFINITIONS

Ballast – The material, usually stone, that surrounds the sleepers on railways to hold them in place.

Borrow – The material, typically soil or rock free of vegetation, which is used in earthworks to establish level surfaces prior to construction of infrastructure.

Borrow pit – The area from which borrow is sourced.

Culvert – A conduit to allow water to pass underneath roads, railways or embankments, consisting of single or multiple barrels of metal or concrete.

Fill – Material, typically spoil from excavations free of vegetation, that is used to build up the natural ground surface to the height required for the construction of infrastructure.

Rip Rap Pad – A permanent cover of rock used to stabilise stream banks, provide in stream channel stability and provide a stabilised outlet below concentrated flows.

Spoil – Waste material, typically soil or rock, which is cast up during earthworks excavations.

Sub Ballast – The compacted layer of material immediately below the ballast on a railway formation. Sub ballast capping is a layer of higher strength and stiffness utilised to protect weak natural ground or embankment fill. This layer ensures the stability of the railway line by distributing loads over a sufficient area of the base, facilitating good drainage and preventing intrusion of ballast into the lower layers of the railway formation.

Watercourse – Any river, creek or stream in which water flows, even if the flow is only intermittent or occasional.

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APPENDICES

Appendix A – Surface Water Management Plan

Appendix B – Significant Species Management Plan

Appendix C – Weed Management Plan

Appendix D – Construction EMP (Refer to CD)

Appendix E – Surface Water Assessment (Refer to CD)

Appendix F – Vegetation and Flora Assessment (Refer to CD)

Appendix G – Fauna Assessment (Refer to CD)

Appendix H – Short Range Endemic Invertebrate and *Aurecocrypta* sp. Assessment (*ecologia*) (Refer to CD)

Appendix I – *Aurecocrypta* sp. Report (Dr R Raven) (Refer to CD)

Appendix J – Vibration Impact Assessment (Refer to CD)

Appendix K – Noise Impact Assessment (Refer to CD)

February 2009

RAIL OPERATIONS

CHICHESTER DEVIATION SURFACE WATER MANAGEMENT PLAN

Revision A

IRON ORE

bhpbilliton

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EXECUTIVE SUMMARY

To increase the efficiency of transporting iron ore from operations in the Pilbara region to Port Hedland, BHP Billiton Iron Ore (BHPBIO) will construct 23 km of dual track railway through the Chichester Ranges (known as the Chichester Deviation). The Chichester Deviation will deviate from the Port Hedland to Newman Mainline at Ch 220 km, and re-join the Mainline at Ch 237.

This Surface Water Management Plan (SWMP) has been developed as a component of the Environment Referral Document (ERD) to provide an appropriate management mechanism to minimise impacts on natural surface water flows resulting from the construction and operation of the Chichester Deviation.

Monitoring programmes, performance indicators and management procedures are described in this SWMP and will be used to maintain natural surface water flows and minimise negative environmental impacts as a result of changes in surface water hydrology.

1 INTRODUCTION

1.1 BACKGROUND

BHP Billiton Iron Ore (BHPBIO) propose to increase the efficiency of transporting iron ore from operations in the Pilbara region to Port Hedland, through the construction of 23 km of dual track railway through the Chichester Ranges (known as the Chichester Deviation), located approximately 230 km south of Port Hedland (Figure 1.1). The Chichester Deviation will deviate to the west of the existing Mainline between Shaw Siding and Cowra Siding (i.e. approximately between chainage[1] [Ch] 220 and Ch 237 on the Mainline). The chainage designation for the new rail tracks is D220 to D242.

The Deviation is located in the upper northwest sector of the Fortescue Marsh catchment. Alteration of the terrain via cut and fill earthworks required for the construction of the Chichester Deviation has the potential to interrupt natural surface water drainage features. Changes to surface water flows may have localised impacts on water volumes within creeklines and adversely impact sheetflow dependent Mulga communities.

1.2 PURPOSE OF THIS PLAN

This Surface Water Management Plan (SWMP) has been prepared to minimise the potential impacts of the construction of the Chichester Deviation to surface water flow. The Plan outlines appropriate surface water management measures, ongoing monitoring programmes and reporting procedures to be implemented during the construction and operation of the Chichester Deviation Project.

This SWMP is a working document and is to be reviewed and revised periodically in order to allow the incorporation of advances in management measures where possible. Where one or more of the management measures described in this SWMP are found to be sub-optimal, a review of the measure(s) will be conducted and alternative control strategies will be implemented where necessary. Any new measures will be developed and implemented to the satisfaction of the DEC and will be documented in a new revision of this SWMP where appropriate.

1.3 RELEVANT LEGISLATION

The following table outlines the legislation applicable to the protection and management of surface water within Western Australia (Table 1.1).

[1] The 'chainage' is the distance in kilometres south along the Mainline from Port Hedland. The chainages of the Deviation are denoted by the prefix 'D'.

Table 1.1 – Relevant Legislation and its Application

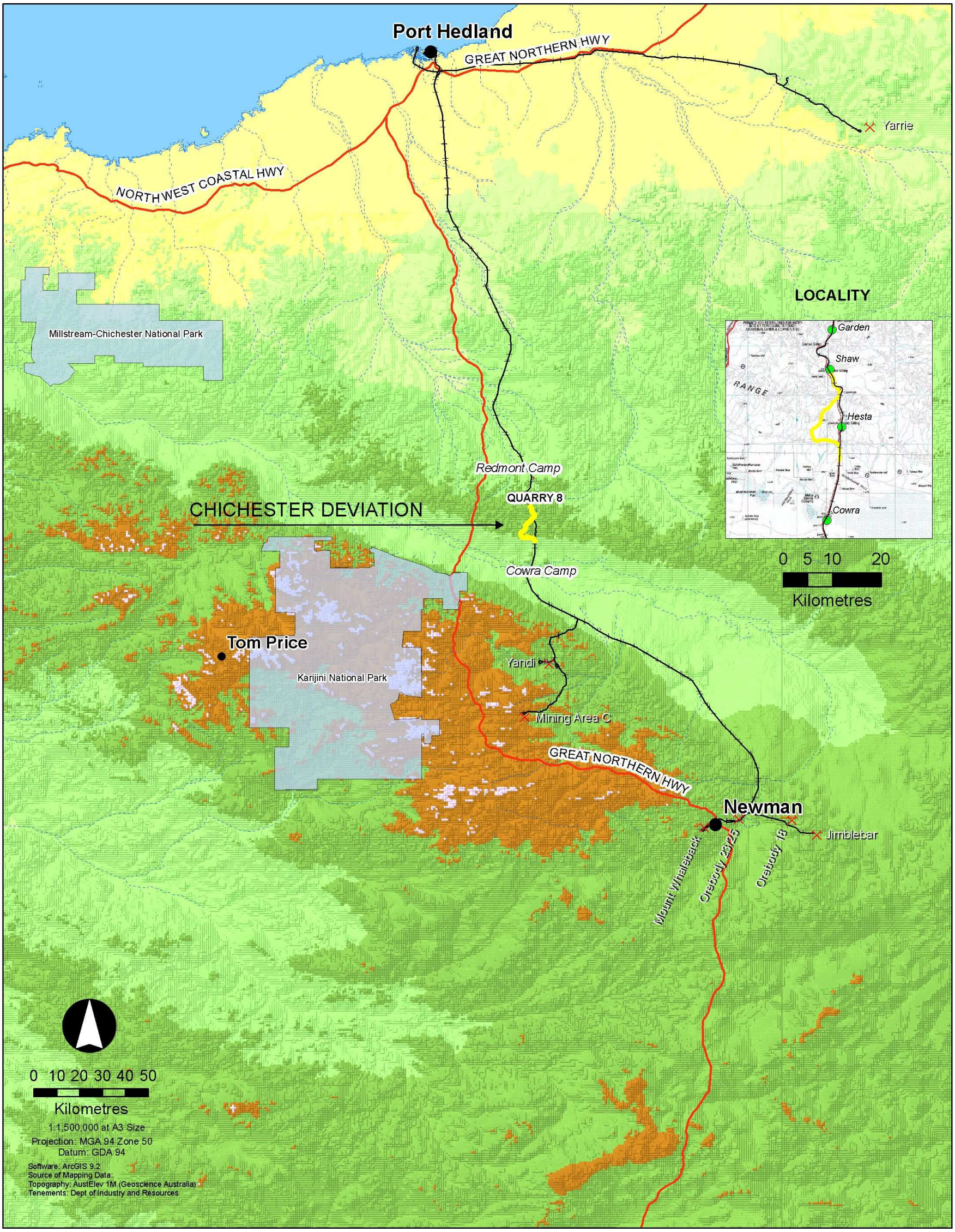
Legislation	Regulatory Authority	Application & Relevance
Rights in Water and Irrigation Act 1914	Department of Water (DoW)	Legislative obligations and potential liabilities for the interference with any watercourse.
Wildlife Conservation Act 1950	Department of Environment and Conservation (DEC)	Protection of flora and fauna as a result of any changes in drainage.
Dangerous Goods Safety Act 2004	Department of Mines and Petroleum (DMP)	Safe storage, handling and transport of dangerous goods.
Environmental Protection Act 1986	Department of Environment and Conservation (DEC)	Environmental Impact Assessment and Ministerial approval process and prevention of environmental harm and pollution.
Water and Rivers Commission Act 1995	Department of Water (DoW)	Establishment of the Water and Rivers Commission for the protection of waterways.

1.4 SUMMARY OF KEY ISSUES COVERED BY THIS PLAN

The construction of the proposed Chichester Deviation has the potential to impact surface water through:

- interruption of drainage features resulting in adverse impacts to sheetflow sensitive Mulga communities or other vegetation communities;
- increased erosion, siltation, scouring and turbidity; and
- contamination of surface waters from inappropriate disposal of waste or spills.

Figure 1.1 – Project Location



1.5 ROLES AND RESPONSIBILITIES

As the proponent, BHPBIO is responsible for the implementation of the proposal and adherence to the commitments made within this management plan. Table 1.2 identifies the responsibilities associated with various positions.

Table 1.2 – Roles and Responsibilities

Position	Responsibility
Project Manager (Construction Phase)	• Responsible for overall planning of the project to ensure construction is conducted in accordance with the SWMP. • Responsible for compliance with statutory regulations.
Construction Manager (Construction Phase)	• Ensures that the work is continuing in accordance with the SWMP. • Instructs subcontractors on control measures. • Directs site activities according to SWMP. • Ensures all site personnel are aware of any changes to the SWMP and any revised procedures. • Reports to the Site Environmental Officer or Project Manager of any breaches of the SWMP. • Ensures that construction activities support achievement of the Key Performance Indicators (KPIs) set by the SWMP. • Ensures adequate training of all construction and field staff in the requirements of the SWMP.
Operations Manager (Operational Phase)	• Ensures that site work is conducted in accordance with the SWMP. • Instructs subcontractors on control measures. • Directs site activities according to SWMP. • Ensures all site personnel are aware of any changes to the SWMP and any revised procedures. • Reports to the Environmental Manager of any breaches of the SWMP. • Ensures that operational activities support achievement of the KPIs set by the SWMP. • Ensures adequate training of all operational field staff in the requirements of the SWMP.
Environmental Manager (Construction Phase and Operational Phase)	• Ensures that the system for Mulga management is planned, documented, implemented and maintained in accordance with the SWMP. • Monitors operations of the SWMP and recommends any necessary changes to the Project Manager (Construction Phase) or Operations Manager (Operational Phase).

	• Provides advice, assistance and direction to the Project Manager (Construction Phase) or Operational Manager (Operational Phase) to ensure operations are conducted in accordance with the SWMP.
Site Environmental Officer (Construction Phase)	• Provides advice, assistance and direction to the Environmental Manager to ensure operations are conducted in accordance with the SWMP. • Monitors operations of the SWMP and recommends any necessary changes to the Environmental Manager. • Keeps copies of monitoring results. • Oversees implementation of environmental controls, monitoring programs, inspections and audits. • Verifies that the requirements set in this SWMP are adequate to the Project scope, should the project scope change. • Assists the Construction Manager in ensuring that the project team are trained in the requirements of the SWMP. • Completes compliance reporting requirements. • Prepares environmental monitoring reports. • Provides advice with respect to environmental issues where required.
Supervisors	• Implements management actions as directed by the Project Manager, Construction Manager or Site Environmental Officer. • Reports to the Site Environmental Officer, Project Manager or Construction manager any breaches of the SWMP. • Re-iterates the requirements of this SWMP to workgroups through pre-starts and HSEC meetings.
All BHPBIO employees and contractors	• Comply with the requirements of this SWMP. • Comply with legal requirements under the approvals documents and relevant Acts. • Exercise a Duty of Care to the environment. • Report all environmental incidents to an immediate supervisor or the Site Environmental Officer.

2 STUDIES AND EXISTING ENVIRONMENT

2.1 MULGA VEGETATION AND SHEETFLOW

Mulga is a bushy shrub or small tree that is widely distributed over arid areas of inland Australia and is commonly found on lowland plains (Greig, 1992). Mulga has a shallow root system and relies on surface water flows for plant water uptake. Mulga often forms patches or groves with bare inter-grove areas in flat, low sloping areas. These patches appear as bands, also known as Tiger Bush, that run parallel to the natural drainage direction. Groves of Mulga encourage biological activity in the soil. Soil aggregation and macroporosity is also improved in the vicinity of the Mulga which enhances soil moisture retention and soil hydraulic conductivity. These soil characteristics allow Mulga to maximise water use efficiency during rainfall events (Ludwig *et al.*, 2005). As a result, sheetflow forms a critical component of water distribution to some Mulga communities. These Mulga communities are also referred to as 'sheetflow dependent Mulga'.

Sheetflow refers to surface water flow over the ground surface as a thin even layer, not concentrated in a channel. Sheetflow has been reported to occur in slopes ranging from 0.2 – 2% (Ludwig *et al.*, 1997; Mabutt and Fanning, 1987).

Mulga was found to exist in all three sections of the Deviation, as outlined in Table 2.1. Mulga vegetation is most common in the Southern Section, with the majority of the 200 m rail corridor occupied by Mulga vegetation units. The Central Section contains patches of Mulga vegetation, whilst the Northern Section contains only small isolated patches.

Table 2.1 – % Area of Mulga Vegetation and Sheetflow Sensitive Mulga Within 200 m Buffer of Rail Line (for vegetation units 3 and 4 (*ecologia*, 2008))

Chichester Deviation Section 200 m Buffer	Area within 200 m of centreline	% Area Mulga Vegetation	% Area Sheetflow Sensitive Mulga
Northern Section **(Ch D220 – Ch D229 km)**	361 ha	5.9 % (13 ha)	3.2 % (7 ha)
Central Section **(Ch D229 – Ch D236 km)**	281 ha	19.1 % (51 ha)	10.4 % (29 ha)
Southern Section **(Ch D236 – Ch D242 km)**	240 ha	60.7 % (115 ha)	59.1 % (112 ha)

The distribution of Mulga vegetation and sheetflow dependent Mulga along the Chichester Deviation is shown in Figure 2.1.

During construction and operational phases of the Chichester Deviation, it is important that sheetflow downstream of the rail line is maintained in areas of sheetflow dependent Mulga communities. Re-establishing sheetflow within 200 m of the rail line will minimise negative impacts of disturbed sheetflow as a result of the Chichester Deviation rail line.

2.2 EXISTING ENVIRONMENT

The Chichester Deviation is located within the Fortescue Marsh catchment. A description of surface water flow characteristics along the Deviation is provided below:

- **Northern Section (Ch D220 – Ch D229 km)** – Surface water drainage generally flows towards the south and south east (Figure 2.1). This section of the deviation is more

incised and contains only small patches of Mulga vegetation in low sloping areas. Based on the topography, it is unlikely that sheetflow is a major component of the surface water flow regime within this section. Surface water flows in this section are likely to be channelised within natural drainage lines (Aquaterra, 2008).

- **Central Section (Ch D229 – Ch D236 km)** – Surface water drainage generally flows in a south-westerly direction, crossing the proposed rail line and joining a drainage line that runs parallel with the proposed rail line (Figure 2.1). Patches of Mulga vegetation are present within low sloping southern areas of this section. Based on the topography, it is likely that sheetflow forms a component of surface water flows within this section, particularly on the western and southern side of the proposed rail line between Ch D234 km and Ch D236 km (Aquaterra, 2008).

- **Southern Section (Ch D236 – Ch D242 km)** – Surface water drainage flows in a southerly direction, generally perpendicular, to the proposed rail line (Figure 2.1). The gradients are low and areas of Mulga vegetation are present in this section. Based on the topography, it is likely that sheetflow forms a major component of surface water flows within this section (Aquaterra, 2008).

Figure 2.1 – Location of Sheetflow Dependent Mulga

(Sheet 1 of 2)

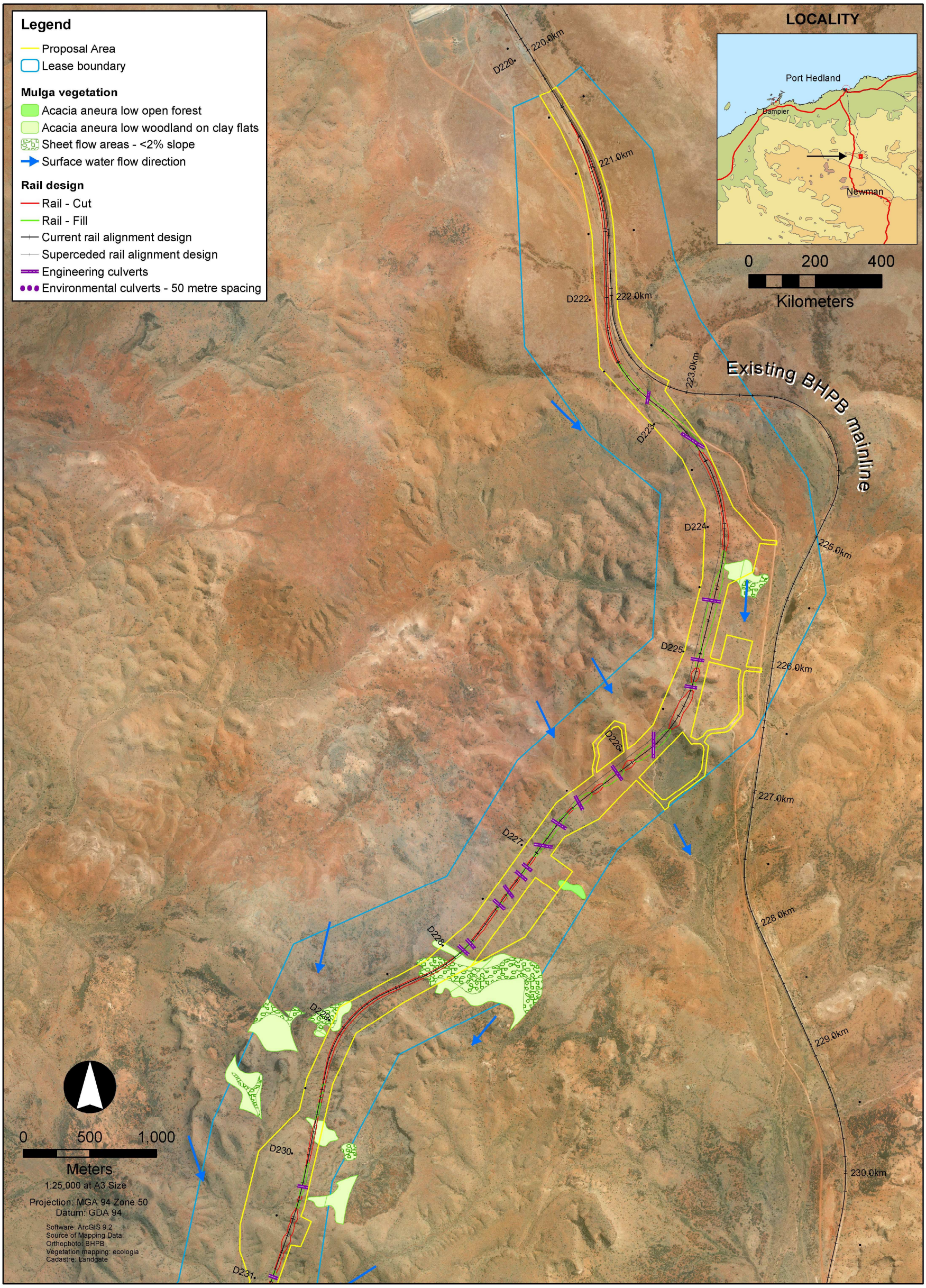
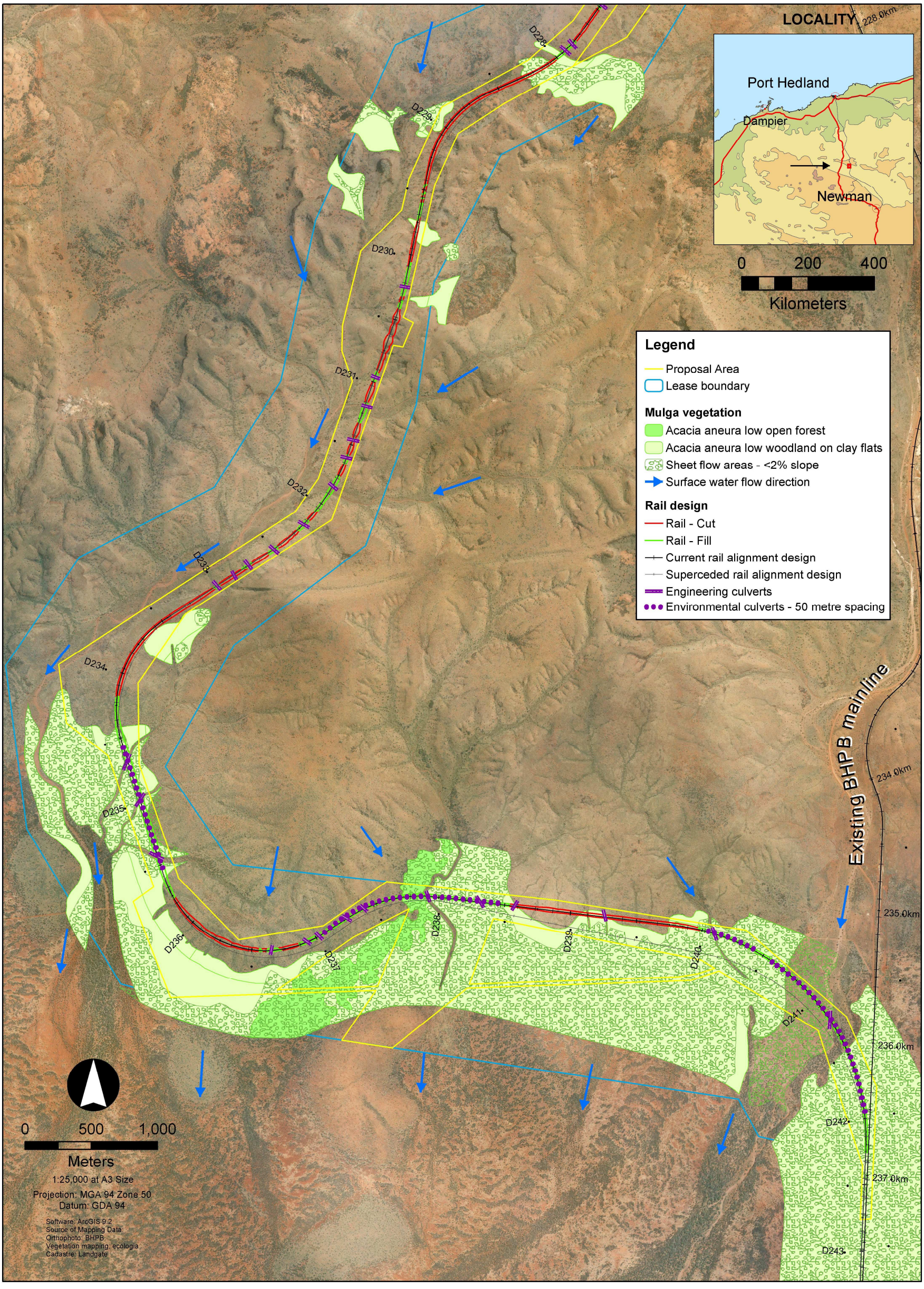


Figure 2.1 – Location of Sheetflow Dependent Mulga

(Sheet 2 of 2)



3 PROJECT ENVIRONMENTAL MANAGEMENT

BHPBIO and its contractors operate within a comprehensive Environmental Management System. The BHPBIO Corporate Sustainability Framework establishes BHPBIO's commitment to health, safety, environment, community responsibility and sustainable development. Supporting the framework is the Sustainable Development Policy, which outlines a commitment to sustainable development and to continual improvement in performance, efficient use of natural resources and aspires to zero harm to people and the environment. The framework is implemented via the HSEC Management Standards, which include the requirement to develop specific operational environmental management plans and procedures. Implementation of HSEC Management Standards is measured through BHPBIO's Assessment and Targets Reporting processes.

During the construction phase of the Chichester Deviation Project contractors must comply with BHPBIO's Construction Environmental Management Plan (EMP) (BHPBIO, 2008), which incorporates specific environmental management procedures, risk management, induction and training, inspections and audits, event management, emergency response, performance tracking and reporting, and record keeping. Compliance with the requirements of the construction EMP is monitored through an ongoing auditing process.

Implementation of standards and procedures within BHPBIO's construction EMP will minimise the potential environmental impacts of the rail expansion project.

3.1 RELATIONSHIP BETWEEN THIS PLAN AND OTHER MANAGEMENT PLANS

BHPBIO's Asset Development Projects construction EMP will be adopted for the Chichester Deviation project (BHPBIO, 2008). The construction EMP provides an overall framework for environmental management for the Project. The construction EMP also contains specific measures regarding management of surface water, which are included in this SWMP.

3.2 EPA OBJECTIVES

The Environmental Protection Authority's (EPA) objectives for the management of surface water are to:

- maintain the quantity of water so that existing and potential environmental values, including ecosystem maintenance, are protected; and
- ensure that emissions do not adversely affect environment values or health, welfare and amenity of people and land uses by meeting statutory requirements and acceptable standards.

3.3 KEY PERFORMANCE INDICATORS

The success of surface water management measures described in this management plan will be regularly evaluated through routine monitoring, inspections and audits in accordance with Section 4.3.

The overall performance indicators for this SWMP are listed below and are incorporated into management measures in Section 4:

- maintain the quantity of surface water flows upstream and downstream of the rail line;
- surface water runoff does not result in offsite sediment transport;
- no unmitigated releases of hydrocarbons or chemicals; and

- no loss of significant vegetation (i.e. Mulga communities) outside of the approved disturbance corridor.

4 SPECIFIC MANAGEMENT AND MONITORING MEASURES

Potential impacts to surface water from the proposal include:

- alteration of surface water flow patterns;
- reduction of surface water runoff volume;
- impacts on downstream watercourse ecology; and
- impacts on downstream vegetation communities (particularly Mulga communities).

BHPBIO aims to mitigate impacts to surface water hydrology and quality within the proposal area, by implementing preventative controls, as described in Section 4.1 and Section 4.2 below.

4.1 SURFACE WATER HYDROLOGY

Culverts will be installed at natural drainage crossings to maintain flows from the upstream catchment. To this end, engineering culverts are proposed for approximately 46 locations along the proposed rail formation. In addition, environmental culverts (minimum 300 mm diameter) are proposed at intervals of 50 m in areas of sheet flow to allow for conveyance of surface water downstream of the rail line. Scour protection structures (i.e. riprap pads) are proposed to be installed immediately downstream of the environmental culverts and railway access roads. Environmental culverts will be sized for a 1 in 50 year rainfall event.

Due to the irregular occurrence of surface water flow within the region, monitoring of the effects of the Project on surface water flows will consist of periodic and event-based monitoring as outlined in Table 4.1.

Visual monitoring will be undertaken by the Site Environmental Officer prior to the wet season and following significant rainfall events (those which create surface runoff) to assess the following:

- surface water flow characteristics (i.e. occurrence of expansion or contraction of drainage lines and whether there is re-establishment of sheetflow downstream of environmental culverts); and
- occurrence of ponding upstream of culverts.

Shadowing is possible on the downstream side of the rail line between culvert locations, particularly in sheetflow areas. Culvert spacing will determine the extent of shadowing. A closer culvert spacing will reduce the shadowing effect. Energy dissipation devices (i.e. riprap pads) are expected to enhance sheetflow redistribution and reduce shadowing effects. In areas where sheetflow dependent Mulga communities exist within the 200 m rail line buffer, the effect of shadowing is likely to have some effect on sheetflow dependent Mulga communities on the downstream side of the rail line within the buffer zone.

Annual reporting of sheetflow redistribution observations will provide an ongoing assessment of surface water flow within the Chichester Deviation and will identify areas requiring maintenance. The measured performance of culverts, in particular environmental culverts will also provide a reasonable indication as to the effectiveness of these structures in redistributing sheetflow to the downstream Mulga communities.

Measures proposed to minimise impacts to surface water hydrology are listed in Table 4.1.

Table 4.1 – Surface Water Hydrology Management Plan

Objective	Maintain surface water supply required to sustain upstream and downstream vegetation communities.
Management Actions	• Install engineering culverts where natural drainage features intersect the proposed rail line. • Install environmental culverts (minimum 300 mm diameter but sized appropriately to convey a 1 in 50 year rainfall event) at 50 m intervals along the rail formation in areas of sheet flow sensitive Mulga communities. • Install low spur embankments on the upstream side of the rail line to direct surface water flows to culverts and preserve existing drainage patterns. • Install a shallow cement stabilised road based dip in the rail access road downstream of environmental culverts. • Install scour protection structures (i.e. riprap pads) immediately downstream of environmental culverts and railway access roads to disperse surface water runoff. • Vee drains will not be installed adjacent to access tracks where they may obstruct water flow from culverts.
Performance Indicators	• No adverse impact to upstream or downstream vegetation, particularly sheetflow dependent Mulga communities. • No ponding upstream of culvert locations. • Re-establishment of sheetflow downstream of environmental culverts.
Monitoring	• Visual inspection of culverts and riprap pads prior to the onset of the typical wet season, and following significant rainfall events which create surface runoff. • Conduct visual inspection of areas immediately downstream of environmental culverts to evaluate whether sheetflow is re-established. • Baseline Mulga vegetation condition assessment prior to commencement of construction. • A Mulga monitoring program will be developed in conjunction with the Department of Environment and Conservation (refer Section 4.3.1). This will include qualitative and quantitative monitoring of potentially impacted Mulga vegetation.
Reporting	• Damaged or blocked culverts to be reported to the Site Environmental Officer. • Damaged low spur embankments, cement stabilised road base dips and riprap pads are to be reported to the Site Environmental Officer. • Vegetation monitoring results to be presented in the BHPBIO

	Annual Environmental Report.
Term	• Construction and Operational phases.
Responsibilities	• Refer to Table 1.2.

4.2 SURFACE WATER QUALITY

The two main potential impacts to surface water quality are increased turbidity as a result of erosion during construction of the rail line and contamination as a result of hydrocarbon or chemical releases.

Measures proposed to minimise impacts to surface water quality are outlined in Table 4.2.

Table 4.2 – Surface Water Quality Management Plan

Objective	Maintain surface water quality required to sustain upstream and downstream vegetation communities.
Management Actions	• Where possible, construct the railway access road on the downslope side of the rail line to minimise sediment accumulation in culverts. • Where possible, install culverts at right angles to surface water flows. • Implement sediment and erosion controls to prevent scouring and erosion (e.g. rip rap protection). • Minimise clearing of native vegetation within the rail corridor. • Where possible, stage topsoil and vegetation stockpiles outside of natural waterways, drainage lines or sheetflow areas. • Locate laydown areas, parked heavy machinery and parked vehicles at least 50 m from defined waterways. • Undertake progressive rehabilitation in conjunction with construction. • Manage chemicals and hydrocarbons in accordance with the *Dangerous Goods Safety Act 2004*.
Performance Indicators	• Surface water runoff does not result in offsite sediment transport. • No sediment accumulation / blockages in culverts. • No releases of hydrocarbon or chemical contaminants into surface water.
Monitoring	• Visual inspection of culverts and riprap pads prior to the onset of the typical wet season, and following significant rainfall events which create surface runoff. • Visual inspection for evidence of erosion in areas of rehabilitation.

	• Visual inspection of site offices and laydown areas to verify that chemicals and hydrocarbons are being managed in accordance with the *Dangerous Goods Safety Act 2004*.
Reporting	• Blocked culverts to be reported to the Site Environmental Officer. • All other incidents of erosion to be reported to the Site Environmental Officer. • Contaminant spills to be reported to the Site Environmental Officer. • Presentation of release incidents in the BHPBIO Annual Environmental Report.
Term	• Construction and Operational phases.
Responsibilities	• Refer to Table 1.2.

4.3 MONITORING OF MANAGEMENT CONTROLS

BHPBIO will conduct internal compliance audits of the implementation of Project environmental management commitments during the construction phase, including:

- quarterly on-site audits of compliance with this management plan;
- audits of contractors environmental management; and
- weekly work area inspections and monitoring.

Non-conformances identified during inspections will be documented, addressed with appropriate corrective and preventative actions, and rectified within an agreed time frame.

4.3.1 Mulga Monitoring Program

A monitoring program will be established in consultation with DEC to evaluate the impact on sheet flow-dependent Mulga vegetation downstream of the Chichester Deviation railway.

The program will include the establishment of vegetation health monitoring quadrants at various distances from the rail line between chainages D234 and D242 and at suitable reference sites outside of the potential impact zone. The location of sites will be confirmed in consultation with DEC.

It is proposed that monitoring will involve field assessment and consider structure, composition and health/condition as physical indicators of stress. BHPBIO will also investigate potential surrogate measures of Mulga health that may provide more proactive indicators of potential impacts on Mulga (e.g. ant communities).

Mulga condition over a broader area will also be evaluated using remote sensing data (e.g. hyperspectral analysis) and ground-truthed utilising information from the field monitoring component of the program.

It is proposed that field monitoring and remote sensing will be undertaken in the dry season (i.e. September to November) and conducted:

1. prior to construction of the Chichester Deviation to establish a baseline;
2. following conclusion of construction activities; and
3. on a 2-yearly basis with a review of the necessity to continue monitoring undertaken with DEC after 2 successive monitoring periods (i.e. 4 years post construction).

It is proposed that the monitoring program will be reviewed at regular intervals with DEC to determine the effectiveness of the surface water management plan. This will include, but not be limited to, items such as the trends in Mulga health and additional management measures that may be required.

This SWMP will be reviewed annually and updated as required.

5 REPORTING

Information regarding the Surface Water Management Plan will be provided in BHPBIO's annual environmental report for rail operations, reporting on the previous 12 month period.

BHPBIO will report results of the Mulga monitoring program to DEC on a 2 yearly basis following monitoring and collation of results from the field activities and remote sensing. This information will include a comparison to baseline information captured prior to construction of the rail and following conclusion of construction activities.

6 REFERENCES

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February 2009

RAIL OPERATIONS

CHICHESTER DEVIATION SIGNIFICANT SPECIES MANAGEMENT PLAN

Revision A

IRON ORE

bhpbilliton

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EXECUTIVE SUMMARY

To increase the efficiency of transporting iron ore from operations in the Pilbara region to Port Hedland, BHP Billiton Iron Ore (BHPBIO) will construct 23 km of dual track railway through the Chichester Ranges (known as the Chichester Deviation). The Chichester Deviation will deviate from the Port Hedland to Newman Mainline at Ch 220 km and re-join the Mainline at Ch 237.

Baseline biological surveys conducted along the rail corridor recorded a number of flora and fauna species of conservation significance. Additional conservation significant species which were not observed during biological surveys for the Project but are considered likely to occur within the Project area are also considered in this Significant Species Management Plan (SSMP).

Control measures have been developed by BHPBIO and are addressed in this SSMP to reduce the potential impacts of the Project to significant species. Management commitments include general control measures for project planning, construction and operations, and specific measures that address potential project impacts on significant species.

No Declared Rare Flora (DRF) have been recorded within the Chichester Deviation Project area to date, however should DRF species be identified within the Project footprint that can not be avoided, BHPBIO will prepare and submit an application(s) to take DRF pursuant to the *Wildlife Conservation Act 1950*. In addition, BHPBIO will maintain appropriate records of impacted flora/fauna species, vegetation associations and/or habitat areas of conservation significance and will report on the management activities of significant species in its Annual Environmental Report (AER).

The management measures, ongoing monitoring programmes and reporting procedures contained in this SSMP have been developed to minimise or avoid the impacts of the Chichester Deviation Project area to all known populations of significant species, as well as those species not currently recorded, however known to occur within the greater Chichester area.

1 INTRODUCTION

1.1 BACKGROUND

BHP Billiton Iron Ore (BHPBIO) propose to increase the efficiency of transporting iron ore from operations in the Pilbara region to Port Hedland, through the construction of 23 km of dual track railway through the Chichester Ranges (known as the Chichester Deviation), located approximately 230 km south of Port Hedland (Figure 1.1). The Chichester Deviation will deviate to the west of the existing Mainline between Shaw Siding and Cowra Siding (i.e. approximately between chainage[1] [Ch] 220 and Ch 237 on the Mainline). The chainage designation for the new rail tracks is D220 to D242.

Initial biological surveys conducted along the rail corridor recorded a number of flora and fauna species of conservation significance. Conservation significant species that were not observed during the biological surveys for the Project, but are considered likely to occur within the Project area, are also considered in this Significant Species Management Plan (SSMP).

1.2 PURPOSE OF THIS PLAN

The purpose of this SSMP is to assist BHPBIO and its contractors in the implementation of appropriate flora and fauna management measures, ongoing monitoring programmes and reporting procedures for significant flora and fauna species during the construction and operation of the Chichester Deviation Project.

1.3 RELEVANT LEGISLATION

The management measures contained within the SSMP have been developed in accordance with the relevant provisions of the *Environmental Protection Act 1986* (EP Act), the *WA Wildlife Conservation Act 1950* (WC Act) and the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). An overview of the provisions of these Acts that are relevant to the current Chichester Deviation Project is provided below. The information presented herein is intended solely to provide a summary of the subject matter covered and is not intended as a complete summary of all environmental legislation which may be applicable to the Project.

WA Environmental Protection Act, 1986

The EP Act provides for the establishment of the Environmental Protection Authority (EPA), which has the objective of overseeing the prevention, control and abatement of pollution and environmental harm and the conservation, preservation, protection, enhancement and management of the environment. The EPA has developed policies to assist with achieving this objective. These include policies on the use of the precautionary principle, consideration of intergenerational equity, the conservation of biological diversity and ecological integrity and waste minimisation.

Part IV of the EP Act establishes provisions for the EPA to carry out Environmental Impact Assessments (EIA) in WA. Where relevant, the EPA issues and directs proponents to comply with Guidance Statements that contain the EPA's minimum requirements for the protection of elements of the environment such as flora and fauna. *Guidance Statement 51 – Terrestrial flora and vegetation surveys for Environmental Impact Assessment in Western Australia* and *Guidance Statement 56 – Terrestrial fauna surveys for environmental impact*

[1] The 'chainage' is the distance in kilometres south along the Mainline from Port Hedland. The chainages of the Deviation are denoted by the prefix 'D'.

assessment in Western Australia (EPA, 2004b) require proponents to assess flora and fauna of conservation significance in their EIA.

Wildlife Conservation Act, 1950

The WC Act provides for the protection of flora and fauna species of conservation significance. Protected species are identified as either Declared Rare Flora (DRF) or Scheduled Fauna. DRF are plant species that are extant and considered likely to become extinct or rare and therefore in need of special protection. They are listed in the *Wildlife Conservation (Rare Flora) Notice 2005.* Scheduled Fauna are listed in the *Wildlife Conservation (Specially Protected Fauna) Notice 2008.* There are four levels of Scheduled Fauna (i.e. 1 to 4) and a description of each of these conservation levels is provided in Appendix A.

The DEC also maintains a list of four Priority codes for flora, and five Priority codes for fauna. Priority flora and fauna are either poorly known, believed to be uncommon, rare or under threat, but have not been designated DRF or Scheduled Fauna under the WC Act. The WC Act does not provide specific protection for Priority species, however the potential impacts of new proposals on Priority species is generally considered as part of the EIA process under the EP Act (see above).

Environmental Protection and Biodiversity Conservation Act, 1999

The Commonwealth EPBC Act contains a list of flora and fauna species that are nominated as being of 'National Environmental Significance'. The list is divided into groups according to conservation status (Appendix A). The EPBC Act also provides for the protection of migratory bird species listed in the Bonn Convention (Convention on the Conservation of Migratory Species of Wild Animals), the Agreement between the Government of Australia and the Government of the Peoples Republic of China for the Protection of Migratory Birds and their Environment (CAMBA) and the Agreement between the Government of Japan and the Government of Australia for the Protection of Migratory Birds and Birds in Danger of Extinction and their Environment (JAMBA).

1.4 RELATIONSHIP BETWEEN THIS PLAN AND OTHER MANAGEMENT PLANS

BHPBIO's Asset Development Projects construction Environmental Management Plan (EMP) will be adopted for the Chichester Deviation Project (BHPBIO, 2008a). The construction EMP provides an overall framework for environmental management for the Project. The construction EMP also contains specific measures regarding management of flora and fauna, which are included in this SSMP.

1.5 SUMMARY OF KEY ISSUES COVERED BY THIS PLAN

Ten significant species (one plant, five bird, three mammal and one potential short range endemic) were recorded during baseline surveys within the Chichester Deviation Project area and an additional 17 significant species are considered likely to occur.

The following sections provide an overview of these species and previous flora and fauna surveys that have been conducted within the Chichester Deviation Project area (Section 2), locations of recorded significant species (Section 3), general environmental management measures to be implemented within the Project area (Section 4) and the specific management measures that are to be used for species of conservation significance (Section 5).

This SSMP is a working document and is to be reviewed periodically during the construction phase in order to allow the incorporation of relevant changes to the conservational status of species and advances in management measures to be included where possible. The level of

management response assigned to species of conservation significance will be reviewed as part of this process. In addition, and where one or more of the management measures described in this SSMP are found to be sub-optimal, a review of the measure(s) will be conducted and alternative control strategies will be implemented where necessary. Any new measures will be developed and implemented in consultation with the DEC and will be documented in a new revision of this SSMP.

1.6 EPA OBJECTIVE

The Environmental Protection Authority (EPA) objectives for management of terrestrial fauna and flora are:

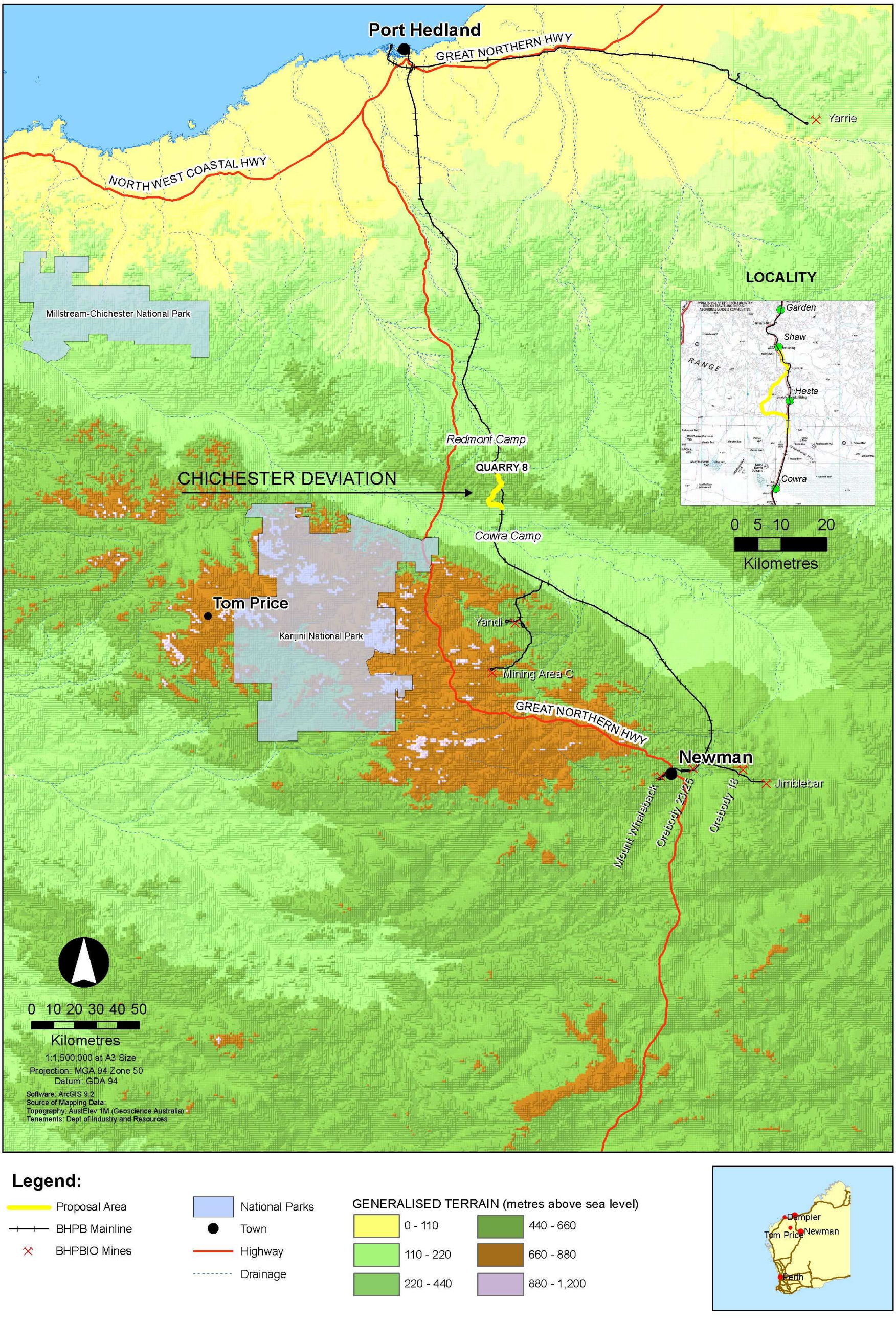
- to maintain the abundance, diversity, geographic distribution and productivity of fauna at species and ecosystem levels through the avoidance or management of adverse impacts and improvement in knowledge; and
- to maintain the abundance, species diversity, geographic distribution and productivity of vegetation communities through the avoidance or management of adverse impacts and improvement in knowledge.

1.7 KEY PERFORMANCE INDICATORS

The overall performance indicators for this SSMP are to ensure that the Project does not result in:

- direct loss of significant flora;
- adverse impact to vegetation outside the approved disturbance corridor; and
- direct loss of significant fauna outside the approved disturbance corridor.

Figure 1.1 – Project Location



1.8 ROLES AND RESPONSIBILITIES

As the proponent, BHPBIO is responsible for the implementation of the Chichester Deviation proposal and adherence to the commitments made within this management plan.

Table 1.1 identifies the responsibilities associated with various positions for the Project.

Table 1.1 – Roles and Responsibilities

Position	Responsibility
Project Manager (Construction Phase)	• Responsible for overall planning of the project to ensure construction is conducted in accordance with the SSMP. • Responsible for compliance with statutory regulations.
Construction Manager (Construction Phase)	• Ensures that the work is continuing in accordance with the SSMP. • Instructs subcontractors on control measures. • Directs site activities according to SSMP. • Ensures all site personnel are aware of any changes to the SSMP and any revised procedures. • Reports to the Site Environmental Officer or Project Manager of any breaches of the SSMP. • Ensures that construction activities support achievement of the Key Performance Indicators (KPIs) set by the SSMP. • Ensures adequate training of all construction and field staff in the requirements of the SSMP.
Operations Manager (Operational Phase)	• Ensures that site work is conducted in accordance with the SSMP. • Instructs subcontractors on control measures. • Directs site activities according to SSMP. • Ensures all site personnel are aware of any changes to the SSMP and any revised procedures. • Reports to the Environmental Manager of any breaches of the SSMP. • Ensures that operational activities support achievement of the KPIs set by the SSMP. • Ensures adequate training of all operational field staff in the requirements of the SSMP.
Environmental Manager (Construction Phase and Operational Phase)	• Ensures that the system for weed management is planned, documented, implemented and maintained in accordance with the SSMP and WMP. • Monitors operations of the SSMP and recommends any necessary changes to the Project Manager (Construction Phase) or

Position	Responsibility
	Operations Manager (Operational Phase). • Provides advice, assistance and direction to the Project Manager (Construction Phase) or Operational Manager (Operational Phase) to ensure operations are conducted in accord with the SSMP.
Site Environmental Officer (Construction Phase)	• Provides advice, assistance and direction to the Environmental Manager to ensure operations are conducted in accord with the SSMP. • Monitors operations of the SSMP and recommends any necessary changes to the Environmental Manager. • Keeps copies of monitoring results. • Ensures that weed hygiene and weed management measures are implemented. • Oversees implementation of environmental controls, monitoring programs, inspections and audits. • Verifies that the requirements set in this SSMP are adequate to the Project scope, should the project scope change. • Assists the construction manager in ensuring that the project team are trained in the requirements of the SSMP. • Completes compliance reporting requirements. • Prepares environmental monitoring reports. • Provides advice with respect to environmental issues where required.
Supervisors	• Implements management actions as directed by the Project Manager, Construction Manager or Site Environmental Officer. • Reports verbally to the Site Environmental Officer, Project Manager or Construction manager any breaches of the SSMP. • Re-iterates the requirements of this SSMP to workgroups through pre-starts and HSEC meetings.
All BHPBIO employees and contractors	• Comply with the requirements of this SSMP. • Comply with legal requirements under the approvals documents and relevant Acts. • Exercise a Duty of Care to the environment. • Report all environmental incidents to an immediate supervisor or the Site Environmental Officer.

2 SUMMARY OF EXISTING SURVEY INFORMATION

2.1 FLORA

Several baseline surveys, impact assessments and studies have been conducted to document and monitor the vegetation associations, flora and fauna within the Chichester Deviation Project area (*ecologia*, 2008a).

A total of 306 flora taxa were identified within the Project area during baseline surveys, consisting predominantly of species from the Poaceae, Mimosaceae and Malvaceae families (*ecologia*, 2008a).

Five populations of *Goodenia nuda* (Priority 3) have been identified within creeklines and drainage channels of the Project area (*ecologia*, 2008a). *G. nuda* is considered to have wide distribution range throughout the Pilbara (*ecologia*, 2008a). The locations of *Goodenia nuda* recorded within the Project area are included in Section 3.1.

Nine vegetation units have been recorded within the Project area (*ecologia*, 2008a). The key characteristics of each association are provided in Table 2.1.

Table 2.1 – Summary of Vegeattion Units within the Chichester Deviation

Habitat	*ecologia* Vegetation Unit	Vegetation Description
Gilgai Plains: Red-Brown Cracking Clay	1	*Astrebla pectinata* tussock grassland
	2	*Acacia xiphophylla* open scrubland
Plain: Open bare areas of hard clay pans with common ferrous pebbles	3	*Acacia aneura* woodland
Drainage areas at the base of the footslope	4a	*Acacia aneura* low open forest
	4b	*Acacia ayersiana* and *Acacia aneura* low open forest
Major creek lines of the flat areas	5	*Acacia citrinoviridis* open low forest
	6	*Acacia citrinoveridis* and *Corymbia hamersleyana* low woodland
Major creek lines of the Chichester Ranges	7a	*Eucalyptus victix* open forest, over *Melaleuca glomerata* shrubland
	7b	*Petalostylis labicheoides* and mixed *Acacia* spp. high shrubland
	7c	*Corymbia* spp. and *Hakea chordophylla* low open woodland
Rocky hill slopes: stone and boulders of ironstone	8a	*Eucalyptus leucophloia* low open woodland, over *Triodia basedowii* hummock grassland
	8b	*Acacia aneura* low woodland
	8c	*Acacia rhodophloia* high shrubland
Drainage channel on rocky hill slopes: stones and bounders of ironstone	9a	Mixed *Acacia* spp. open heath
	9b	*Acacia aneura* low open forest

Three of these vegetation units are considered to have moderate to high local and regional conservation significance (*ecologia*, 2008a):

- mixed tussock grassland on the low lying flats/plains (Vegetation Unit 1);

- *Acacia xiphophylla* medium to tall scrubland (Vegetation Unit 2); and
- moderately dense *Acacia ayersiana* and *Acacia aneura* woodland (Vegetation Unit 4b).

2.2 FAUNA

Ecologia (2008b) identified four major terrestrial fauna habitats within the proposal area:

- Mulga woodland over long unburnt dense grass hummocks;
- Open woodland over dense understory on rocky ground. Dense understory can be patchy;
- Spinifex grassland on rocky hill slope; and
- Regenerating vegetation after recent fire activity.

In addition, six major avian fauna habitats were identified (*ecologia* 2008b):

- Mulga woodland over spinifex hummocks;
- Open woodland over dense grass hummocks;
- Regenerating rocky hill slope after fire;
- Open woodland over dense understory on rocky ground. Dense understory can be patchy;
- Rocky hill side with dense Spinifex hummocks; and
- Burnt Mulga woodland, open canopy with regenerating Spinifex.

The dominant habitat types that may be impacted by construction of the Chichester Deviation are open to very open woodland over Spinifex on rocky soils. These habitat types are widespread throughout the region and adverse impacts to regional biodiversity are not expected. Fauna habitats centred on drainage lines are moderately common in the region hence reductions in diversity are expected to be localised and short-term.

Based on the results of baseline fauna surveys (*ecologia* 2008b), information from previous surveys and database records, 36 native mammal species, 137 bird species, 100 reptile species and 6 amphibian species may potentially occur within the proposal area.

Fauna species of conservation significance which have been recorded within the Chichester Deviation project area to date are listed in Section 3.1.

2.3 SHORT RANGE ENDEMIC FAUNA

Endemism refers to the restriction of species to a particular area (Allen *et al*., 2002). Short range endemism refers to endemic species with restricted ranges, currently defined in Western Australia as less than 10,000 km^2 (100 km x 100 km) (Harvey, 2002). Short range endemic species (SRE) are generally invertebrates.

The Pilbara region contains a large number of arid adapted invertebrate species such as Scorpions, Pseudoscorpions and Centipedes. Other SRE groups that are likely to be found in the proposal area in lesser numbers include Isopods, Mygalomorph spiders and snails (ecologia, 2008c).

Baseline fauna surveys of the Chichester Deviation project area identified a number of specimens from groups containing SRE invertebrate fauna species. These included Scorpions (Scorpiones), Pseudoscorpians (Pseudoscorpionida), Trap-door spiders (Mygalomorphae), Harvestmen (Opiliones) and Centipedes (Chilopoda). Of the specimens collected during the surveys, only one species of trapdoor spider (*Aurecocrypta* "Chichester" sp.), was considered to have a strong likelihood of being a short range endemic species (*ecologia*, 2008c).

The *Aurecocrypta* species occurring within the Chichester Range was found to be an undescribed species. Four male specimens were recorded at two sites within the northern portion of the Chichester Deviation area (Figure 3.1). Five additional rounds of sampling throughout the Chichester Range identified two female specimens (*ecologia*, 2008c).

Examination of WA Museum (WAM) records revealed that the species is widespread across the north of the Western Australia and is not a short range endemic species (*ecologia*, 2008c). WA Museum and *ecologia* records of *Aurecocrypta* "Chichester" sp. specimens are summarised in Table 2.2.

Suitable habitat for many Mygalomorph spiders is limited by the presence of soil in which the spiders dig their burrows. Within the Chichester Range, *Aurecocrypta* "Chichester" sp. habitat is generally within areas of *Acacia* vegetation and on rocky slopes (Raven, 2008).

Aurecocrypta "Chichester" sp. will be managed in accordance with the general management measures included in Section 4.

Table 2.2 – Records of *Aurecocrpyta* "Chichester" sp. Specimens

Locality	Details	Easting	Northing
Chichester Range[2]	3 males collected by *ecologia* pitfall trapping (Sept 2007)	708040.0	7549180.0
Chichester Range[3]	1 male collected by *ecologia* pitfall trapping (Sept 2007)	708310.6	7549410.3
Chichester Range	1 female collected by *ecologia* foraging (Jun 2008)	661846.3	7554495.5
Chichester Range	1 female collected by R. Raven foraging with *ecologia* (Aug 2008)	706763.4	7555765.7
Robinson Range	1 male collected by *ecologia* pitfall trapping (Apr 08)	261638.3	7394826.8
Jack Hills	1 male collected by *ecologia* pitfall trapping (July 08)	514033.5	7120203.3
Weld Range	1 male collected by *ecologia* pitfall trapping (Aug 08)	579575.6	7029279.2
Weld Range	1 male collected by *ecologia* pitfall trapping (Aug 08)	562535.5	7019602.2
Hamersley Ranges	Collector Unknown, WAM Record	660758.8	7505926.4
22.1km W of Pannawonica	Collector Unknown, WAM Record	403653.5	7631758.4
West Turner Syncline	Collector Unknown, WAM Record	529965.9	7519215.7
Sulphur Springs	Collector Unknown, WAM Record	720309.4	7665826.1
Sulphur Springs	Collector Unknown, WAM Record	721846.2	7667267.5
Sulphur Springs	Collector Unknown, WAM Record	721846.2	7667267.5
Sulphur Springs	Collector Unknown, WAM Record	720652.3	7668158.4
Sulphur Springs	Collector Unknown, WAM Record	720309.4	7665826.1
Sulphur Springs	Collector Unknown, WAM Record	720309.4	7665826.1
Barlee Ra Nat Reserve	Collector Unknown, WAM Record	340687.9	7448991.2
Tanami, 89k W of Tanami Downs	Collector Unknown, WAM Record	448970.9	7840211.7
Mesa J, 16.6km SW of Pannawonica	Collector Unknown, WAM Record	410259.4	7627423.9
Waramboo, 52.1 k W of Pannawonica	Collector Unknown, WAM Record	343574.3	7633395.1
Waramboo, 50.5k W of Pannawonica	Collector Unknown, WAM Record	344575.0	7632840.1

[2] Specimens recorded within the proposal area.
[3] Specimen recorded within Lease area (L45/147), outside of the proposal area.

3 RECORDED AND POTENTIAL SIGNIFICANT SPECIES

3.1 RECORDED SIGNIFICANT SPECIES

Significant species identified within the surveys of the Chichester Deviation Project area are listed in Table 3.1 and shown in Figure 3.1.

Table 3.1 – Recorded Significant Species

Species	Conservation Classification	Easting	Northing
Flora			
Goodenia nuda	Priority 3	705130 mE	7546312 mN
		708461 mE	7550082 mN
		703011 mE	7543186 mN
		705897 mE	7547299 mN
		707688 mE	7548843 mN
Fauna			
Western Pebble-mouse[4] (*Pseudomys chapmani)*	Priority 4 (DEC)	703270 mE	7541012 mN
		705352 mE	7541566 mN
		705440 mE	7541961 mN
		705655 mE	7546061 mN
		705714 mE	7542087 mN
		705783 mE	7541748 mN
		706092 mE	7547491 mN
		706095 mE	7547501 mN
		706149 mE	7547408 mN
		706319 mE	7547873 mN
		706328 mE	7547775 mN
		706346 mE	7548078 mN
		706354 mE	7547686 mN
		706435 mE	7548215 mN
		706513 mE	7547762 mN
		706640 mE	7548023 mN
		706676 mE	7547800 mN
		706733 mE	7547851 mN
		706798 mE	7548172 mN
		707048 mE	7548404 mN
		707405 mE	7548368 mN
Northern Short-tailed Mouse (*Leggadina lakedownensis)*	Priority 4 (DEC)	707309 mE	7552615 mN
		706232 mE	7556457 mN
Ghost Bat[5] (*Macroderma gigas)*	Priority 4 (DEC)	705004 mE	7546058 mN
Australian Bustard (*Ardeotis australis)*	Priority 4 (DEC)	706081 mE	7547413 mN
		705531 mE	7541814 mN
		702958 mE	7542253 mN

[4] Locations of active or recently active Western Pebble-mouse mounds recorded during baseline surveys (*ecologia*, 2008b).
[5] While the Ghost Bat (*Macroderma gigas)* was not physically observed within the proposal area, a call, believed to be that of the Ghost Bat, was recorded (*ecologia*, 2008b). No suitable roosts were identified within the Project area.

		703270 mE 702236 mE 707672 mE	7541012 mN 7541018 mN 7548386 mN
Western Star Finch (*Neochmia ruficauda)*	Priority 4 (DEC)	708665 mE	7549457 mN
Fork tailed Swift (*Apus pacificus)*	Migratory terrestrial species (EPBC)	706759 mE	7553619 mN
Rainbow Bee-eater (*Merops ornatus)*	Migratory terrestrial species (EPBC)	706081 mE 705004 mE 704673 mE 703270 mE 702958 mE 708218 mE 702542 mE	7547413 mN 7546058 mN 7544323 mN 7541012 mN 7542253 mN 7540498 mN 7542407 mN
Wood Sandpiper (*Tringa glareola)*	Migratory terrestrial species (EPBC)	708665 mE	7549457 mN

Figure 3.1 – Significant Species Recorded within the Project Area

(Sheet 1 of 2)

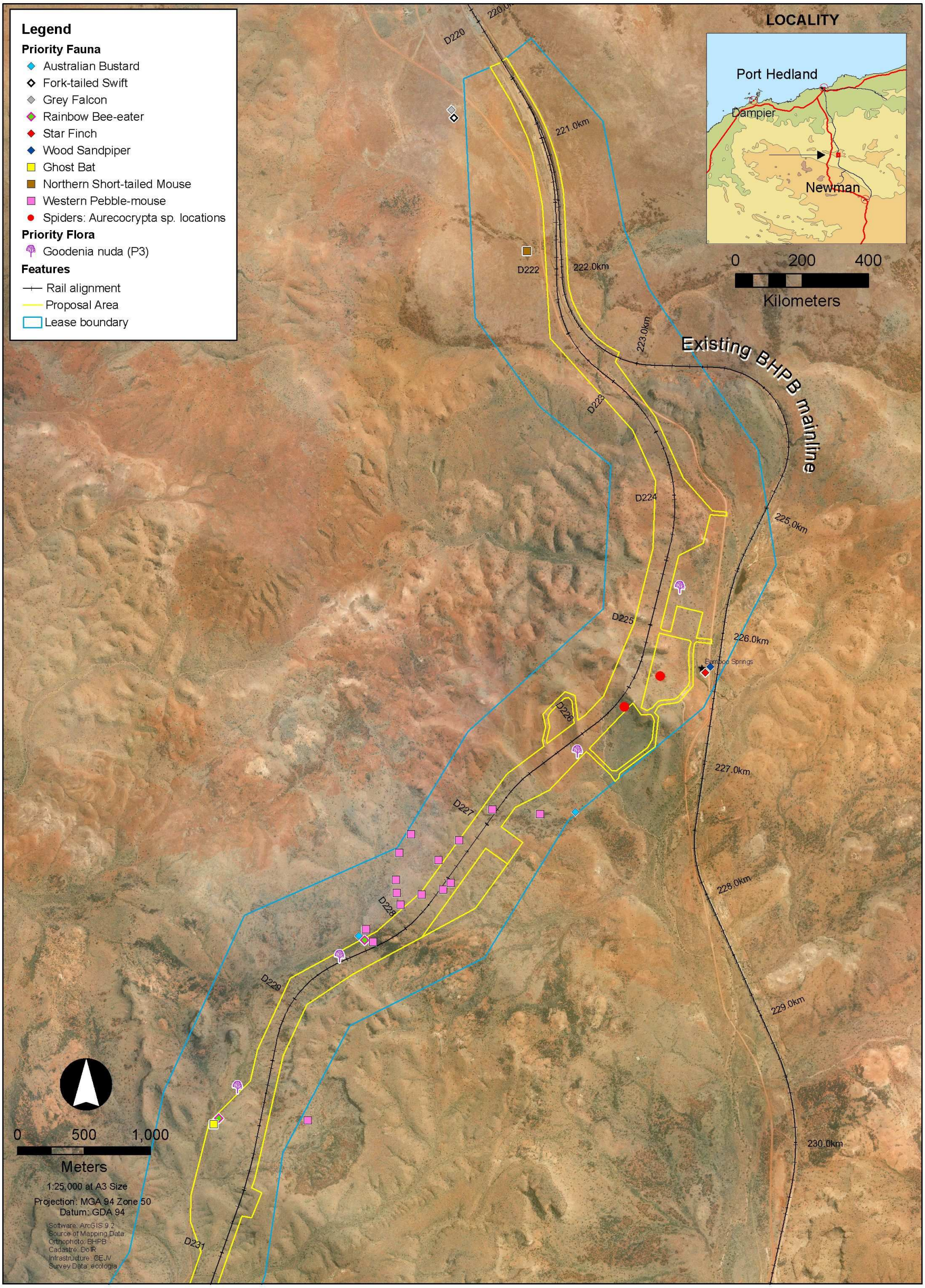
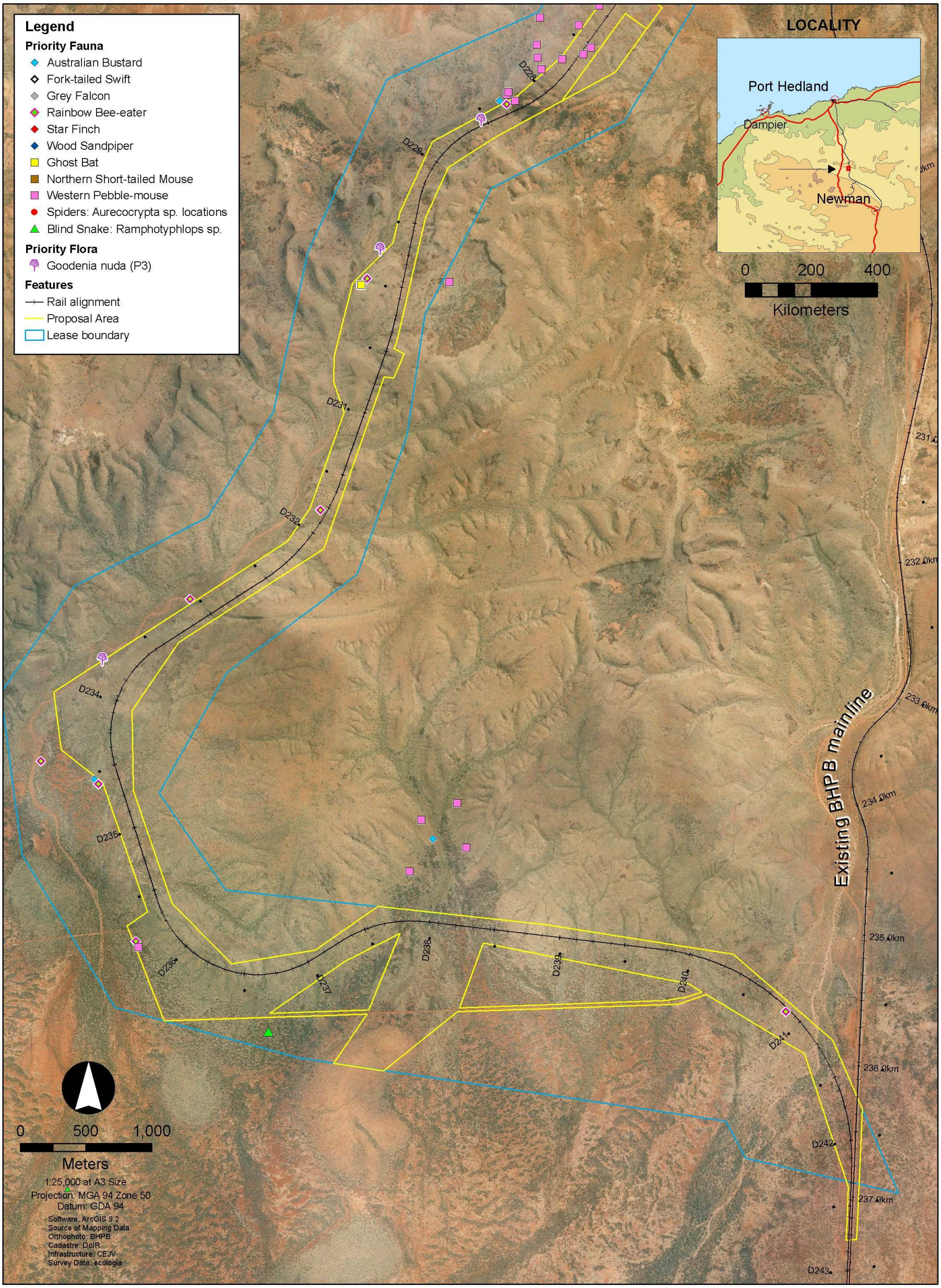


Figure 3.1 – Significant Species Recorded within the Project Area

(Sheet 2 of 2)



3.2 POTENTIAL SIGNIFICANT SPECIES

Based on habitats, known distribution, database searches and results of previous biological surveys in the surrounding areas, the following significant species have the potential to occur within the Chichester Deviation Project area (*ecologia*, 2008a & 2008b).

Table 3.2 – Conservation Significant Flora with the Potential to Occur within the Project Area

Scientific Name	Conservation Significance	Habitat
Lediduim catapycnon	Declared Rare (WC Act)	Stony hill slopes
Eremophila spongiocarpa	Priority 1 (DEC)	Weakly saline alluvial plain on margins of marsh, claypans
Goodenia sp. East Pilbara.	Priority 1 (DEC)	Red-brown clayey pan, swamp on major river floodplain
Gonocarpus ephemerus	Priority 2 (DEC)	Granite outcrop, red silty sand – clay, rocky outcrop, sandstone
Ischaemum albovillosum	Priority 2 (DEC)	Cracking clay, Gilgai
Gymnanthera cunninghamii	Priority 3 (DEC)	Brown red sand, major drainage, limestone rise, creekline, river sand
Hibiscus brachysiphoius	Priority 3 (DEC)	Red loam over basalt, hard setting red clay pan on limestone, Gilgai within clayey plain
Tephrosia sp. Cathedral Gorge	Priority 3 (DEC)	Stony hill slope, ridge crest, skeletal loam, gentle drainage depression
Triumfetta leptacantha	Priority 3 (DEC)	Red clay over boulder, red loam, fluviatile gravel, rocky breakaway, steep rock slopes, skeletal soils
Eremophila yougii supbp. *lepidota*	Priortiy 4 (DEC)	Stony red sandy loam. Flats plains, floodplains, sometimes semi-saline, clay flats

Table 3.3 – Conservation Significant Fauna with the Potential to Occur within the Project Area

Common Name	Scientific Name	Conservation Significance	Habitat	Potential to Occur in Project Area
Northern Quoll	*Dasyurus hallucatus*	Endangered (EPBC) Schedule 1 (DEC)	Rocky area, also eucalypt forest and woodland.	Recent records from Abydos plain and Quarry 4 and from Hamersley range to the south.
Greater Bilby	*Macrotis lagotis*	Vulnerable (EPBC) Schedule 1 (DEC)	Spinifex hummock grassland and acacia scrub. Has characteristic burrow systems.	Suitable habitat is present and there are nearby records of the species. No burrows observed within rail corridor.
Bush Stone-curlew	*Burhinus grallarius*	Priority 4 (DEC)	Lightly wooded country next to daytime shelter of thickets or long grass.	Recorded opportunistically approximately 6 km north of the project area. Suitable habitat adjacent to proposal area.
Grey Falcon	*Falco hypoleucos*	Priority 4 (DEC)	Coastal cliffs, riverine gorges and wooded watercourses.	Recorded at Repeater 5 (north of Project area).
Peregrine	*Falco peregrinus*	Priority 4 (DEC)	Coastal cliffs, riverine	Recorded just north of

Common Name	Scientific Name	Conservation Significance	Habitat	Potential to Occur in Project Area
Falcon			gorges and wooded watercourses.	study area and may use Project area for hunting.
Night Parrot	*Pezoporus occidentalis*	Endangered (EPBC) Schedule 1 (WC Act) Critically Endangered (DEC)	*Triodia* hummock grassland or chenopod shrublands. Thick unburnt vegetation most suitable.	Suitable habitat in some unburnt pockets of vegetation. Three individuals observed approximately 30 km from Project area.
A blind snake	*Ramphotyphlops ganei*	Priority 1 (DEC)	Unknown. Previous record found in clay/loam with Spinifex.	Recorded approximately 500 m south of Ch D237 during a previous survey (*ecologia*, 2005). Species is likely to still be resident in project area despite not being recorded during baseline surveys in 2008.
Pilbara Olive Python	*Liasis olivaceus barroni*	Vulnerable (EPBC) Schedule 1 (DEC)	Gorges and escarpments. Areas of permanent water.	Generally no suitable habitat for the species, except for permanent water and associated vegetation at Bamboo Springs.

With the exception of a *Ramphotyphlops ganei*, none of these significant species have been recorded within the Chichester Deviation Project area to date, however they are either known to occur in the wider area or suitable habitat exists within the Project area.

One individual of the *Ramphotyphlops ganei* was recorded approximately 500 m south of the rail alignment at Ch D237 during a previous survey within the Project area (*ecologia*, 2005). This species was not identified during baseline surveys of the Project area conducted in 2008.

4 GENERAL MANAGEMENT MEASURES FOR FLORA AND FAUNA

Management measures to minimise the potential impacts of the Chichester Deviation Project to all flora and fauna (i.e. not just significant species) can be broadly sub-divided into the following three categories:

- planning;
- construction; and
- operational and maintenance phases.

General management controls for each of these three phases are included in Table 4.1.

Table 4.1 – General Management Measures

Management Measure	Timing	Responsible Person
The rail formation and layout of associated infrastructure will be designed to minimise environmental impacts (including impacts on flora and fauna).	Planning	Project Manager
The results of baseline flora and fauna surveys will be assessed and the rail formation will be refined to minimise impacts on species of conservation significance.	Planning	Project Manager
The location of significant fauna and flora species, their habitat and significant vegetation types will be recorded on relevant environmental management databases and construction plans (where possible).	Planning / Construction	Site Environmental Officer
The area of land disturbance will be kept to a practicable minimum and rehabilitation will be conducted progressively where possible.	Construction	Construction Manager
Sensitive areas will be marked in the field using temporary flagging where possible, including an appropriately sized buffer.	Construction	Site Environmental Officer
BHPBIO's Site Environmental Officer (or nominated delegate) will retain records of areas that have been disturbed by construction activities, and where possible, record significant flora populations that have been impacted. A summary of areas of disturbance will be included in the Annual Environmental Report.	Construction	Site Environmental Officer
Night work will be avoided as far as practicable, however scheduling may require night works to occur. If night works are required, illumination of probable fauna habitat will be minimised where possible and contractors will be educated as to the potential locations and movements of nocturnal fauna species.	Construction	Construction Manager
Barbed wire fencing will not be used in the project area.	Construction / Operation	Construction Manager / Operations Manager
Weed management measures will be implemented in accordance with the Chichester Deviation Weed Management Plan (WMP).	Construction / Operation	Construction Manager/Operations Manager
The induction programme will be used to promote awareness of flora and fauna management measures (including significant species). The induction programme will include information on fauna interaction and appropriate waste management procedures.	Construction / Operation	Construction Manager/Operations Manager
Fauna injury or death within the Chichester Deviation Project area will reported to the Site Environmental Officer.	Construction	Project Manager
Reported fauna injury or death will be investigated to determine the cause of injury or death.	Construction	Site Environmental Officer

Management Measure	Timing	Responsible Person
Injured fauna species found within the Chichester Deviation Project area will be handled and transported in accordance with the procedures outlined in the BHPBIO Fauna Management Work Instruction (Appendix B).	Construction / Operation	Construction Manager/Operations Manager
BHPBIO 'Enviro Alert' information sheets for flora and fauna aspects of particular relevance to the Chichester Deviation Project site (e.g. management of particular significant species, weeds, or pests) will be prepared and distributed to increase awareness amongst employees and contractors as necessary.	Construction	Site Environmental Officer
Equipment and machinery movement		
Existing access tracks will be used where possible.	Construction / Operation	Construction Manager/Operations Manager
There will be no unauthorised off-road driving or other such recreational activities involving off-road vehicles.	Construction / Operation	Construction Manager/Operations Manager
Vehicle speed limits will be restricted to a maximum 80 km/h on access roads and construction haul roads.	Construction / Operation	Construction Manager/Operations Manager
Speed limits for driving activities will be subject to a risk assessment and will take into account a number of factors including the environment and safety.	Construction / Operation	Construction Manager/Operations Manager
Vehicles and machinery will be parked only in designated locations.	Construction / Operation	Construction Manager/Operations Manager
General Clearing		
Clearing will be conducted in accordance with the construction EMP including: A Project Environmental and Aboriginal Heritage Review (PEAHR) must be completed for review and sign off by BHPBIO representatives prior to commencement of clearing, to ensure compliance with legal and environmental requirements.	Construction / Operation	Construction Manager/Operations Manager
BHPBIO's Site Environmental Officer (or nominated delegate) will include any operational flora and fauna management requirements in the PEAHR authorisation form for the relevant planned clearing area. These management requirements will be determined on a case by case basis and may include, but are not necessarily restricted to the following: • Demarcation and retention of particular mature trees which can reasonably be avoided and may provide ongoing habitat during operations. • Specific timing requirements or clearing methods to be used in order to minimise potential harm to fauna species (i.e. staged clearing to maximise the opportunity for mobile species to move to adjoining areas). • Requirements to salvage and temporarily stockpile particular vegetation types or habitat features (i.e. leafy material, stumps, logs, boulders) for use in rehabilitation programmes. • Specific management measures to minimise impacts of species of conservation significance that may occur within or near the planned clearing area (i.e. identification of a particular species, protocol for reporting, requirements to avoid/collect/record).	Construction / Operation	Site Environmental Officer / Environmental Manager
Clearance plans will be prepared prior to clearing taking place to identify the extent of the area authorised to be cleared. The area to be cleared will be identified on the ground (e.g. with pegs and/or flagging tape). The BHPBIO Site Environmental Officer (or nominated delegate) will check the ground markings and regularly monitor clearing operations to verify works are	Construction	Site Environmental Officer

Management Measure	Timing	Responsible Person
proceeding according to plan.		
A condition prohibiting unauthorised clearing will be included in all contracts.	Construction	Project Manager
Blasting and Quarrying		
BHPBIO will conduct targeted pre-disturbance surveys of habitat identified as potentially containing significant fauna or flora. Disturbance of significant fauna and flora will be avoided where practicable.	Construction	Site Environmental Officer
Pits and Trenches		
Trenches and pits will be backfilled as soon as possible. Those trenches which remain open overnight will be fitted with egress ramps, to be placed at an angle no greater than 45 degrees.	Construction	Construction Manager
Daily inspections of open pits and trenches will be carried out prior to commencement of work to identify trapped or injured fauna.	Construction	Site Environmental Officer
Turkeys nests will be fenced to restrict access by fauna. Fauna escape methods such as wire mesh will be fixed within turkeys nests to allow fauna egress. Egress ramps will be placed at an angle no greater than 45 degrees.	Construction	Construction Manager
Bores will be capped and locked to prevent fauna entry.	Construction	Construction Manager

5 SPECIFIC MANAGEMENT MEASURES FOR SPECIES OF CONSERVATION SIGNIFICANCE

Information included in each of the following species profiles has been sourced from FaunaBase (Western Australian Museum 2008), Florabase (Western Australian Herbarium 2008), Hussey et al. (1997), *ecologia* Environment (2008a, 2008b, 2008c) and BHPBIO (2006a, 2006b and 2008b).

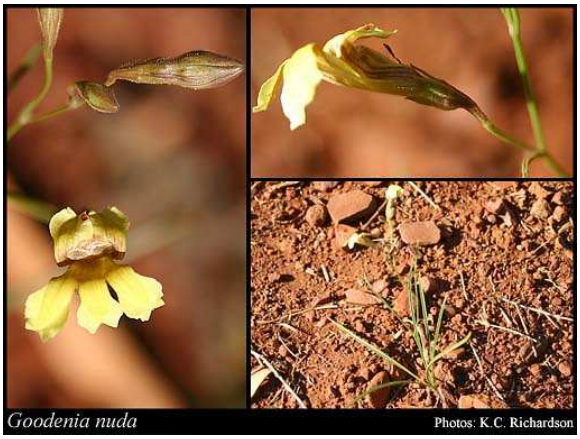
5.1.1 *Goodenia nuda*

Goodenia nuda

Description: Erect to ascending annual herb. Grows to 0.5m tall and produces yellow flowers from April – August.

Habitat: Dry scoured river beds, Spinifex grassland or mulga scrub.

Status: Priorty 3 (DEC) – Poorly known taxa. Taxa which are known from several populations, at least some of which are not believed to be under immediate threat.



(Image Source: WA Herbarium 2008)

Known Locations within the Project area

- Refer to Figure 3.1. Three known populations within the Project footprint.

General Management Measures

- Implement management measures described in Section 4 of this SSMP.

Specific Management Measures

- The Site Environmental Officer will review the results of baseline surveys to determine where *Goodenia nuda* has been recorded and ensure clearance plans are modified, where possible, to minimise or avoid impacts on *Goodenia nuda.*
- During clearing/construction in the area surrounding known locations of *Goodenia nuda*, the BHPBIO Site Environmental Office (or nominated delegate) will:
    - Work alongside operations personnel to assist in minimising impact on *Goodenia nuda* during clearing/construction operations.
    - Clearly demarcate identified populations of *Goodenia nuda* located in the vicinity of disturbance areas.
    - Maintain appropriate records of impacted populations.

Further Information: BHPBIO Site Environmental Officer.

Further Reading: WA Herbarium (2008) *Florabase* – http://florabase.calm.wa.gov.au

5.1.2 Ghost Bat (*Macroderma gigas*)

Ghost Bat

(*Macroderma gigas*)

Description: Light to dark grey upper body and paler below. Long ears joined together, large eyes, simple noselead and no tail. Largest micro-chiropteran bat in Australia.

Habitat: Rests in large caves, mines or deep rock fixtures.

Feeding: Australia's only carnivorous bat. A predator on large insects, frogs, lizards, birds, small mammals and even other bats (including bentwinged, horseshoe, leafnosed, heathtailed, and the little cave bat).

Status: Priority 4 (DEC) - Taxa which are considered to have been adequately surveyed, or for which sufficient knowledge is available, and which are considered not currently threatened or in need of special protection, but could if present circumstances change. These taxa are usually represented on conservation lands.

Known Locations within the Project area

- No suitable roost sites have been identified, however, Ghost Bats may forage within the Project area. A ghost bat call was recorded at Ch D230km during baseline fauna surveys.

General Management Measures

- Implement management measures described in Section 4 of this SSMP.

Specific Management Measures

- The Site Environmental Officer (or nominated delegate) will conduct periodic visual inspections of potential habitat areas for the Ghost Bat.
- If bats are encountered, the Site Environmental Officer (or nominated delegate) will consult the DEC and engage a bat specialist, if required, to identify bat species.
- Maintain appropriate records of impacted populations.

Relocation Potential

- Not suitable for relocation

Further Information: BHPBIO Site Environmental Officer.

Further Reading: WA Museum (2008) *Faunabase* – http://www.museum.wa.gov.au/faunabase

5.1.3 Western Pebble-mouse (*Pseudomys chapmani*)

Western Pebble-mouse

(*Pseudomys chapmani*)

Description: Blackish-brown head, buff brown back and sides and a buff/white underbody. Grows to 135mm long (including 75mm tail).

Habitat: Rocky, hummock grasslands, with little or no soil. Occupies burrows under mounds of pebbles collected from nearby.

Feeding: Grasses and seeds.

Status: Priority 4 (DEC) - Taxa which are considered to have been adequately surveyed, or for which sufficient knowledge is available, and which are considered not currently threatened or in need of special protection, but could if present circumstances change. These taxa are usually represented on conservation lands.

Known Locations within the Project area

- 20 active or recently active Pebble-mouse mounds have been identified throughout the Lease area. Seven of these mounds were recorded within the Project area. The majority of identified mounds are located north of Ch D228.5km. Refer to Figure 3.1.

General Management Measures

- Implement management measures described in Section 4 of this SSMP.

Specific Management Measures

- The rail formation design will be refined to minimise or avoid impacts to areas which are known locations of the Western Pebble-mound mouse.
- During clearing and construction near known locations of Western Pebble-mouse mounds, the Site Environmental Officer (or nominated delegate) will:
    - Work alongside operations personnel to assist in minimising impacts on the Western Pebble-mouse and its mounds during clearing/construction operations.
    - Clearly demarcate areas which contain populations of Western Pebble-mouse in the vicinity of disturbance areas.
    - Maintain appropriate records of impacted populations.
- The Site Environmental Officer (or nominated delegate) will conduct periodic visual inspections of potential habitat areas for the Western Pebble-mouse.
- Maintain appropriate records of impacted populations.

Relocation Potential

- Not noted to relocate well. Relocation is not recommended.

Further Information: BHPBIO Site Environmental Officer.

Further Reading: WA Museum (2008) *Faunabase* – http://www.museum.wa.gov.au/faunabase

5.1.4 Northern short-tailed mouse (*Leggadina lakedownensis)*

Northern short-tailed mouse

(*Leggadina lakedownensis)*

Description: 60 to 75 mm body and 40 to 45 mm tail. Grey colour.

Habitat: Open grassland with pockets of savannah woodland.

Feeding: Native and introduced grass seeds.

Status: Priority 4 (DEC) - Taxa which are considered to have been adequately surveyed, or for which sufficient knowledge is available, and which are considered not currently threatened or in need of special protection, but could if present circumstances change. These taxa are usually represented on conservation lands.

Known Locations within the Project area

- Recorded to the north of the Chichester Range, outside the Project area, near sites of cracking clays. Refer to Figure 3.1.

General Management Measures

- Implement management measures described in Section 4 of this SSMP.

Specific Management Measures

- Minimise disturbance to areas of cracking clays.
- The Site Environmental Officer (or nominated delegate) will conduct periodic visual inspections of potential habitat areas for the Northern Short-tailed Mouse.
- Maintain appropriate records of impacted populations.

Further Information: BHPBIO Site Environmental Officer.

Further Reading: WA Museum (2008) *Faunabase* – http://www.museum.wa.gov.au/faunabase

5.1.5 Northern Quoll (*Dasyurus hallucatus*)

Northern Quoll

(*Dasyurus hallucatus*)

Description: Grey-brown to brown above with large white spots, cream to white below. The head and body is 123 to 310 mm long and the tail is 127 to 308mm long.

Habitat: Broken, rocky country and in open eucalyptus forest within 150km of the coast.

Feeding: Small mammals, reptiles, worms, insects and soft fruits.

Status: Endangered (EPBC Act) – The species is likely to become extinct unless the circumstances and factors threatening its abundance, survival or evolutionary development cease to operate; or its numbers have been reduced to such a critical level, or its habitats have been so drastically reduced, that it is in immediate danger of extinction.

Known Locations within the Project area:

- Not recorded within Project area.

General Management Measures

- Implement management measures described in Section 4 of this SSMP.

Specific Management Measures

- Minimise activities in the vicinity of surface water bodies (e.g. Bamboo Springs).
- The Site Environmental Officer (or nominated delegate) will maintain appropriate records of possible sightings of Northern Quolls including location, date and time.

Further Information: BHPBIO Site Environmental Officer.

Further Reading: WA Museum (2008) *Faunabase* – http://www.museum.wa.gov.au/faunabase

5.1.6 Greater Bilby (*Macrotis lagotis*)

Greater Bilby

(*Macrotis lagotis*)

Description: Tail black on proximal half, then changes abruptly to white. Prominent dorsal crest and extreme tip of tail naked. Muzzle long and pointed, and has long ears to back of head. Hindfoot lacks first toe. Light and delicate in build, with soft and silky hair. Approximate body size is 300 to 500 mm (males) and 290 to 390 mm (females).

Habitat: Desert environmental, with habitat ranging from clayey and stony downs soils with sparse ground cover to massive red earths with Acacia shrubland.

Feeding: Derives water from food. Diet of larvae, seeds, bulbs, fruit and fungi.

Status: Schedule 1 (WC Act) – fauna which is Rare or likely to become extinct.

Vulnerable (EPBC Act) – Within the next 25 years, the species is likely to become endangered unless the circumstances and factors threatening its abundance, survival or evolutionary development cease to operate.

Known Locations within the Project area:

- Not recorded within the Project area.

General Management Measures

- Implement management measures described in Section 4 of this SSMP.

Specific Management Measures

- Minimise activities in the vicinity of surface water bodies (e.g. Bamboo Springs).
- The Site Environmental Officer (or nominated delegate) will maintain appropriate records of possible sightings of Greater Bilbies including location, date and time.

Further Information: BHPBIO Site Environmental Officer.

Further Reading: WA Museum (2008) *Faunabase* – http://www.museum.wa.gov.au/faunabase

5.1.7 Pilbara Olive Python (*Morelia olivacea barroni*)

Pilbara Olive Python

(*Morelia olivacea barroni*)

Description: Dark olive, yellowish brown to olive brown with pearly sheet. The ventral surfaces white to cream. Grow to 4.5 to 6.5 m in length.

Habitat: Rocky areas along watercourses including escarpments and gorges.

Feeding: Small animals up to the size of rock wallabies.

Status: Schedule 1 (WC Act) – fauna which is Rare or likely to become extinct.

Vulnerable (EPBC Act) – Within the next 25 years, the species is likely to become endangered unless the circumstances and factors threatening its abundance, survival or evolutionary development cease to operate.

Known Locations within the Project area:

- Not recorded in the region.
- Limited suitable habitat exists in the Project area.

General Management Measures

- Implement management measures described in Section 4 of this SSMP.

Specific Management Measures

- Minimise activities in the vicinity of surface water bodies (e.g. Bamboo Springs).
- The Site Environmental Officer (or nominated delegate) will maintain appropriate records of possible sightings of Pilbara Olive Pythons including location, date and time.

Relocation Potential

- In the event that a Pilbara Olive Python is found within or near an existing or planned disturbance area, and may reasonably be expected to be harmed if left in that location, the Site Environmental Officer (or nominated representative) will arrange for the individual to be captured and moved to a nearby protected area with similar habitat. All capture and relocation activities will be conducted by a person qualified in snake handling and in accordance with the procedures outlined in the BHPBIO Snake Relocation Manual.

Further Information: BHPBIO Site Environmental Officer.

Further Reading: WA Museum (2008) *Faunabase* – http://www.museum.wa.gov.au/faunabase

5.1.8 Unnamed Blind Snake (*Ramphotyphlops ganei*)

Unnamed Blind Snake

(*Ramphotyphlops ganei*)

Description: Harmless, specialised burrowing snakes. Represented by a dark spot beneath head scales. Usually less than 50 cm in length and have well-developed anal glands.

Habitat: Moist gorges and gullies in arid environments.

Feeding: Feed on invertebrates.

Status: Priority 1 (DEC) – Taxa which are known from few specimens or sight records from one or a few localities, on lands not managed for conservation, e.g. agricultural or pastoral lands, urban areas, active mineral leases. The taxon needs urgent survey and evaluation of conservation status before consideration can be given to declaration as threatened fauna.

Known Locations within the Project area:

- Previously recorded south of Ch D237. Refer to Figure 3.1

General Management Measures

- Implement management measures described in Section 4 of this SSMP.

Specific Management Measures

- Minimise activities in the vicinity of surface water bodies (e.g. Bamboo Springs).
- The Site Environmental Officer (or nominated delegate) will maintain appropriate records of possible sightings of Blind Snakes including location, date and time.

Relocation Potential

- In the event that a Blind Snake is found within or near an existing or planned disturbance area, and may reasonably be expected to be harmed if left in that location, the Site Environmental Officer (or nominated representative) will arrange for the individual to be captured and moved to a nearby protected area with similar habitat. All capture and relocation activities will be conducted by a person qualified in snake handling and in accordance with the procedures outlined in the BHPBIO Snake Relocation Manual.

Further Information: BHPBIO Site Environmental Officer.

Further Reading: WA Museum (2008) *Faunabase* – http://www.museum.wa.gov.au/faunabase

5.1.9 Rainbow Bee-eater (*Merops ornatus*)

Rainbow Bee-eater

(*Merops ornatus*)

Description: Light-green back with black tail. Black eye-stripe, edged blue and a black band on yellow throat. Grows to 23 to 28 cm.

Habitat: Open country, including sand dunes and banks.

Feeding: The majority of its diet consists of insects.

Status: Migratory Species (EPBC Act) – species listed in the Bonn Convention, Government of Australia and the Government of the Peoples Republic of China for the Protection of Migratory Birds and their Environment (CAMBA) and Agreement between the Government of Japan and the Government of Australia for the Protection of Migratory Birds and Birds in Danger of Extinction and their Environment (JAMBA).

Known Locations within the Project area:

- Rainbow Bee-eaters were observed at seven locations within the Deviation corridor. Refer to Figure 3.1.
- Suitable habitat exists across most of Project area, particularly along major creeklines.

General Management Measures

- Implement management measures described in Section 4 of this SSMP.

Specific Management Measures

- Minimise disturbance to creek lines and river banks.
- The Site Environmental Officer (or nominated delegate) will inspect river banks and creek lines prior to disturbance to identify Rainbow Bee-eater breeding tunnels.
- If breeding tunnels are identified within the area of disturbance, the Site Environmental Officer (or nominated delegate) will liaise with the DEC to determine best practice management.
- The Site Environmental Officer (or nominated delegate) will maintain appropriate records of possible sightings of Rainbow Bee-eaters including location, date and time.

Relocation Potential

- Bird species are expected to disperse prior to disturbance. No relocation required.

Further Information: BHPBIO Site Environmental Officer.

Further Reading: WA Museum (2008) *Faunabase* – http://www.museum.wa.gov.au/faunabase

5.1.10 Australian Bustard (*Ardeotis australis*)

Australian Bustard

(*Ardeotis australis*)

Description: Back and wings are brown. Upper wing coverts black and white. Underparts white to grey. Legs and feet pale yellow to grey. The crown is black with white eyebrow. The neck is white with a black breast band. The females crown is brown and the breast band is less visible. There is also less black on wings.

Habitat: Tussock grassland, grassy woodland and low woodlands.

Feeding: Insects, small vertebrates, seeds and fruit.

Status: Priority 4 (DEC) - Taxa which are considered to have been adequately surveyed, or for which sufficient knowledge is available, and which are considered not currently threatened or in need of special protection, but could if present circumstances change. These taxa are usually represented on conservation lands.

Known Locations within the Project area:

- This species is relatively common in the Chichester Deviation Project area with suitable habitat across much of the rail corridor. Refer to Figure 3.1.

General Management Measures

- Implement management measures described in Section 4 of this SSMP.

Specific Management Measures

- The Site Environmental Officer (or nominated delegate) will maintain appropriate records of possible sightings of Australian Bustards including location, date and time.

Relocation Potential

- Bird species are expected to disperse prior to disturbance. No relocation required.

Further Information: BHPBIO Site Environmental Officer.

Further Reading: WA Museum (2008) *Faunabase* – http://www.museum.wa.gov.au/faunabase

5.1.11 Bush Stone-curlew (*Burhinus grallarius*)

Bush Stone-curlew

(*Burhinus grallarius*)

Description: Medium black bill. Forehead buff, pale buff eyebrow. Large yellow eyes. Black eye-stripe through to neck. Black streaking on grey-brown upperparts; buff-white underparts. Whitish shoulder patch. Approximate size is 55cm. Sound a mournful, wailing 'wee-loo' usually at night. Fly in single pairs or loose flocks up to 100 individuals or more. Active at night. Sulking habits, rigid movements and freezes to escape notice.

Habitat: Require sparsely grassed, lightly timbered, open forests or woodland.

Feeding: Small vertebrates and invertebrates, as well as seeds and shoots.

Status: Priority 4 (DEC) - Taxa which are considered to have been adequately surveyed, or for which sufficient knowledge is available, and which are considered not currently threatened or in need of special protection, but could if present circumstances change. These taxa are usually represented on conservation lands.

Known Locations within the Project area:

- Not identified within the Chichester Deviation Project area. Recorded approximately 6 km north of the Project area during nocturnal survey. Refer to Figure 3.1.

General Management Measures

- Implement management measures described in Section 4 of this SSMP.

Specific Management Measures

- The Site Environmental Officer (or nominated delegate) will maintain appropriate records of possible sightings of Bush Stone-curlew including location, date and time.

Relocation Potential

- Bird species are expected to disperse prior to disturbance. No relocation required.

Further Information: BHPBIO Site Environmental Officer.

Further Reading: WA Museum (2008) *Faunabase* – http://www.museum.wa.gov.au/faunabase

5.1.12 Star Finch (Western subspecies) (*Neochmia ruficauda subclarescens*)

Star Finch (Western subspecies)

(*Neochmia ruficauda subclarescens*)

Description: Males are red faced with dark olive above and yellow-olive below. They are crested, rump and flank with tail spotted white. Females are duller, greyer with red only in the fronts and cheeks. The chin has coarser spots ventrally. Approximate size is 10-12 cm. Juveniles are plainer with black bill. They have a penetrating 'sweet' sound.

Habitat: Tall grass by swamps.

Feeding: Seeds of a number of grasses and among watered suburban gardens.

Status: Priority 4 (DEC) - Taxa which are considered to have been adequately surveyed, or for which sufficient knowledge is available, and which are considered not currently threatened or in need of special protection, but could if present circumstances change. These taxa are usually represented on conservation lands.

Known Locations within the Project area:

- Not recorded in Project Area, however recorded at Bamboo Springs.

General Management Measures

- Implement management measures described in Section 4 of this SSMP.

Specific Management Measures

- Minimise activities in the vicinity of surface water bodies (e.g. Bamboo Springs).
- The Site Environmental Officer (or nominated delegate) will maintain appropriate records of possible sightings of Star Finches including location, date and time.

Relocation Potential

- Bird species are expected to disperse prior to disturbance. No relocation required.

Further Information: BHPBIO Site Environmental Officer.

Further Reading: WA Museum (2008) *Faunabase* – http://www.museum.wa.gov.au/faunabase

5.1.13 Wood Sandpiper (*Tringa glareola*)

Wood Sandpiper

(*Tringa glareola*)

Description: Medium, straight, black bill. Narrow pale eyebrow to behind the eye. Pale underwing and brown black dark wings, spotted white. White rump and yellow-green legs.

Habitat: Adjacent to fresh water.

Feeding: -

Status: Migratory Species (EPBC Act) – species listed in the Bonn Convention, Government of Australia and the Government of the Peoples Republic of China for the Protection of Migratory Birds and their Environment (CAMBA) and Agreement between the Government of Japan and the Government of Australia for the Protection of Migratory Birds and Birds in Danger of Extinction and their Environment (JAMBA).

Known Locations within the Project area:

- Not recorded in Project Area.
- Recorded at Bamboo Springs however is unlikely to be a resident.

General Management Measures

- Implement management measures described in Section 4 of this SSMP.

Specific Management Measures

- Minimise activities in the vicinity of surface water bodies (e.g. Bamboo Springs).
- The Site Environmental Officer (or nominated delegate) will maintain appropriate records of possible sightings of Wood Sandpipers including location, date and time.

Relocation Potential

- Bird species are expected to disperse prior to disturbance. No relocation required.

Further Information: BHPBIO Site Environmental Officer.

Further Reading: WA Museum (2008) *Faunabase* – http://www.museum.wa.gov.au/faunabase

5.1.14 Grey Falcon (*Falco hypoleucos*)

Grey Falcon

(*Falco hypoleucos)*

Description: Grey above with black streak under eye, black wing-tips. White below with fine dark streaks. Tail grey, faintly barred as are the wings. Females are 41 to 43 cm in size, males 33 to 36 cm. Sounding is chattering and clucking. Heavy shouldered, Peregrine-like in flight.

In the first year of life colour is darker with heavier streaks on underparts.

Habitat: Woodland and scrub types in arid zone.

Feeding: Preys on birds, mostly granivorous parrots, pigeons and mammals. It occasionally feeds on carrion, including dead lambs.

Status: Priority 4 (DEC) - Taxa which are considered to have been adequately surveyed, or for which sufficient knowledge is available, and which are considered not currently threatened or in need of special protection, but could if present circumstances change. These taxa are usually represented on conservation lands.

Known Locations within the Project area:

- Not identified within the Project area.
- Recorded at Repeater 5 to the north of the Project area at Ch 220.

General Management Measures

- Implement management measures described in Section 4 of this SSMP.

Specific Management Measures

- The Site Environmental Officer (or nominated delegate) will maintain appropriate records of possible sightings of Grey Falcons including location, date and time.

Relocation Potential

- Bird species are expected to disperse prior to disturbance. No relocation required.

Further Information: BHPBIO Site Environmental Officer.

Further Reading: WA Museum (2008) *Faunabase* – http://www.museum.wa.gov.au/faunabase

5.1.15 Peregrine Falcon (*Falco peregrinus*)

Peregrine Falcon

(*Falco peregrinus*)

Description: Blue-grey upperparts and cream underparts with dark barring on belly. The head and cheeks are black. Male grows to 45 to 54 cm and the female to 52 to 56 cm.

Habitat: Most land types particularly rocky outcrops and cliffs.

Feeding: Small birds typically taken in the air.

Status: Priority 4 (DEC) - Taxa which are considered to have been adequately surveyed, or for which sufficient knowledge is available, and which are considered not currently threatened or in need of special protection, but could if present circumstances change. These taxa are usually represented on conservation lands.

Known Locations within the Project area:

- No individuals recorded within the Project area.
- Little suitable breeding habitat within the Project area.
- Could use the Project area for hunting.

General Management Measures

- Implement management measures described in Section 4 of this SSMP.

Specific Management Measures

- The Site Environmental Officer (or nominated delegate) will maintain appropriate records of possible sightings of Peregrine Falcons including location, date and time.

Relocation Potential

- Bird species are expected to disperse prior to disturbance. No relocation required.

Further Information: BHPBIO Site Environmental Officer.

Further Reading: WA Museum (2008) *Faunabase* – http://www.museum.wa.gov.au/faunabase

5.1.16 Night Parrot (*Pezoporus occidentalis*)

Night Parrot

(*Pezoporus occidentalis*)

Description: Medium sized nocturnal parrot. Thick set and short tailed. Upper parts are a dull, yellowish green with mottled and barred black and dark brown. Underparts are yellowish; primaries brown. No red fronts. Approximately 23 cm in size.

Habitat: Inland plains, breakaways, samphire about salt lakes. In day, believed to hide in dense saltbush or Spinifex and emerges at dusk.

Photo not available

Feeding: -

Status: Schedule 1 (WC Act) - fauna that is rare or is likely to become extinct.

Vulnerable (EPBC Act) – within the next 25 years, the species is likely to become endangered unless the circumstances and factors threatening its abundance, survival or evolutionary development cease to operate.

Known Locations within the Project area:

- No individuals recorded within the Project area.

General Management Measures

- The Site Environmental Officer (or nominated delegate) will maintain appropriate records of possible sightings of Night Parrots including location, date and time.

Specific Management Measures

- The Site Environmental Officer (or nominated delegate) will maintain appropriate records of possible sightings of Night Parrots including location, date and time.

Relocation Potential

- Bird species are expected to disperse prior to disturbance. No relocation required.

Further Information: BHPBIO Site Environmental Officer.

Further Reading: WA Museum (2008) *Faunabase* – http://www.museum.wa.gov.au/faunabase

6 MONITORING AND INSPECTIONS

6.1 OVERVIEW

Monitoring of significant flora and fauna species will consist of two main components:

- monitoring and audit of management controls; and
- monitoring of significant fauna death and injury during the Project.

6.2 MONITORING OF MANAGEMENT CONTROLS

BHPBIO will conduct internal compliance audits of the implementation of Project environmental management commitments during the construction phase, including:

- quarterly on-site audits of compliance with this management plan;
- audits of contractors environmental management; and
- weekly work area inspections and monitoring.

Non-conformances identified during inspections will be documented, addressed with appropriate corrective and preventive actions and rectified within an agreed time frame.

This SSMP and the management measures herein will be reviewed annually and amended if required.

6.3 MONITORING OF FAUNA DEATH OR INJURY

Incidents during the Project will be managed in accordance with BHPBIO's environmental event management procedures, including:

- reporting death or injury of significant fauna as an environmental event to the Site Environmental Officer;
- conducting an event investigation within 72 hours of the event occurring;
- implementing corrective and preventative actions appropriate to the nature and scale of the event, that reduce the probability of re-occurrence and include review and/or revision of the risk register, relevant procedures and documentation (including this plan);
- assessing the effectiveness of corrective and preventative actions, particularly for repeat occurrences; and
- reporting all deaths of significant species to the DEC.

In the event that a control measure appears not to be effective, it will be adjusted as necessary in consultation with the DEC This SSMP will be updated if necessary to reflect any significant changes to control measures.

7 REPORTING

Information regarding the Significant Species Management Plan will be provided in BHPBIO's annual environmental report for rail operations, reporting on the previous 12 month period.

8 REFERENCES

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Appendix A – Explanation of Conservation Codes Used in Western Australia

FLORA

Environment Protection and Biodiversity Conservation Act 1999

At a National level, flora and fauna are protected under the Commonwealth Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act). The Act contains a list of species that are considered Critically Endangered, Endangered, Vulnerable, Conservation Dependent, Extinct or Extinct in the Wild.

Table 8.1 – Definition of Categories Described under the EPBC Act

Conservation Category	Definition
Extinct	A species is extinct if there is no reasonable doubt that the last member of the species has died.
Extinct in the Wild	A species is categorised as extinct in the wild if it is only known to survive in cultivation, in captivity or as a naturalised population well outside its past range; or if it has not been recorded in its known/expected habitat, at appropriate seasons, anywhere in its past range, despite exhaustive surveys over a time frame appropriate to its life cycle and form.
Critically Endangered	The species is facing an extremely high risk of extinction in the wild in the immediate future.
Endangered	The species is likely to become extinct unless the circumstances and factors threatening its abundance, survival or evolutionary development cease to operate; or its numbers have been reduced to such a critical level, or its habitats have been so drastically reduced, that it is in immediate danger of extinction.
Vulnerable	Within the next 25 years, the species is likely to become endangered unless the circumstances and factors threatening its abundance, survival or evolutionary development cease to operate.
Conservation Dependent	The species is the focus of a specific conservation program, the cessation of which would result in the species becoming vulnerable, endangered or critically endangered within a period of 5 years.

Wildlife Conservation Act 1950

Rare Flora is also protected under the *Western Australian Wildlife Conservation (Rare Flora) Notice 2005* of the *Wildlife Conservation Act 1950*. The notice lists protected flora taxa that are extant and considered likely to become extinct or rare. Generally speaking, species of flora are considered as being of Declared Rare Flora (DRF) or Priority conservation status where their populations are restricted geographically or threatened by local processes. DEC maintains a list of all DRF and Priority Flora taxa within Western Australia (Atkins, 2003). Definitions of categories of DRF and Priority Flora are provided below. Priority Flora are either poorly known, believed to be uncommon, rare or under threat but have not been designated as DRF and thereby legally protected because the detailed survey work to justify this has not been carried out. Priority species are maintained on a "Reserve List" and assigned to one of four Priority categories (Atkins, 2003).

Table 8.2 – Definition of Declared Rare and Priority Flora Categories

Code	Definition
DRF	Declared Rare Flora – Extant Taxa. Taxa which have been adequately searched for and are deemed to be in the wild either rare, in danger of extinction, or otherwise in need of special protection.
P1: Priority One	Poorly Known Taxa. Taxa which are known from one or a few (generally <5) populations

Code	Definition
	which are under threat.
P2: Priority Two	Poorly Known Taxa. Taxa which are known from one or a few (generally <5) population, at least some of which are not believed to be under immediate threat.
P3: Priority Three	Poorly Known Taxa. Taxa which are known from several populations, at least some of which are not believed to be under immediate threat.
P4: Priority Four	Rare Taxa. Taxa which are considered to have been adequately surveyed and which whilst being rare, are not currently threatened by any identifiable factors.

(From Atkins, K.J., Declared Rare and Priority Flora List April 2003, Dept CALM)

FAUNA

Commonwealth EPBC Act

Schedule 1 of the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* contains a list of species that are considered Critically Endangered, Endangered, Vulnerable, Extinct, Extinct in the wild and Conservation Dependent.

Table 8.3 – Explanation of Codes for Fauna under the Commonwealth EPBC Act

Conservation Category	Definition
Critically Endangered	The species is facing an extremely high risk of extinction in the wild in the immediate future.
Endangered	The species is likely to become extinct unless the circumstances and factors threatening its abundance, survival or evolutionary development cease to operate; or its numbers have been reduced to such a critical level, or its habitats have been so drastically reduced, that it is in immediate danger of extinction.
Vulnerable	Within the next 25 years, the species is likely to become endangered unless the circumstances and factors threatening its abundance, survival or evolutionary development cease to operate.
Extinct	A species is presumed extinct if it has not been located in the last 50 years, or it has not been located in the last 10 years despite thorough searching.
Extinct in the Wild	The species is only known to survive in cultivation, in captivity or as a naturalised population well outside its past range or it has not been recorded in its known and/or expected habitat, at appropriate seasons, anywhere in its past range, despite exhaustive surveys over a timeframe appropriate to its life cycle and form.
Conservation Dependent	The species is the focus of a specific conservation program, the cessation of which would result in the species becoming vulnerable, endangered or critically endangered within a period of 5 years.

WA Wildlife Conservation Act 1950 (Specially Protected Fauna) Notice

Classification of rare and endangered fauna under the WA *Wildlife Conservation (Specially Protected Fauna) Notice 2005*, recognises four distinct schedules.

Table 8.4 – Explanation of Codes under the WA *Wildlife Conservation Act 1950 (Specially Protected Fauna) Notice*

Code	Definition
Schedule 1	"fauna which are Rare or likely to become extinct, are declared to be fauna that is in need of special protection"
Schedule 2	"fauna which are presumed to be extinct, are declared to be fauna that is in need of special protection"
Schedule 3	"birds which are subject to an agreement between the governments of

	Australia and Japan relating to the protection of migratory birds and birds in danger of extinction, are declared to be fauna that is in need of special protection"
Schedule 4	"declared to be fauna that is in need of special protection, otherwise than for the reasons mentioned in paragraphs (a), (b) and (c)."

DEC Priority Fauna

Species on the DEC Priority Fauna list include those removed from the Scheduled fauna list and other species known from only a few populations or in need of monitoring. Four Priority Codes are recognised.

Explanation of DEC Priority Fauna Categories

Priority Category	Definition
Priority One Taxa with few, poorly known populations on threatened lands.	Taxa which are known from few specimens or sight records from one or a few localities, on lands not managed for conservation, *e.g.* agricultural or pastoral lands, urban areas, active mineral leases. The taxon needs urgent survey and evaluation of conservation status before consideration can be given to declaration as threatened fauna.
Priority Two Taxa with few, poorly known populations on conservation lands.	Taxa which are known from few specimens or sight records from one or a few localities, on lands not under immediate threat of habitat destruction or degradation, *e.g.* national parks, conservation parks, nature reserves, State forest, vacant crown land, water reserves, etc. The taxon needs urgent survey and evaluation of conservation status before consideration can be given to declaration as threatened fauna.
Priority Three Taxa with several, poorly known populations, some on conservation lands.	Taxa which are known from few specimens or sight records from several localities, some of which are on lands not under immediate threat of habitat destruction or degradation. The taxon needs urgent survey and evaluation of conservation status before consideration can be given to declaration as threatened fauna.
Priority Four Taxa in need of monitoring	Taxa which are considered to have been adequately surveyed, or for which sufficient knowledge is available, and which are considered not currently threatened or in need of special protection, but could if present circumstances change. These taxa are usually represented on conservation lands.
Priority Five Taxa in need of monitoring	Taxa which are not considered threatened but are subject to a specific conservation program, the cessation of which would result in the species becoming threatened within five years.

IUCN Redbook

Table 8.5 – Explanation of IUCN Fauna Categories

Category	Definition
Extinct (EX)	A taxon is Extinct when there is no reasonable doubt that the last individual has died. A taxon is presumed Extinct when exhaustive surveys in known and/or expected habitat, at appropriate times (diurnal, seasonal, annual), throughout its historic range have failed to record an individual. Surveys should be over a time frame appropriate to the taxon's life cycle and life form.
Extinct in the Wild (EW)	A taxon is Extinct in the Wild when it is known only to survive in cultivation, in captivity or as a naturalized population (or populations) well outside the past range. A taxon is presumed Extinct in the Wild when exhaustive surveys in known and/or expected habitat, at appropriate times (diurnal, seasonal, annual), throughout its historic range have failed to record an individual. Surveys should be over a time frame appropriate to the taxon's life cycle and life form.
Critically Endangered (CR)	A taxon is Critically Endangered when the best available evidence indicates that it meets any of the criteria A to E for Critically Endangered (see Section

Category	Definition
	V), and it is therefore considered to be facing an extremely high risk of extinction in the wild.
Endangered (EN)	A taxon is Endangered when the best available evidence indicates that it meets any of the criteria A to E for Endangered (see Section V), and it is therefore considered to be facing a very high risk of extinction in the wild.
Vulnerable (VU)	A taxon is Vulnerable when the best available evidence indicates that it meets any of the criteria A to E for Vulnerable (see Section V), and it is therefore considered to be facing a high risk of extinction in the wild.
Near Threatened (NT)	A taxon is Near Threatened when it has been evaluated against the criteria, does not qualify for Critically Endangered, Endangered or Vulnerable now, but is close to qualifying for, or is likely to qualify for, a threatened category in the near future.
Least Concern (LC)	A taxon is Least Concern when it has been evaluated against the criteria and does not qualify for Critically Endangered, Endangered, Vulnerable or Near Threatened. Widespread and abundant taxa are included in this category.
Data Deficient (DD)	A taxon is Data Deficient when there is inadequate information to make a direct, or indirect, assessment of its risk of extinction based on its distribution and/or population status. A taxon in this category may be well studied, and its biology well known, but appropriate data on abundance and/or distribution are lacking. Data Deficient is therefore not a category of threat. Listing of taxa in this category indicates that more information is required and acknowledges the possibility that future research will show that threatened classification is appropriate. It is important to make positive use of whatever data are available. In many cases great care should be exercised in choosing between DD and a threatened status. If the range of a taxon is suspected to be relatively circumscribed, and a considerable period of time has elapsed since the last record of the taxon, threatened status may well be justified.
Not Evaluated (NE)	A taxon is Not Evaluated when it is has not yet been evaluated against the criteria.

IUCN categories are further classified based on the following criteria:

Critically Endangered (CR)

A taxon is Critically Endangered when the best available evidence indicates that it meets any of the following criteria (A to E), and it is therefore considered to be facing an extremely high risk of extinction in the wild:

A. Reduction in population size based on any of the following:

1. An observed, estimated, inferred or suspected population size reduction of 90% over the last 10 years or three generations, whichever is the longer, where the causes of the reduction are clearly reversible AND understood AND ceased, based on (and specifying) any of the following:

    a. direct observation;
    b. an index of abundance appropriate to the taxon;
    c. a decline in area of occupancy, extent of occurrence and/or quality of habitat;
    d. actual or potential levels of exploitation; and
    e. the effects of introduced taxa, hybridization, pathogens, pollutants, competitors or parasites.

2. An observed, estimated, inferred or suspected population size reduction of 80% over the last 10 years or three generations, whichever is the longer, where the reduction or its causes may not have ceased OR may not be understood OR may not be reversible, based on (and specifying) any of a-e under A1.

3. A population size reduction of 80%, projected or suspected to be met within the next 10 years or three generations, whichever is the longer (up to a maximum of 100 years), based on (and specifying) any of b-e under A1.

4. An observed, estimated, inferred, projected or suspected population size reduction of 80% over any 10 year or three generation period, whichever is longer (up to a maximum of 100 years in the future), where the time period must include both the past and the future, and where the reduction or its causes may not have ceased OR may not be understood OR may not be reversible, based on (and specifying) any of a-e under A1.

B. Geographic range in the form of either B1 (extent of occurrence) OR B2 (area of occupancy) OR both:

1. Extent of occurrence estimated to be less than 100 km², and estimates indicating at least two of a-c:

   a. Severely fragmented or known to exist at only a single location.

   b. Continuing decline, observed, inferred or projected, in any of the following:
      (i) extent of occurrence;
      (ii) area of occupancy;
      (iii) area, extent and/or quality of habitat;
      (iv) number of locations or subpopulations; and
      (v) number of mature individuals.

   c. Extreme fluctuations in any of the following:
      (i) extent of occurrence;
      (ii) area of occupancy;
      (iii) number of locations or subpopulations; and
      (iv) number of mature individuals.

2. Area of occupancy estimated to be less than 10 km², and estimates indicating at least two of a-c:

   a. Severely fragmented or known to exist at only a single location.

   b. Continuing decline, observed, inferred or projected, in any of the following:
      (i) extent of occurrence;
      (ii) area of occupancy;
      (iii) area, extent and/or quality of habitat;
      (iv) number of locations or subpopulations; and
      (v) number of mature individuals.

   c. Extreme fluctuations in any of the following:
      (i) extent of occurrence
      (ii) area of occupancy
      (iii) number of locations or subpopulations
      (iv) number of mature individuals.

C. Population size estimated to number fewer than 250 mature individuals and either:

1. An estimated continuing decline of at least 25% within three years or one generation, whichever is longer, (up to a maximum of 100 years in the future) OR

2. A continuing decline, observed, projected, or inferred, in numbers of mature individuals AND at least one of the following (a-b):

    a. Population structure in the form of one of the following:
        (i) no subpopulation estimated to contain more than 50 mature individuals, OR
        (ii) at least 90% of mature individuals in one subpopulation.

    b. Extreme fluctuations in number of mature individuals.

D. Population size estimated to number fewer than 50 mature individuals.

E. Quantitative analysis showing the probability of extinction in the wild is at least 50% within 10 years or three generations, whichever is the longer (up to a maximum of 100 years).

Endangered (EN)

A taxon is Endangered when the best available evidence indicates that it meets any of the following criteria (A to E), and it is therefore considered to be facing a very high risk of extinction in the wild:

A. Reduction in population size based on any of the following:

1. An observed, estimated, inferred or suspected population size reduction of 70% over the last 10 years or three generations, whichever is the longer, where the causes of the reduction are clearly reversible AND understood AND ceased, based on (and specifying) any of the following:
   a. direct observation;
   b. an index of abundance appropriate to the taxon;
   c. a decline in area of occupancy, extent of occurrence and/or quality of habitat;
   d. actual or potential levels of exploitation; and
   e. the effects of introduced taxa, hybridization, pathogens, pollutants, competitors or parasites.

2. An observed, estimated, inferred or suspected population size reduction of 50% over the last 10 years or three generations, whichever is the longer, where the reduction or its causes may not have ceased OR may not be understood OR may not be reversible, based on (and specifying) any of a-e under A1.

3. A population size reduction of 50%, projected or suspected to be met within the next 10 years or three generations, whichever is the longer (up to a maximum of 100 years), based on (and specifying) any of b-e under A1.

4. An observed, estimated, inferred, projected or suspected population size reduction of 50% over any 10 year or three generation period, whichever is longer (up to a maximum of 100 years in the future), where the time period must include both the past and the future, and where the reduction or its causes may not have ceased OR may not be understood OR may not be reversible, based on (and specifying) any of a-e under A1.

B. Geographic range in the form of either B1 (extent of occurrence) OR B2 (area of occupancy) OR both:

1. Extent of occurrence estimated to be less than 5000 km², and estimates indicating at least two of a-c:

   a. Severely fragmented or known to exist at no more than five locations.

   b. Continuing decline, observed, inferred or projected, in any of the following:
      (i) extent of occurrence;
      (ii) area of occupancy;
      (iii) area, extent and/or quality of habitat;
      (iv) number of locations or subpopulations; and
      (v) number of mature individuals.

   c. Extreme fluctuations in any of the following:
      (i) extent of occurrence;
      (ii) area of occupancy;

(iii) number of locations or subpopulations; and
(iv) number of mature individuals.

2. Area of occupancy estimated to be less than 500 km², and estimates indicating at least two of a-c:

   a. Severely fragmented or known to exist at no more than five locations.

   b. Continuing decline, observed, inferred or projected, in any of the following:
      (i) extent of occurrence;
      (ii) area of occupancy;
      (iii) area, extent and/or quality of habitat;
      (iv) number of locations or subpopulations; and
      (v) number of mature individuals.

   c. Extreme fluctuations in any of the following:
      (i) extent of occurrence;
      (ii) area of occupancy;
      (iii) number of locations or subpopulations; and
      (iv) number of mature individuals.

C. Population size estimated to number fewer than 2500 mature individuals and either:

1. An estimated continuing decline of at least 20% within five years or two generations, whichever is longer, (up to a maximum of 100 years in the future) OR

2. A continuing decline, observed, projected, or inferred, in numbers of mature individuals AND at least one of the following (a-b):

   a. Population structure in the form of one of the following:
      (i) no subpopulation estimated to contain more than 250 mature individuals, OR
      (ii) at least 95% of mature individuals in one subpopulation.

   b. Extreme fluctuations in number of mature individuals.

D. Population size estimated to number fewer than 250 mature individuals.

E. Quantitative analysis showing the probability of extinction in the wild is at least 20% within 20 years or five generations, whichever is the longer (up to a maximum of 100 years).

Vulnerable (VU)

A taxon is Vulnerable when the best available evidence indicates that it meets any of the following criteria (A to E), and it is therefore considered to be facing a high risk of extinction in the wild:

A. Reduction in population size based on any of the following:

1. An observed, estimated, inferred or suspected population size reduction of 50% over the last 10 years or three generations, whichever is the longer, where the causes of the reduction are: clearly reversible AND understood AND ceased, based on (and specifying) any of the following:
   a. direct observation
   b. an index of abundance appropriate to the taxon
   c. a decline in area of occupancy, extent of occurrence and/or quality of habitat
   d. actual or potential levels of exploitation
   e. the effects of introduced taxa, hybridization, pathogens, pollutants, competitors or parasites.

2. An observed, estimated, inferred or suspected population size reduction of 30% over the last 10 years or three generations, whichever is the longer, where the reduction or its causes may not have ceased OR may not be understood OR may not be reversible, based on (and specifying) any of a-e under A1.

3. A population size reduction of 30%, projected or suspected to be met within the next 10 years or three generations, whichever is the longer (up to a maximum of 100 years), based on (and specifying) any of b-e under A1.

4. An observed, estimated, inferred, projected or suspected population size reduction of 30% over any 10 year or three generation period, whichever is longer (up to a maximum of 100 years in the future), where the time period must include both the past and the future, and where the reduction or its causes may not have ceased OR may not be understood OR may not be reversible, based on (and specifying) any of a-e under A1.

B. Geographic range in the form of either B1 (extent of occurrence) OR B2 (area of occupancy) OR both:

1. Extent of occurrence estimated to be less than 20,000 km², and estimates indicating at least two of a-c:

   a. Severely fragmented or known to exist at no more than 10 locations.

   b. Continuing decline, observed, inferred or projected, in any of the following:
      (i) extent of occurrence;
      (ii) area of occupancy;
      (iii) area, extent and/or quality of habitat;
      (iv) number of locations or subpopulations; and
      (v) number of mature individuals.

   c. Extreme fluctuations in any of the following:
      (i) extent of occurrence
      (ii) area of occupancy

(iii) number of locations or subpopulations
(iv) number of mature individuals.

2. Area of occupancy estimated to be less than 2000 km², and estimates indicating at least two of a-c:

   a. Severely fragmented or known to exist at no more than 10 locations.

   b. Continuing decline, observed, inferred or projected, in any of the following:
      (i) extent of occurrence;
      (ii) area of occupancy;
      (iii) area, extent and/or quality of habitat;
      (iv) number of locations or subpopulations; and
      (v) number of mature individuals.

   c. Extreme fluctuations in any of the following:
      (i) extent of occurrence;
      (ii) area of occupancy;
      (iii) number of locations or subpopulations; and
      (iv) number of mature individuals.

C. Population size estimated to number fewer than 10,000 mature individuals and either:

1. An estimated continuing decline of at least 10% within 10 years or three generations, whichever is longer, (up to a maximum of 100 years in the future) OR

2. A continuing decline, observed, projected, or inferred, in numbers of mature individuals AND at least one of the following (a-b):

   a. Population structure in the form of one of the following:
      (i) no subpopulation estimated to contain more than 1000 mature individuals, OR
      (ii) all mature individuals are in one subpopulation.

   b. Extreme fluctuations in number of mature individuals.

D. Population is very small or restricted in the form of either of the following:

1. Population size estimated to number fewer than 1000 mature individuals.

2. Population with a very restricted area of occupancy (typically less than 20 km²) or number of locations (typically five or fewer) such that it is prone to the effects of human activities or stochastic events within a very short time period in an uncertain future, and is thus capable of becoming Critically Endangered or even Extinct in a very short time period.

E. Quantitative analysis showing the probability of extinction in the wild is at least 10% within 100 years.

Appendix B – BHPBIO Fauna Management Work Instruction

FAUNA MANAGEMENT

TABLE OF CONTENTS

AUTHORISATION

AUTHORISING OFFICER'S SIGNATURE ***Electronic Authorisation***
POSITION **AUTHORISED BY:** **MANAGER ENVIRONMENT AND SUSTAINABLE DEVELOPMENT**
AUTHOR(S)' NAME **MYCHELLE JOYCE**
POSITION/S Senior Environmental Advisor

AMENDMENTS

ISSUE	PAGE	DATE	DETAILS
1.0	All	19/03/07	Issued as new document

1.0 PURPOSE & SCOPE

To ensure that native fauna species are not adversely affected by construction, operations or decommissioning of work areas across BHPB Iron Ore sites.

This work instruction provides details on the safe handling and transportation of injured fauna and also deals with the capture and relocation of animals. A section on feral animal control is included. The document is not intended to describe monitoring programmes.
This document shall encompass Environmental Technicians in Newman & Port Hedland, or any other BHPB personnel or contractors engaged in undertaking fauna management.

2.0 REFERENCES

Legal, Standards & Other Requirements
Wildlife Conservation Act 1950
AS/NZS ISO14001:2004
BHP Billiton HSEC Management Standards

Related Documents
BHP Billiton Sustainable Development Policy
WIN-ENV-LAND NW-013 Snake Relocation
WIN-OPD-GEN-026 Procedure for the Rescue or Humane Dispatch of Fauna trapped in the Tailings Storage Facility
MAN-ENV-LAND NW-004 Fauna Management
MAN-ENV-FNA POP-001 Management of Feral Cats
WIN-IEN-LAND NW-001 Injured Cow Notification Procedure

ADP Specific
PP-09-099 Bulls

3.0 DEFINITIONS

Shall and should	the word “shall” is to be understood as mandatory and the word “should” as recommended but non-mandatory.
ADP	Asset Development Projects (construction)
Native Fauna	Animals that are native to Australia
Feral Animals	Foreign animals that are in Australia

4.0 ROLES AND RESPONSIBILITIES

All employees & contractors are responsible for the prevention of injury and harm to native fauna.

The Environmental section is responsible for supplying technical support to work groups who require it.

5.0 PROCEDURE

5.1 General Fauna Management Onsite

Minimal accidental or intentional impacts on native fauna shall be employed. This will include the prohibition of:

- Firearms on site (rail exempt);
- Off-road/ off-track use of vehicles;
- Pets on site (including taming of cats);
- Unnecessary disturbance of fauna habitat; and
- Fauna particularly native, being captured, fed, harmed or disturbed. If fauna relocation is required, the Environmental Representative shall be contacted.

In addition, the following management practices shall be employed during activities undertaken on any BHPBIO site:

- All bores will remain with locked caps in place, piping and conduit will be taped at ends- to prevent small creatures becoming trapped;
- Egress for fauna shall be made available by fixing rope, wire mesh or other materials in the corners of water storage facilities (e.g. turkeys nests), ensuring the egress materials are situated reaching the top of the water storage facility to the water surface at all times;
- Unless authorised, barbed wire is prohibited and will not be used in the work area, e.g. for fencing;
- All trenches, costeans, pits and bores shall be filled at the completion of use and ramped at the ends during works to ensure egress for fauna;
- In capturing animals, ensure that the appropriate PPE, including safety glasses and gloves, are worn (section 5.4 below).

5.2 Injured Native Fauna

For road kill advice see section 5.3 below.

Upon capturing an animal, or for assistance, the Environmental Representative must be immediately contacted, they will ask your name, location, type of fauna and injury sustained so appropriate capture equipment can be obtained.

Fauna shall be kept warm at all times once captured and will not be fed under any circumstances. A small dish of water may be placed with the animal.

All native fauna deaths shall be reported via an Event Notification. Feral animal sightings and deaths will be reported via Hazard Notification Form.

Birds

The size and type of bird being rescued can involve different tactics.

Small birds: Can be caught by hand (wearing gloves) or by placing a blanket over the animal before picking up. The bird can then be placed in a small box or cloth bag.

Large birds: When catching large birds, in particular raptors, the handler must wear long protective gloves. Cover with blankets being sure to secure the claws as they can pierce bone. Captured birds can be placed in a large box or plastic rubbish bin to be transported.

Reptiles

Snakes shall only be handled by persons that have completed a snake handling course and are recorded as a snake handler by the environmental section.

Small lizards: Can be caught by hand (wearing gloves) or by placing a blanket over the animal before picking up. They can then be placed in a cardboard box before relocating.

Large lizards: such as Bungarra's require a minimum of 3-4 people to safely capture the animal. First a lasso must be placed around the animals neck to secure the animal at a distance. Blankets should be placed over the animal and securing the tail is another method helpful in stopping the animal thrashing. While still holding the animal with the lasso and by the tail the animal can be placed in a cage for transporting.

5.3 Road Kills-Native Fauna

Road kills shall be removed at least 15m from the edge of the road and reported as an environmental event.

Kangaroos

- If an deceased kangaroo is found on the road, the animal shall be removed a minimum of 15m from the road edge to prevent predators becoming victims of on-coming traffic (e.g. Wedgetail eagles). Remove the animal with a shovel or similar.

- Injured kangaroos shall be humanely destroyed (e.g. though a blunt object like a tyre jack, or re-hitting the animal with the vehicle). Smaller Kangaroos that appear in reasonable condition (i.e. a broken leg) shall be covered and placed in the back of vehicles. Contact the nearest security gate or environmental officer for emergency contact numbers.
- Pouches must be checked live young. If present the joey should be taken out, wrapped in blanket (or similar) and the environmental coordinator contacted immediately.

Cattle

If a cow is hit by any form of mine vehicular traffic, the driver after coming to rest in a controlled manner and attending to any required medical aid, shall follow the process detailed below:

- The vehicle driver shall inspect the area of impact to locate the cow and assess the level of physical damage to the cow.

The following information shall be recorded:

- Approximate location of impact area;
- Cow ear tag colour and engraving (from a comfortable distance);
- Physical state of cow (i.e. Visible injury, unable to stand).

Immediately contact the Environmental Coordinator, or security if after hours. Refer to WIN-IEN-LAND NW-001 Injured Cow Notification Procedure for more detailed information and station contacts.

Procedure PP-09-099 Bulls, details information when working near and around cattle.

Cattle injuries or deaths are not reported as an environmental event.

5.4 Safety when Handling Fauna

A government permit is required to take and relocate any native animal. It is then essential that a Take 5 or JHA be completed before attempting to rescue or relocate any animal. The following are generic procedures that should be considered when assessing the task.

- Always do a Take 5 or JHA before attempting to rescue any animal;
- Ensure the appropriate PPE is worn during capture and handling, Gloves and Safety Glasses should be worn wherever there is a risk of injury;
- Ensure animals are kept securely contained during transport to prevent injury to themselves or others;

- Riggers gloves are to be worn when dealing with bats. Bats are not to be touched by hand;
- Wash hands thoroughly after any contact with animals.

5.5 Additional Information * Environment Office Use Only*

If the animal is a snake, follow the procedure detailed in WIN-ENV-LAND NW-013 (Snake Relocation). Should the call out be for any animal trapped in the Tailings Storage Facility (TFS) refer to WIN-OPD-GEN-026 Rescue or Humane Dispatch of Fauna Trapped in the Tailings Storage Facility. *Always contact the Emergency Services Department if safety is at risk or help is required.*

LOCATION	CARER	OPENING HOURS	CONTACT NUMBER 1	CONTACT NUMBER 2
Port Hedland	Vet	Business hrs & 24 hr Emergency	9172 1608	
Newman	Vet	Business hrs & 24 hr Emergency	9175 1309	
Pilbara	Pilbara wildlife Carers	Business hrs & reasonable after hrs	Kangaroos 0439984371 Birds* 0438924842 Reptiles 0418631656 Bats 0438924842	

Equipment Required / Location

Equipment	Location Newman	Location Port Hedland	Location ADP
Plastic rubbish bins	EW- seed storeroom	Environmental Shed	Wherever available - Speak to contractors
Large cages	EW- 2nd floor		
Small cages	EW- seed storeroom		
Lasso	EW- seed storeroom & ES		
Blankets	ES		
Rope	EW- seed storeroom, HSE9 & ES		
Harness	ES		
Recovery planks	Env. chemical shed	N/A	N/A

6.0 DOCUMENTATION

6.1 Records

- Native fauna deaths and injuries shall be recorded in the FPe database with all details pertaining to the event. These records will be kept for the life of operations.
- Records shall be maintained in accordance with the BHP Billiton Records Disposal Guidelines and Schedule.

6.2 Appendices

Nil

February 2009

RAIL OPERATIONS

CHICHESTER DEVIATION
WEED MANAGEMENT PLAN

Revision A

IRON ORE

bhpbilliton

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EXECUTIVE SUMMARY

BHP Billiton Iron Ore (BHPBIO) propose to increase the efficiency of transporting iron ore from operations in the Pilbara region to Port Hedland, through the construction of 23 km of dual track railway through the Chichester Ranges (known as the Chichester Deviation). The Chichester Deviation will diverge to the west of the existing Mainline between Shaw Siding and Cowra Siding (i.e. approximately between Ch 220 and Ch 237 on the Mainline).

Baseline flora surveys conducted within the project area identified six environmental weed species, most of which were observed within drainage lines and areas close to the existing Mainline. The spatial footprint of weeds is considered minimal, relative to the total project area.

Weeds can impact the ecology and biodiversity of natural systems by out-competing native species for habitat, nutrients and water. Once established, weeds can also alter the composition and structure of vegetation communities.

This Weed Management Plan (WMP) has been prepared to guide the prevention, control and monitoring of weeds during the construction and operational phases of the Chichester Deviation. General weed management measures to minimise the potential impacts of the Chichester Deviation Project are outlined in this WMP.

1 INTRODUCTION

1.1 BACKGROUND

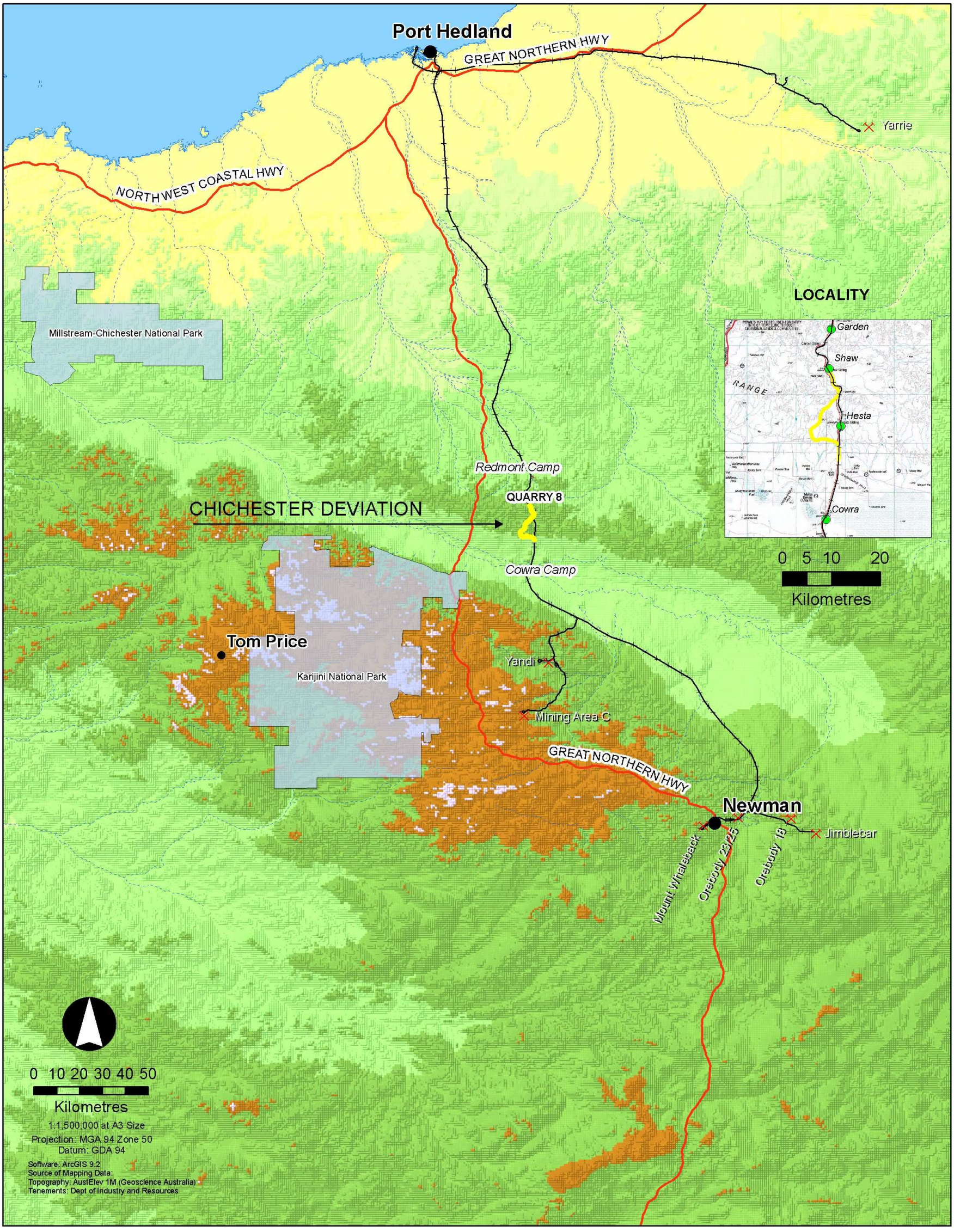
BHP Billiton Iron Ore (BHPBIO) propose to increase the efficiency of transporting iron ore from operations in the Pilbara region to Port Hedland, through the construction of 23 km of dual track railway through the Chichester Ranges (known as the Chichester Deviation), located approximately 230 km south of Port Hedland (Figure 1.1). The Chichester Deviation will diverge to the west of the existing Mainline between Shaw Siding and Cowra Siding (i.e. approximately between Ch 220 and Ch 237 on the Mainline).

The Chichester Deviation is located in an area of relatively undisturbed land. Results of baseline flora surveys indicate the spatial footprint of weeds is minimal, relative to the total project area. This Weed Management Plan (WMP) discusses the potential for the introduction and spread of weeds through construction and operational activities and the management controls to be implemented.

1.2 PURPOSE OF THIS PLAN

The purpose of this WMP is to assist BHPBIO and its contractors in the implementation of appropriate weed management measures, to prevent the introduction and spread of weed species during the construction and operation of the Chichester Deviation.

Figure 1.1 – Location Plan



1.3 RELEVANT LEGISLATION

The management measures contained within this WMP have been developed with reference to Commonwealth, State and Local government weed management strategies, policies and action plans, which are summarised below. The information presented herein is intended solely to provide a summary of the subject matter covered and is not intended as a complete summary of all environmental legislation which may be applicable to the Project.

National Weeds Strategy

The Commonwealth National Weeds Strategy: A Strategic Approach to Weed Problems of National Significance (the Strategy), which has been jointly prepared by the Agriculture and Resource Management Council of Australia and New Zealand (ARMCANZ), Australian and New Zealand Environment and Conservation Council (ANZECC) and Forestry Ministers (1997), describes broad strategies which aim to reduce the impact of weeds through nationally coordinated weed management programs. The Strategy focuses on weeds classified as being of 'National Significance' and defines the broad goals and objectives for managing these weeds at a National level. The Strategy encourages the development of complementary State, regional and local weed management plans.

Baseline flora surveys did not identify any weed species of 'National Significance' within the Project area. Ongoing monitoring and implementation of preventative management measures, as detailed in Section 5 of this WMP, will be conducted throughout the construction and operation phases of the Project to minimise the potential for introduction of weed species of 'National Significance' into the Project area.

Declared Weeds

The management of weeds in WA is primarily regulated through the provisions of the *Agriculture and Related Resources Protection Act 1976* (ARRP Act), which is administered by the Department of Agriculture. The ARRP Act lists gazetted 'Declared' weeds that require control in WA (DAF, 2008). The Declared Plant Control Handbook (6th Edition) was produced by the Department of Agriculture in 2002 and provides recommendations for the control of Declared weeds (Peirce & Pratt, 2002).

Baseline flora surveys did not identify any Declared weeds within the Chichester Deviation Project area. Ongoing monitoring and implementation of preventative management measures, as detailed in Section 5 of this WMP, will be conducted throughout the construction and operation phases of the Project to minimise the potential for introduction of Declare' weed species into the Project area.

Environmental Weeds

A second category of weeds (i.e. 'Environmental Weeds'), is used to describe introduced plants which establish themselves in natural ecosystems and proceed to modify natural processes, often causing adverse effect to the communities they invade (DEC, 1999). The Environmental Weed Strategy for Western Australia (DEC, 1999) details management priorities and general control measures and monitoring of environmental weeds.

Baseline flora surveys identified several environmental weed species within the Chichester Deviation Project area. Additional species, which have not been identified in the area to date, are considered to have the potential to occur. Sections 3.2 and 4.1 describe the management measures for the existing and potential weed species, respectively.

State Weed Plan

In 2001, the then WA Department of Agriculture (now known as the Department of Agriculture and Food) released a Weed Plan for Western Australia (Department of Agriculture, 2001) which is known as the State Weed Plan. The State Weed Plan is an overarching document which aims to achieve coordinated, collaborative and effective weed management throughout WA (Department of Agriculture, 2001). The State Weed Plan is to be supported by a work plan for implementation (the State Weed Action Plan, which is currently being drafted).

BHPBIO will continue to monitor the development of the State Weed Action Plan. Where appropriate, BHPBIO will review and revise weed management practices (including this WMP) to be consistent with the State Weed Action Plan.

1.4 RELATIONSHIP BETWEEN THIS PLAN AND OTHER MANAGEMENT PLANS

BHPBIO's Asset Development Projects construction Environmental Management Plan (EMP) will be adopted for the Chichester Deviation project (BHPBIO, 2008). The construction EMP provides an overall framework for environmental management for the Project. The construction EMP also contains specific measures regarding the management of weeds, which are included in this WMP.

1.5 POTENTIAL IMPACTS

Weeds can impact the ecology and biodiversity of natural systems by out-competing native species for habitat, nutrients and water. Once established, weeds can also alter the composition and structure of vegetation communities.

The construction of the proposed Chichester Deviation has the potential to spread existing weed infestations and to introduce weeds into previously weed-free areas. Weeds are commonly spread through:

- the transfer of seeds via tyres and tracks as a result of inadequate vehicle hygiene;
- use of non-designated tracks and roads; and
- uncontrolled personnel and vehicle access to site.

Once established, weed seeds can also be spread by feral and native animals.

1.6 EPA OBJECTIVES

The Environmental Protection Authority's (EPA) objective with regard to weed management is to maintain the abundance, species diversity, geographic distribution and productivity of vegetation communities through the avoidance or management of adverse impacts and improvement in knowledge.

1.7 KEY PERFORMANCE INDICATORS

The key performance indicators (KPIs) for this Weed Management Plan are:

- no new weed species introduced into the Project area as a result of construction or operational activities; and
- existing weed species are not spread outside of their current footprint.

1.8 ROLES AND RESPONSIBILITIES

As the proponent, BHPBIO is responsible for the implementation of the proposal and adherence to the commitments made within this management plan.

Table 1.1 identifies the responsibilities associated with the key management positions.

Table 1.1 – Roles and Responsibilities

Position	Responsibility
Project Manager (Construction Phase)	• Responsible for overall planning of the project to ensure construction is conducted in accordance with the WMP. • Responsible for compliance with statutory regulations.
Construction Manager (Construction Phase)	• Ensures that the work is continuing in accordance with the WMP. • Instructs subcontractors on control measures. • Directs site activities according to WMP. • Ensures all site personnel are aware of any changes to the WMP and any revised procedures. • Reports to the Site Environmental Officer or Project Manager of any breaches of the WMP. • Ensures that construction activities support achievement of the KPIs set by the WMP. • Ensures adequate training of all construction and field staff in the requirements of the WMP.
Operations Manager (Operational Phase)	• Ensures that site work is conducted in accordance with the WMP. • Instructs subcontractors on control measures. • Directs site activities according to WMP. • Ensures all site personnel are aware of any changes to the WMP and any revised procedures. • Reports to the Environmental Manager of any breaches of the WMP. • Ensures that operational activities support achievement of the KPIs set by the WMP. • Ensures adequate training of all operational field staff in the requirements of the WMP.
Environmental Manager (Construction Phase and Operational Phase)	• Ensures that the system for weed management is planned, documented, implemented and maintained in accordance with the WMP. • Monitors operations of the WMP and recommends any necessary changes to the Project Manager (Construction Phase) or Operations Manager (Operational Phase). • Provides advice, assistance and direction to the Project Manager (Construction Phase) or Operational Manager (Operational Phase) to ensure operations are conducted in accord with the WMP.
Site Environmental Officer (Construction Phase)	• Provides advice, assistance and direction to the Environmental Manager to ensure operations are conducted in accord with the WMP. • Monitors operations of the WMP and recommends any necessary changes to the Environmental Manager.

	• Keeps copies of monitoring results. • Ensures that weed hygiene and weed management measures are implemented • Oversees implementation of environmental controls, monitoring programs, inspections and audits. • Verifies that the requirements set in this WMP are adequate to the Project scope, should the project scope change. • Assists the construction manager in ensuring that the project team are trained in the requirements of the WMP • Completes compliance reporting requirements. • Prepares environmental monitoring reports. • Provides advice with respect to environmental issues where required.
Supervisors	• Implements management actions as directed by the Project Manager, Construction Manager or Site Environmental Officer. • Reports verbally to the Site Environmental Officer, Project Manager or Construction manager any breaches of the WMP. • Re-iterates the requirements of this WMP to workgroups through pre-starts and HSEC meetings.
All BHPBIO employees and contractors	• Comply with the requirements of this WMP. • Comply with legal requirements under the approvals documents and relevant Acts. • Exercise a Duty of Care to the environment. • Report all environmental incidents to an immediate supervisor or the Site Environmental Officer.

2 GENERAL WEED MANAGEMENT, HYGIENE AND MONITORING MEASURES

General weed management measures to minimise the potential impacts of the Chichester Deviation Project are presented in Table 2.1. They have been grouped under five categories (awareness measures, hygiene measures, monitoring measures, reporting measures and rehabilitation measures) and the project phase to which the measure is applicable is identified. There are four distinct Project phases: planning, construction, rehabilitation and operational and maintenance.

Table 2.1 – General Weed Management Measures

Management Measure	Project Phase	Responsible Person
Awareness		
Baseline flora reports will be assessed to determine the location of existing weed infestations within the Project area.	Planning	Site Environmental Officer
Areas of known weed infestation will be shown as 'Weed Risk' areas on construction plans and marked on the ground (using signs or other clearly recognisable measures) through the PEAHR (Project Environmental Aboriginal Heritage Review) process in order to minimise the potential for spreading weeds.	Planning	Site Environmental Officer
Employees will be advised in the project induction that personnel and equipment are not to enter a designated weed risk area, unless specifically directed by a project supervisor	Construction	Construction Manager
The induction programme will be used to promote awareness of weed management measures that are to be used within the Project area. An example 'Enviro Alert' fact sheet for Ruby Dock is provided in Appendix B.	Construction / Operation	Construction Manager/ Operations Manager
Specific training in weed identification and management measures will be provided to relevant BHPBIO personnel and contractors.	Construction / Operations	Construction Manager/ Operations Manager
Review annually the classification status of weed species (i.e. Declared, Environmental or other), development of State and Commonwealth weed management strategies and action plans, developments in weed control methods by keeping abreast of relevant literature (see references in Section 7) and consultation with the Department of Environment and Conservation and the Department of Agriculture.	Construction / Operations	Site Environmental Officer/ Environmental Manager
Hygiene		
Mobile machinery and equipment will be inspected, cleaned and certified prior to being brought into the Chichester Deviation Project area, being moved from a 'Weed Risk' area to another part of the site, or being removed from the Project area. Details of inspections and cleaning will be documented via a Vehicle/Equipment Weed Hygiene Certificate (Appendix A), to be signed off by the Site Environmental Officer or approved delegate.	Construction / Operation	Construction Manager/ Operations Manager
All inspections and cleaning of mobile machinery and equipment will be conducted in accordance with procedures specified by the BHPBIO Environmental Officer (or nominated delegate).	Construction / Operation	Construction Manager/ Operations Manager
Vegetation and topsoil stripped from 'Weed Risk' areas will be stockpiled separately, and the stockpiles marked and recorded on relevant databases and plans by the BHPBIO Environmental Officer (or nominated delegate).	Construction	Construction Manager
Topsoil stockpiles from 'Weed Risk' areas shall be bunded to minimise release of run-off water to the environment.	Construction	Construction Manager

Management Measure	Project Phase	Responsible Person
Ruby Dock has been identified at Quarry 8, from which ballast is likely to be sourced for the Project. Ballast will be certified weed free prior to transport to the Chichester Deviation project area.	Construction	Site Environmental Officer
Imported fill material shall be assessed for the presence of weeds prior to being brought on site, and treated if necessary. The Site Environmental Officer will determine whether treatment is necessary based on the baseline weed mapping to be undertaken.	Construction	Construction Manager
Monitoring		
Conduct baseline weed mapping prior to commencement of construction to identify existing weed populations, determine appropriate management actions and update this WMP as required.	Planning	Site Environmental Officer
Undertake, supervise and/or guide all weed eradication programmes to be conducted in a manner that minimises impacts on native species.	Construction / Operations	Site Environmental Officer / Environmental Manager
Conduct annual inspections of the Chichester Deviation Project area, including borrow pits, in order to monitor for the presence of weeds. Where possible, the inspections will be conducted in the weeks following rainfall events in order to maximise the potential for weed species being observed.	Construction / Operations	Site Environmental Officer / Environmental Manager
Conduct annual audits to ensure implementation of management controls stipulated in this WMP.	Construction / Operations	Site Environmental Officer / Environmental Manager
Document weed records, locations, and 'Weed Risk' areas in BHPBIO's environmental management database.	Construction / Operations	Site Environmental Officer / Environmental Manager
Provide details (and samples where possible) of new weeds or any weeds found outside their (current) known range to the WA Herbarium.	Construction / Operation	Site Environmental Officer / Environmental Manager
Reporting		
In the event that any new weed species are identified, adjustment to the level of management can be applied as necessary, including documentation of the species name, population, location (on relevant construction plans) and control method to be used in the BHPBIO's environmental management database.	Construction / Operation	Site Environmental Officer / Environmental Manager
Report the discovery of any weeds suspected to be new to the Pilbara to the Department of Agriculture.	Construction / Operation	Site Environmental Officer / Environmental Manager
Rehabilitation		
Topsoil stripped from 'Weed Risk' areas will be used to rehabilitate the area it was collected from. Soils from 'Weed Risk' areas that are used in the rehabilitation programme will be closely monitored after rehabilitation, and any weeds that germinate will be treated as appropriate.	Rehabilitation	Construction Manager

Management Measure	Project Phase	Responsible Person
The presence of weeds following the rehabilitation phase will be assessed (via a weed mapping event) as part of the site demobilisation process. Should this inspection indicate that the KPIs under this WMP have not been met, BHPBIO will undertake further weed management measures.	Rehabilitation	Site Environmental Officer

3 RECORDED WEED SPECIES

3.1 BASELINE VEGETATION SURVEYS IN THE PROJECT AREA

Baseline biological and flora surveys and assessments were conducted within the Chichester Deviation Project area by *ecologia* Environmental Consultants in 2008 (*ecologia* Environment, 2008). These surveys and assessments identified the following introduced flora within the Project area:

- Kapok Bush (*Aerva javanica*);
- Bipinnate Beggartick (*Bidens bipinnata);*
- Ulcardo Melon (*Cucumis melo subsp. agrestis*);
- Spiked Malvastrum (*Malvastrum americanum)*; and
- Mimosa Bush (*Vachellia farnesiana).*

Buffel-Grass (*Cenchrus ciliaris*) was also identified within the Chichester Deviation Project area during baseline biological surveys. Buffel-Grass has historically been planted in pastoral regions as a pasture grass and has since become widespread throughout the Pilbara. This species is favoured by pastoralists due to its drought tolerance. No specific control or eradication programs will be implemented for Buffel-Grass.

Figure 2.1 shows the locations where there species were identified during baseline flora surveys of the Project area.

3.2 SPECIFIC WEED MANAGEMENT, HYGIENE AND MONITORING MEASURES

Species-specific weed management measures for the six weed species identified within the Chichester Deviation Project area are provided in the following sub-sections.

Figure 2.1 – Baseline Weed Records

(Sheet 1 of 2)

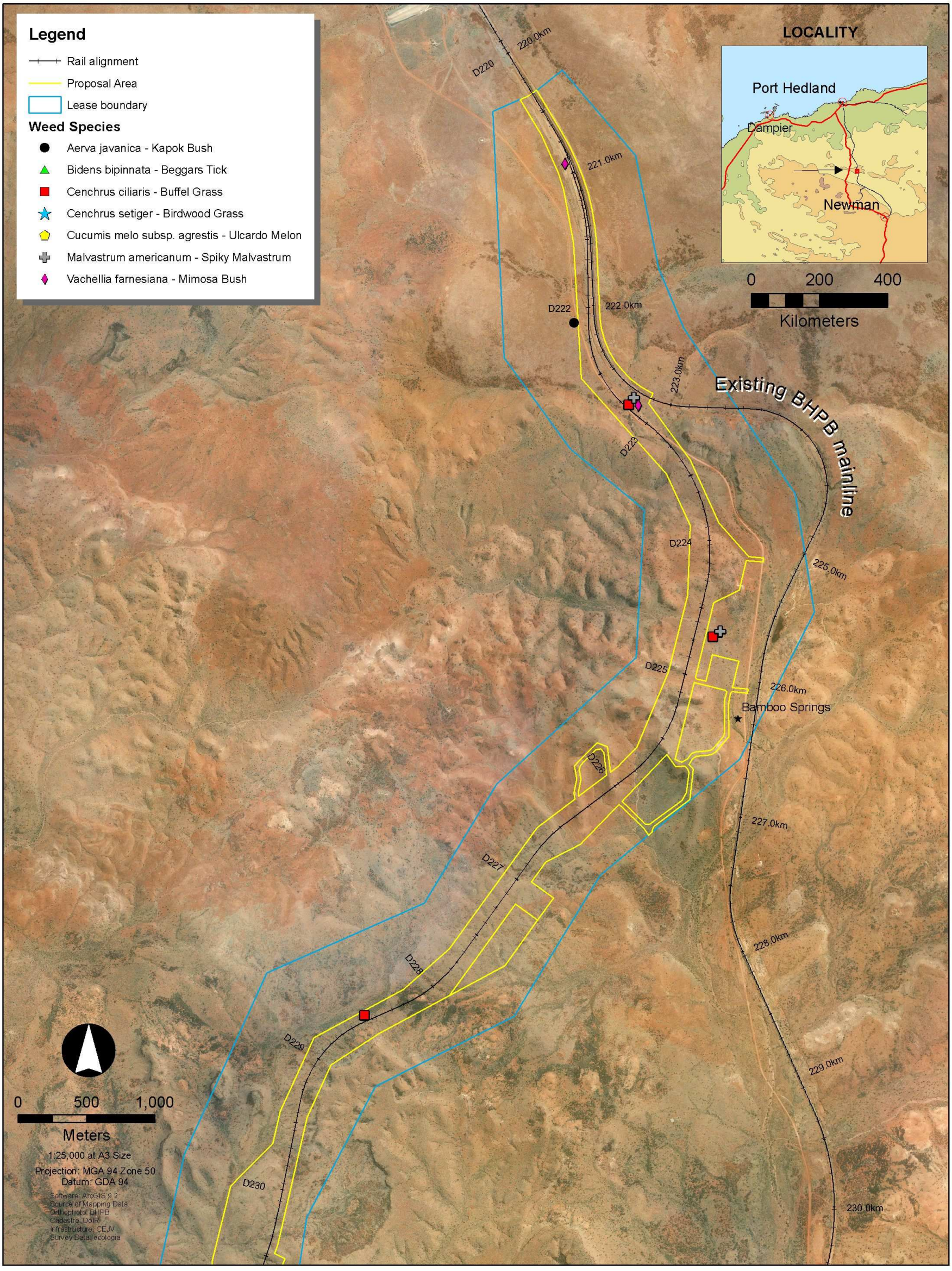
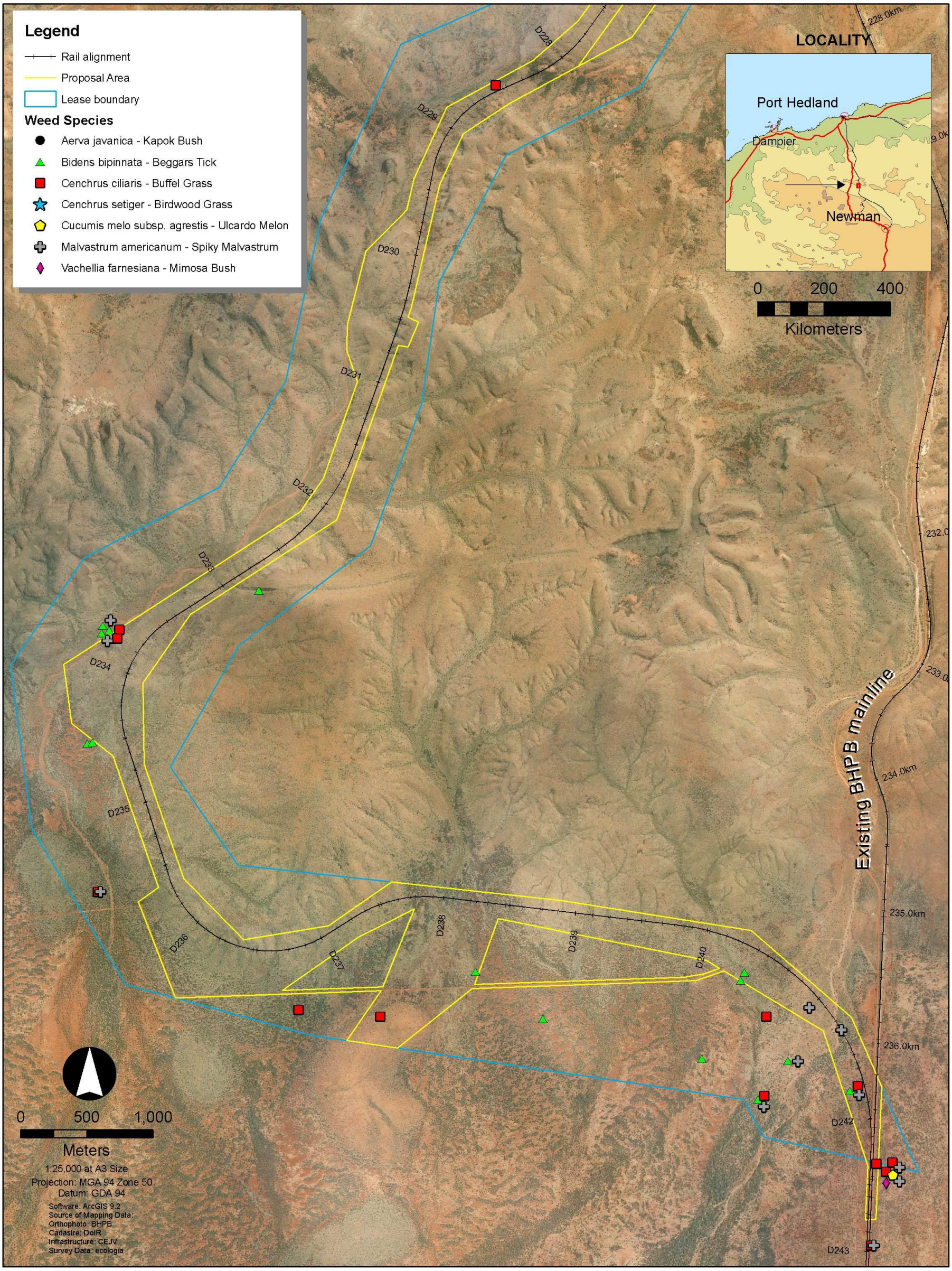


Figure 2.1– Baseline Weed Records

(Sheet 2 of 2)



3.2.1 Kapok Bush

Kapok Bush

Aerva javanica

Description: Erect, multi-branched perennial shrub reaching 0.4 – 1.4 m in height. Leaves are 2 - 7cm long and alternate along the stems (e*cologia* Environment, 2001)

Flowers: White flowers between January – October and resemble 'woolly' clusters at the tops of stems which contain thousands of seeds (*ecologia* Environment, 2001).

Habitat: Sandy soils

Status: Environmental Weed (DEC, 1999).

(Image source: WA Herbarium, 2008)

Recorded Locations within the Project area:

- Refer to Figure 2.1

General Control Measures:

- Implement management measures described in Section 2 of this WMP.

Specific Management Measures:

- The Site Environmental Officer (or nominated delegate) will co-ordinate and manage Kapok Bush eradication programmes if required based on inspections and/or identification of new outbreaks.
- The Site Environmental Officer will undertake or co-ordinate follow-up inspections (and respraying if necessary) of treated areas within 8 weeks of the initial eradication programme.
- Details of all eradication programs and follow-up inspections/programmes will be recorded and will include, but not necessarily be limited to, the following: location and approximate numbers of plants in each of the areas treated, method used and timing.

Further Information: BHPBIO Site Environmental Officer

Further Reading: WA Herbarium (2008) *Florabase* - http://florabase.calm.wa.gov.au/

3.2.2 Beggars Tick

Beggars Tick

Bidens bipinnata

Description: Erect annual herb reaching from 0.1 to 0.9 m in height.

Flowers: Yellow flowers are produced between March – September.

Habitat: Commonly found in alluvium, clay, loam over sandstone, limestone and along rivers, creeks, coastal areas and rocky hillsides

Status: Environmental Weed (DEC, 1999).

(Image source: *ecologia* Environment, 2008)

Recorded Locations within the Project area:

- Refer to Figure 2.1

General Control Measures:

- Implement management measures described in Section 2 of this WMP.

Specific Management Measures:

- The Site Environmental Officer (or nominated delegate) will co-ordinate and manage Beggars Tick eradication programmes if required based on inspections and/or identification of new outbreaks.
- The Site Environmental Officer will undertake or co-ordinate follow-up inspections (and respraying if necessary) of treated areas within 8 weeks of the initial eradication programme.
- Details of all eradication programs and follow-up inspections/programmes will be recorded and will include, but not necessarily be limited to, the following: location and approximate numbers of plants in each of the areas treated, method used and timing.

Further Information: BHPBIO Site Environmental Officer

Further Reading: WA Herbarium (2008) *Florabase* - http://florabase.calm.wa.gov.au/

3.2.3 Ulcardo Melon

Ulcardo Melon

Cucumis melo subsp. agrestis

Description: A trailing annual herb or climber.

Flowers: Yellow flowers between February – June and September – October.

Fruit: Produces fleshy fruit.

Habitat: Woodland or grassland on clay soils (Royal Botanic Gardens & Domain Trust, 2007).

Status: Environmental Weed (DEC, 1999).

(Image source: Australian National Botanic Gardens, 2008)

Recorded Locations within the Project area:

- Refer to Figure 2.1

General Control Measures:

- Implement management measures described in Section 2 of this WMP.

Specific Management Measures:

- The Site Environmental Officer (or nominated delegate) will co-ordinate and manage Ulcardo Melon eradication programmes if required based on inspections and/or identification of new outbreaks.
- The Site Environmental Officer will undertake or co-ordinate follow-up inspections (and respraying if necessary) of treated areas within 8 weeks of the initial eradication programme.
- Details of all eradication programs and follow-up inspections/programmes will be recorded and will include, but not necessarily be limited to, the following: location and approximate numbers of plants in each of the areas treated, method used and timing.

Further Information: BHPBIO Site Environmental Officer

Further Reading: WA Herbarium (2008) *Florabase* - http://florabase.calm.wa.gov.au/

3.2.4 Spiked Malvastrum

Spiked Malvastrum

Malvastrum americanum

Description: Erect, hairy, perennial herb or shrub growing to between 0.5 and 1.3 m in height.

Flowers: Yellow/orange flowers are produced between April – July.

Habitat: River and creek margins, wastelands, and many arid zone habitats from the Nullarbor to the Pilbara and Kimberley Regions of Western Australia.

Status: Environmental Weed (DEC, 1999).

(Image source: *ecologia* Environment, 2008)

Recorded Locations within the Project area:

- Refer to Figure 2.1

General Control Measures:

- Implement management measures described in Section 2 of this WMP.

Specific Management Measures:

- The Site Environmental Officer (or nominated delegate) will co-ordinate and manage Spike Malvastrum eradication programmes if required based on inspections and/or identification of new outbreaks. Eradication will be undertaken preferably after rainfall events and prior to seed set.
- The Site Environmental Officer will undertake or co-ordinate follow-up inspections (and respraying if necessary) of treated areas within 8 weeks of the initial eradication programme.
- Details of all eradication programs and follow-up inspections/programmes will be recorded and will include, but not necessarily be limited to, the following: location and approximate numbers of plants in each of the areas treated, method used and timing.

Further Information: BHPBIO Site Environmental Officer

Further Reading: WA Herbarium (2008) *Florabase* - http://florabase.calm.wa.gov.au/

3.2.5 Mimosa Bush

Mimosa Bush

Vachellia farnesiana

Description: Erect, spreading, thicket-forming, thorny tree or shrub growing to 4 m in height. Its bark is dark grey and rough.

Flowers: Produces yellow flowers between June -August.

Habitat: Low-lying areas, river and creek banks and disturbed sites.

Status: Environmental Weed (DEC, 1999).

(Image source: *ecologia* Environment, 2008)

Recorded Locations within the Project area:

- Refer to Figure 2.1

General Control Measures:

- Implement management measures described in Section 2 of this WMP.

Specific Management Measures:

- The Site Environmental Officer (or nominated delegate) will co-ordinate and manage Mimosa Bush eradication programmes if required based on inspections and/or identification of new outbreaks.
- The Site Environmental Officer will undertake or co-ordinate follow-up inspections (and respraying if necessary) of treated areas within 8 weeks of the initial eradication programme.
- Details of all eradication programs and follow-up inspections/programmes will be recorded and will include, but not necessarily be limited to, the following: location and approximate numbers of trees in each of the areas treated, method used and timing.

Further Information: BHPBIO Site Environmental Officer

Further Reading: WA Herbarium (2008) *Florabase* - http://florabase.calm.wa.gov.au/

4 WEED SPECIES WITH THE POTENTIAL TO OCCUR IN THE PROJECT AREA

Based on results of other vegetation and flora surveys conducted along sections of the Mainline (outside of the Project area), 13 additional weed species are considered to have the potential to occur within the Chichester Deviation Project area (*ecologia* Environment, 2008). These species include:

- *Acetosa vesicaria* (Ruby Dock);
- *Argemone ochroleuca* (Mexican Poppy);
- *Citrullus colocynthis* (Colocynth);
- *Cynodon dactylon* (Couch);
- *Digitaria ciliaris* (Summer Grass);
- *Echinochloa colona* (Awnless Barnyard Grass);
- *Passiflora foetida* (Stinking Passion Flower);
- *Portulaca oleracea* (Purslane);
- *Setaria verticillata* (Whorled Pigeon Grass);
- *Sonchus oleraceus* (Common Sowthistle);
- *Tamarix aphylla* (Athel Pine); and
- *Tribulus terrestris* (Caltrop).

In the event that one or more of these species is identified within the Chichester Deviation Project area, the WMP will be updated and revised as appropriate to manage the species. A complete list of weed species found in the Pilbara region is included in Appendix C (WA Herbarium, 2008).

The general weed management controls listed in Table 2.1 also apply to any of the potential weed species listed above.

4.1 SPECIFIC WEED MANAGEMENT, HYGIENE AND MONITORING MEASURES

Species-specific weed management measures are provided in the following sub-sections for the thirteen weed species that have been previously identified along the existing Newman to Port Hedland Mainline.

4.1.1 Ruby Dock

Ruby Dock

Acetosa vesicaria

Description: Succulent, multi-stemmed annual herb which reproduces vegetatively or via seed production. Grow to 0.2 – 1m in height.

Flowers: Red/pink flowers are clustered at the ends of stems between May and June.

Fruit: Bright red/pink fruit.

Habitat: Sandy alluvial or gravely ironstone soils on roadsides or in disturbed areas.

Status: Environmental Weed (DEC, 1999).

(Image source: WA Herbarium, 2008)

Recorded Locations within the Project area:

- Not recorded in Project area.

General Control Measures:

- Implement management measures described in Section 2 of this WMP.

Specific Management Measures:

- The Site Environmental Officer (or nominated delegate) will co-ordinate and manage Ruby Dock eradication programmes if required based on inspections and/or identification of new outbreaks. Eradication will be undertaken preferably after rainfall events and prior to seed set.
- The personnel or contractor commissioned to undertake the Ruby Dock herbicide spraying programmes will use the following methodology (unless otherwise specified by the Site Environmental Officer):
    - Roundup (10mL per 1 L of water) or similar glyphosate product will be used when the plant is actively growing and in accordance with the manufacturers specifications (BHPBIO 2006).
    - PPE and site safety measures will be followed in accordance with the herbicide manufacturer's specifications and Project requirements.
    - Spraying will be undertaken using vehicle mounted units where plants are easily accessible and back pack spray units where infestations are less accessible.
- The Site Environmental Officer will undertake or co-ordinate follow-up inspections (and respraying if necessary) of treated areas within 8 weeks of the initial eradication programme.
- Details of all eradication programs and follow-up inspections/programmes will be recorded and will include, but not necessarily be limited to, the following: location and approximate numbers of plants in each of the areas treated, method used and timing.

Further Information: BHPBIO Site Environmental Officer

Further Reading: WA Herbarium (2008) *Florabase* - http://florabase.calm.wa.gov.au/

4.1.2 Mexican Poppy

Mexican Poppy

Argemone ochroleuca

Description: Erect herbaceous annual, which reaches 0.2 – 1m in height.

Flowers: Solitary white-yellow flowers with dark red stigma between February/ March – July/November (*ecologia* Environment 2001).

Habitat: Sandy soils and red/brown clay loam on moist flats or open, cobble creekbeds where there is no native competition (WA Herbarium 2008; ecologia Environment 2001).

Status: P1 "Declared" Plant under *Agriculture and Related Resources Act 1976*, but not for the Pilbara region. Environmental weed (WAPC, 2003).

(Image source: WA Herbarium, 2008)

Recorded Locations within the Project area:

- Not recorded in Project area.

General Control Measures:

- Implement management measures described in Section 2 of this WMP.

Specific Management Measures:

- The Site Environmental Officer (or nominated delegate) will co-ordinate and manage Mexican Poppy eradication programmes if required based on inspections and/or identification of new outbreaks.
- The Site Environmental Officer will undertake or co-ordinate follow-up inspections (and respraying if necessary) of treated areas within 8 weeks of the initial eradication programme.
- Details of all eradication programs and follow-up inspections/programmes will be recorded and will include, but not necessarily be limited to, the following: location and approximately numbers of plants in each of the areas treated, method used and timing.

Further Information: BHPBIO Site Environmental Officer

Further Reading: WA Herbarium (2008) *Florabase* - http://florabase.calm.wa.gov.au/

4.1.3 Colocynth

Colocynth

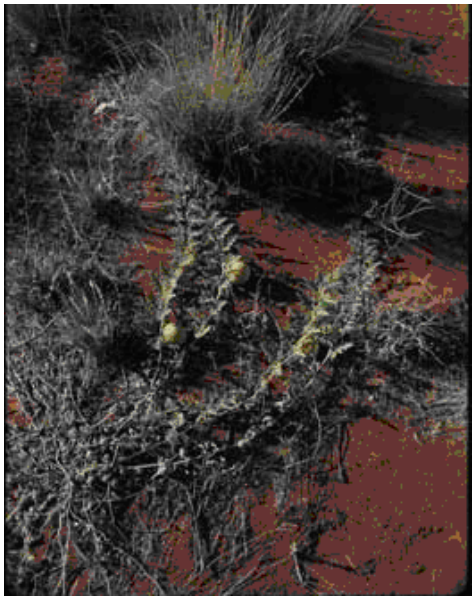
Citrullus colocynthis

Description: Trailing perennial, herb or climber.

Flowers: Yellow flowers between January – October.

Habitat: Sandy, rocky, stony loam, clay or wet soils in disturbed areas and floodplains.

Status: Environmental Weed (DEC, 1999).



(Image source: Australian National Botanic Gardens, 2008)

Recorded Locations within the Project area:

- Not recorded in Project area.

General Control Measures:

- Implement management measures described in Section 2 of this WMP.

Specific Management Measures:

- The Site Environmental Officer (or nominated delegate) will co-ordinate and manage Colocynth eradication programmes if required based on inspections and/or identification of new outbreaks.
- The Site Environmental Officer will undertake or co-ordinate follow-up inspections (and respraying if necessary) of treated areas within 8 weeks of the initial eradication programme.
- Details of all eradication programs and follow-up inspections/programmes will be recorded and will include, but not necessarily be limited to, the following: location and approximate numbers of plants in each of the areas treated, method used and timing.

Further Information: BHPBIO Site Environmental Officer

Further Reading: WA Herbarium (2008) *Florabase* - http://florabase.calm.wa.gov.au/

4.1.4 Couch

Couch

Cynodon dactylon

Description: Grass-like or herb, from 0.05 – 0.3 m in height.

Flowers: Green/purple flowers between June – November/February.

Habitat: Sand, loam, clay soils.

Status: Environmental Weed (DEC, 1999).

(Image source: WA Herbarium, 2008)

Recorded Locations within the Project area:

- Not recorded in Project area.

General Control Measures:

- Implement management measures described in Section 2 of this WMP.

Specific Management Measures:

- The Site Environmental Officer (or nominated delegate) will co-ordinate and manage Couch eradication programmes if required based on inspections and/or identification of new outbreaks.
- The Site Environmental Officer will undertake or co-ordinate follow-up inspections (and respraying if necessary) of treated areas within 8 weeks of the initial eradication programme.
- Details of all eradication programs and follow-up inspections/programmes will be recorded and will include, but not necessarily be limited to, the following: location and approximate numbers of plants in each of the areas treated, method used and timing.

Further Information: BHPBIO Site Environmental Officer

Further Reading: WA Herbarium (2008) *Florabase* - http://florabase.calm.wa.gov.au/

4.1.5 Summer Grass

Summer Grass

Digitaria ciliaris

Description: Tufted annual, grass-like or herb, from 0.02 – 1m in height.

Flowers: Green flowers between November – June.

Habitat: Sand, clay, alluvium and sandstone.

Status: Environmental Weed (DEC, 1999).

(Image source: WA Herbarium, 2008)

Recorded Locations within the Project area:

- Not recorded in Project area.

General Control Measures:

- Implement management measures described in Section 2 of this WMP.

Specific Management Measures:

- The Site Environmental Officer (or nominated delegate) will co-ordinate and manage Summer Grass eradication programmes if required based on inspections and/or identification of new outbreaks.
- The Site Environmental Officer will undertake or co-ordinate follow-up inspections (and respraying if necessary) of treated areas within 8 weeks of the initial eradication programme.
- Details of all eradication programs and follow-up inspections/programmes will be recorded and will include, but not necessarily be limited to, the following: location and approximately numbers of plants in each of the areas treated, method used and timing.

Further Information: BHPBIO Site Environmental Officer

Further Reading: WA Herbarium (2008) *Florabase* - http://florabase.calm.wa.gov.au/

4.1.6 Awnless Barnyard Grass

Awnless Barnyard Grass

Echinochloa colona

Description: Tufted annual, grass-like or herb, growing from 0.2 – 0.6 m in height.

Flowers: Green, purple flowers between February – July.

Habitat: Black sand or black clay near watercourses and swamps.

Status: Environmental Weed (DEC, 1999).

(Image source: WA Herbarium, 2008)

Recorded Locations within the Project area:

- Not recorded in Project area.

General Control Measures:

- Implement management measures described in Section 2 of this WMP.

Specific Management Measures:

- The Site Environmental Officer (or nominated delegate) will co-ordinate and manage Awnless Barnyard Grass eradication programmes if required based on inspections and/or identification of new outbreaks.
- The Site Environmental Officer will undertake or co-ordinate follow-up inspections (and respraying if necessary) of treated areas within 8 weeks of the initial eradication programme.
- Details of all eradication programs and follow-up inspections/programmes will be recorded and will include, but not necessarily be limited to, the following: location and approximate numbers of plants in each of the areas treated, method used and timing.

Further Information: BHPBIO Site Environmental Officer

Further Reading: WA Herbarium (2008) *Florabase* - http://florabase.calm.wa.gov.au/

4.1.7 Stinking Passion Flower

Stinking Passion Flower

Passiflora foetida

Description: Woody climber with an unpleasant smell, which grows to 9m in height.

Flowers: Cream, white and blue flowers between February – November.

Habitat: Coastal areas, rivers and creek banks.

Status: Environmental Weed (DEC, 1999)

(Image source: WA Herbarium, 2008)

Recorded Locations within the Project area:

- Not recorded in Project area.

General Control Measures:

- Implement management measures described in Section 2 of this WMP.

Specific Management Measures:

- The Site Environmental Officer (or nominated delegate) will co-ordinate and manage Stinking Passion Flower eradication programmes if required based on inspections and/or identification of new outbreaks.
- The Site Environmental Officer will undertake or co-ordinate follow-up inspections (and respraying if necessary) of treated areas within 8 weeks of the initial eradication programme.
- Details of all eradication programs and follow-up inspections/programmes will be recorded and will include, but not necessarily be limited to, the following: location and approximately numbers of plants in each of the areas treated, method used and timing.

Further Information: BHPBIO Site Environmental Officer

Further Reading: WA Herbarium (2008) *Florabase* - http://florabase.calm.wa.gov.au/

4.1.8 Purslane

Purslane

Portulaca oleracea

Description: Succulent prostrate to decumbent annual herb, growing to 0.2 m high.

Flowers: Yellow flowers between April – May.

Habitat: Clay loam and sandy soils.

Status: Alien (WA Herbarium, 2008)

(Image source: WA Herbarium, 2008)

Recorded Locations within the Project area:

- Not recorded in Project area.

General Control Measures:

- Implement management measures described in Section 2 of this WMP.

Specific Management Measures:

- The Site Environmental Officer (or nominated delegate) will co-ordinate and manage Purslane eradication programmes if required based on inspections and/or identification of new outbreaks.
- The Site Environmental Officer will undertake or co-ordinate follow-up inspections (and respraying if necessary) of treated areas within 8 weeks of the initial eradication programme.
- Details of all eradication programs and follow-up inspections/programmes will be recorded and will include, but not necessarily be limited to, the following: location and approximate numbers of plants in each of the areas treated, method used and timing.

Further Information: BHPBIO Site Environmental Officer

Further Reading: WA Herbarium (2008) *Florabase* - http://florabase.calm.wa.gov.au/

4.1.9 Whorled Pigeon Grass

Whorled Pigeon Grass

Setaria verticillata

Description: Loosely tufted annual, grass-like or herb, growing to 0.1 – 1.3 m in height.

Flowers: Flowers December – June.

Photo not available.

Habitat: Sand, clay or loam.

Status: Environmental Weed (DEC, 1999).

Recorded Locations within the Project area:

- Not recorded in Project area.

General Control Measures:

- Implement management measures described in Section 2 of this WMP.

Specific Management Measures:

- The Site Environmental Officer (or nominated delegate) will co-ordinate and manage Whorled Pigeon Grass eradication programmes if required based on inspections and/or identification of new outbreaks.
- The Site Environmental Officer will undertake or co-ordinate follow-up inspections (and respraying if necessary) of treated areas within 8 weeks of the initial eradication programme.
- Details of all eradication programs and follow-up inspections/programmes will be recorded and will include, but not necessarily be limited to, the following: location and approximately numbers of plants in each of the areas treated, method used and timing.

Further Information: BHPBIO Site Environmental Officer

Further Reading: WA Herbarium (2008) *Florabase* - http://florabase.calm.wa.gov.au/

4.1.10 Common Sowthistle

Common Sowthistle

Sonchus oleraceus

Description: Erect annual herb ranging from 0.1 – 1.5m in height.

Flowers: Yellow flowers between January – December.

Habitat: Grows in a range of soil types in disturbed areas.

Status: Environmental Weed (DEC, 1999).

(Image source: WA Herbarium, 2008)

Recorded Locations within the Project area:

- Not recorded in Project area.

General Control Measures:

- Implement management measures described in Section 2 of this WMP.

Specific Management Measures:

- The Site Environmental Officer (or nominated delegate) will co-ordinate and manage Common Sowthistle eradication programmes if required based on inspections and/or identification of new outbreaks. Eradication will be undertaken preferably after rainfall events and prior to seed set.
- The Site Environmental Officer will undertake or co-ordinate follow-up inspections (and respraying if necessary) of treated areas within 8 weeks of the initial eradication programme.
- Details of all eradication programs and follow-up inspections/programmes will be recorded and will include, but not necessarily be limited to, the following: location and approximate numbers of plants in each of the areas treated, method used and timing.

Further Information: BHPBIO Site Environmental Officer

Further Reading: WA Herbarium (2008) *Florabase* - http://florabase.calm.wa.gov.au/

4.1.11 Athel Pine

Athel Pine

Tamarix aphylla

Description: Tree to 12 m high.

Flowers: White or pink flowers between February – May.

Habitat: Among medium trees, along river banks and in disturbed native vegetation.

Status: P1 Declared Plant under the *Agriculture and Related Resource Act* 1976. Environmental Weed (DEC, 1999).

(Image source: WA Herbarium, 2008)

Recorded Locations within the Project area:

- Not recorded in Project area.

General Control Measures:

- Implement management measures described in Section 2 of this WMP.

Specific Management Measures:

- The Site Environmental Officer (or nominated delegate) will co-ordinate and manage Athel Pine eradication programmes if required based on inspections and/or identification of new outbreaks.
- The Site Environmental Officer will undertake or co-ordinate follow-up inspections (and respraying if necessary) of treated areas within 8 weeks of the initial eradication programme.
- Details of all eradication programs and follow-up inspections/programmes will be recorded and will include, but not necessarily be limited to, the following: location and approximate numbers of plants in each of the areas treated, method used and timing.

Further Information: BHPBIO Site Environmental Officer

Further Reading: WA Herbarium (2008) *Florabase* - http://florabase.calm.wa.gov.au/

4.1.12 Caltrop

Caltrop

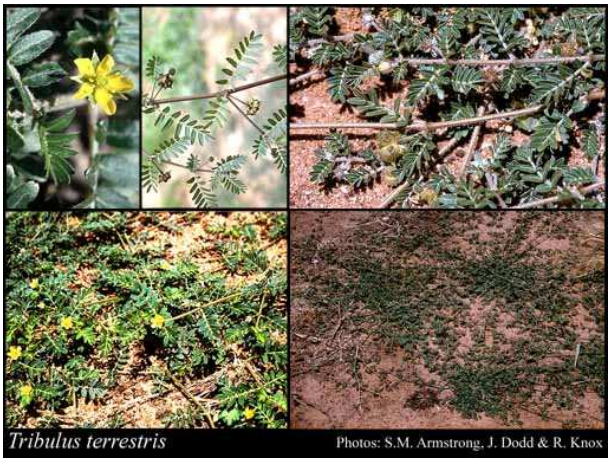
Tribulus terrestris

Description: Prostrate annual herb

Flowers: Yellow flowers between January – December.

Habitat: Often on sandy soils and waste places.

Status: Alien (WA Herbarium, 2008)



(Image source: WA Herbarium 2008)

Recorded Locations within the Project area:

- Not recorded in Project area.

General Control Measures:

- Implement management measures described in Section 2 of this WMP.

Specific Management Measures:

- The Site Environmental Officer (or nominated delegate) will co-ordinate and manage Caltrop eradication programmes if required, based on inspections and/or identification of new outbreaks.
- The Site Environmental Officer will undertake or co-ordinate follow-up inspections (and respraying if necessary) of treated areas within 8 weeks of the initial eradication programme.
- Details of all eradication programs and follow-up inspections/programmes will be recorded and will include, but not necessarily be limited to, the following: location and approximate numbers of plants in each of the areas treated, method used and timing.

Further Information: BHPBIO Site Environmental Officer

Further Reading: WA Herbarium (2008) *Florabase* - http://florabase.calm.wa.gov.au/

5 MONITORING AND PERFORMANCE INDICATORS

5.1 OVERVIEW

Monitoring will consist of two components:

- monitoring and audit of management controls; and
- monitoring of weed infestations during construction and operational activities.

5.2 MONITORING OF MANAGEMENT CONTROLS

The implementation of general weed management and hygiene controls (Section 2) and species-specific management controls (Sections 3.2 and 4.1) will be monitored on a quarterly basis during construction and annually during operational phases of the project. Non-conformances identified during inspections will be documented, addressed with appropriate corrective and preventive actions, and rectified within an agreed time frame.

5.3 WEED MONITORING AND INSPECTION

The success of the general weed management, hygiene and monitoring measures described in this WMP (Sections 2) will be evaluated through routine inspections of disturbance areas (including borrow pits) and weed risk areas by the Site Environmental Officer. These inspections will be conducted on a quarterly basis (minimum) during construction and annually once operational. Records of inspections will be kept by the Site Environmental Officer.

The success of the species-specific weed control measures described in this WMP (Sections 3.2 and 4.1) will be assessed via follow-up inspections. These inspections will be conducted within eight weeks of the initial control programme (preferably after a rainfall event and subsequent inspections) and will include an evaluation of the success of the control measures that were used. Details of all weed management and eradication programmes and follow-up inspections or programs conducted will be recorded in BHPBIO's environmental management database and will include qualitative observations and quantitative measurements where relevant. These observations and measurements may include, but are not necessarily limited to, the following:

- the location timing, and approximate number of individual plants in each of the areas treated;
- the treatment methods used;
- the effectiveness of control measures;
- schedule of further treatments; and
- other observations of relevance to the control of the weed species.

In the event that a weed control measure for a particular species appears not to be effective, control measures will be adjusted following consultation, if necessary, with the Department of Environment and Conservation or Department of Agriculture. This WMP will be updated to reflect any significant changes to control measures.

The Site Environmental Officer will provide details (and samples where possible) of the discovery of weeds new to the Pilbara region or any weeds found outside their (current)

known range to the DEC herbarium. Additionally, the Site Environmental Officer will report any weeds new to the Pilbara to the Department of Agriculture.

The WMP will be reviewed annually and updated as required. The Site Environmental Officer will review annually the classification status of weed species (i.e. Declared, Environmental or other), development of State and Commonwealth weed management strategies and action plans, developments in weed control measures by keeping abreast of relevant literature and consultation with DEC and the Department of Agriculture.

The success of rehabilitation will be assessed as part of the site demobilisation process and on-going field assessment. This will include an assessment of the weed species present, their size, scale and distribution. BHPBIO will implement weed control measures as required to ensure weeds are not spread beyond areas where they currently exist and that no new weeds are introduced into the area.

6 REPORTING

Outcomes of implementation of the Weed Management Plan will be provided in BHPBIO's annual environmental report for rail operations, reporting on the previous 12 month period.

7 REFERENCES

ARMCANZ, ANZECC and Forestry Ministers (1997) *The National Weeds Strategy: A Strategic Approach to Weed Problems of National Significance*. Agricultural and Resource Management Council of Australia and New Zealand, Australian and New Zealand Environmental and Conservation Council, Forestry Ministers.

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Department of Agriculture and Food (DAF) (2008) *Declared Plant List,* available at http://www.agric.wa.gov.au/weeds.htm

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Peirce, J. R. and Pratt, R. A. (2002) *The Declared Plant Control Handbook (6th edition)*. Department of Agriculture, Western Australia.

Royal Botanic Gardens & Domain Trust (2007) *New South Wales Flora Online,* available at http://plantnet.rbgsyd.nsw.gov.au/plantnet_dev/floraonline.htm.

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Western Australian Planning Commission (WAPC) (2003) *Coastal Planning and Management Manual – 8 Weeds and Weed Management*. Western Australian Planning Commission, Perth. available at www.wapc.wa.gov.au/Publications/8_Weeds_Management.pdf?id837

Appendix A – Vehicle / Equipment Weed Hygiene Certificate

MOBILISATION WEED & SEED HYGIENE CERTIFICATE

BHP BILLITON IRON ORE

Equipment will not be granted entry to site if not thoroughly clean

Project:	**Location:**			**Date:**
Name:				
Company:	**Company to be using equipment:**			
Purchase Order #:	**Contract # WA #:**		**Site Contact:**	
Address:	**Phone:**		**Facsimile:**	
Contractor Cited Equipment Prior to Mobilisation:	**Yes:** ☐ **No:** ☐	**Signed:**		**Date:**

Details Equipment # 1	**Checklist**	**Clean**	**Contaminated**	**Comments**
Unit #: **Registration Number:**	Foreign Soil/Gravel	☐	☐	
Equipment Description:	Foreign Objects	☐	☐	
Location of last works undertaken by equipment:	Overall Appearance	☐	☐	
	Oil Leaks/ hydraulic drips	☐	☐	
Date Last Cleaned:	Diesel Leaks	☐	☐	

Details Equipment # 2	**Checklist**	**Clean**	**Contaminated**	**Comments**
Unit #: **Registration Number:**	Foreign Soil/Gravel	☐	☐	
Equipment Description:	Foreign Objects	☐	☐	
Location of last works undertaken by equipment:	Overall Appearance	☐	☐	
	Oil Leaks/ hydraulic drips	☐	☐	
Date Last Cleaned:	Diesel Leaks	☐	☐	

Details Equipment # 3	**Checklist**	**Clean**	**Contaminated**	**Comments**
Unit #: **Registration Number:**	Foreign Soil/Gravel	☐	☐	
Equipment Description:	Foreign Objects	☐	☐	
Location of last works undertaken by equipment:	Overall Appearance	☐	☐	
	Oil Leaks/ Hydraulic drip	☐	☐	
Date Last Cleaned:	Diesel Leaks	☐	☐	

Details Equipment # 4	**Checklist**	**Clean**	**Contaminated**	**Comments**
Unit #: **Registration Number:**	Foreign Soil/Gravel	☐	☐	
Equipment Description:	Foreign Objects	☐	☐	
Location of last works undertaken by equipment:	Overall Appearance	☐	☐	
	Oil Leaks/ Hydraulic drip	☐	☐	
Date Last Cleaned:	Diesel Leaks	☐	☐	

Details Equipment # 5	**Checklist**	**Clean**	**Contaminated**	**Comments**
Unit #: **Registration Number:**	Foreign Soil/Gravel	☐	☐	
Equipment Description:	Foreign Objects	☐	☐	
Location of last works undertaken by equipment:	Overall Appearance	☐	☐	
	Oil Leaks/ Hydraulic drip	☐	☐	
Date Last Cleaned:	Diesel Leaks	☐	☐	

Overall Comments

Signoff	
Inspected By:	Signature:
Approved for Access By:	Signature:
Position:	Date:

FRM-IEN-LAND-001 Mobilisation Weed and Seed Hygiene Certificate (Rev 2.0)

Issued 26/10/2007

Appendix B – Ruby Dock 'Enviro Alert' Fact Sheet

ENVIRO MATTERS

Environmental Management System

Weed Control Programme – Ruby Dock

A weed control programme is currently being conducted across BHPBIO's inland sites. The programme focuses primarily upon the control of ***Ruby Dock (Acetosa vesicarius)***. ***Ruby Dock*** is the most common weed associated with disturbance around mining operations across the Pilbara and the Goldfields. Ruby Dock is a highly vigorous coloniser that can spread rapidly on disturbed areas, especially along transport and communication corridors. This can result in rapid spread across sites, it may reduce the effectiveness of rehabilitation and impact on neighbouring native vegetation communities.

Ruby Dock was introduced from the Mediterranean and Western Asia for ornamental and, ironically, rehabilitation purposes. As time progressed it was recognised as a threat to the native Australian environment and thankfully this practice has been discontinued.

Ruby Dock is an annual, multi-stemmed succulent that can grow rapidly to 50 cm or more following rain (particularly during the start of the winter period). Leaves are oval to heart-shaped. Flowers are clustered at the ends of stems. The most conspicuous part of the plant is the brightly coloured, red-pink fruit.

What can you do to help control Ruby Dock?

- Maintain Vehicle Hygiene procedures for travel around and between sites. Mud attached to the undercarriage of unwashed vehicles is a prime mechanism for the transport of weeds.
- Keep an eye out for the weed-spraying crew. They will be conducting work at your site over the next couple of months.
- Look for ways to minimise the area of disturbance required for your activities.
- Notify your Site Environmental Officer of areas that you have seen ***Ruby Dock***. This will allow them to direct the weed-spraying crew to the areas of greatest infestation.

Environmental management is everyone's responsibility

For further information please contact your site Environmental Officer

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bhpbilliton ENVIRO MATTERS

Appendix C – Weed Species Occuring Within the Pilbara Region

(Source: WA Herbarium 2008)

Scientific Name	Common Name
Acacnthospermum hispidum	Starburr
Acetosa vesicaria	Ruby Dock
Aerva javanica	Kapok Bush
Alternanthera pungens	Khaki Weed
Amaranthus viridis	Green Amaranth
Andropogon gayanus	Gamba Grass
Argemone ochroleuca	Mexican Poppy
Arundo donax	Giant Reed
Asclepias curassavica	Redhead Cottonbush
Asphodelus fistulosus	Onion Weed
Bidens bipinnata	Bipinnate Beggartick
Bidens pilosa	Cobbler's Pegs
Catharanthus roseus	Pink Periwinkle
Cenchrus biflorus	Gallon's Curse
Cenchrus ciliaris	Buffel-Grass
Cenchrus echinatus	Burrgrass
Cenchrus setiger	Birdwood Grass
Chenopodium murale	Nettle-leaf Goosefoot
Chloris barbata	Purpletop Chloris
Chloris virgata	Feathertop Rhodes Grass
Citrullus colocynthis	Colocynth
Citrullus lanatus	Pie Melon
Clitoria ternatea	
Coccinia grandis	
Conyza bonariensis	Flaxleaf Fleabane
Crotalaria juncea	Sunnhemp
Cucumis melo subsp. agrestis	Ulcardo Melon
Cucumis myriocarpus	Prickly Paddy Melon
Cyclospermum leptophyllum	
Cyperus involucratus	
Cyperus polystachyos	Bunchy Sedge
Cyperus rotundus	Nut Grass
Datura leichhardtii	Native Thornapple
Datura metel	Downy Thornapple
Desmodium scorpiurus	
Digitaria ciliaris	Summer Grass
Echinochloa colona	Awnless Barnyard Grass
Eragrostis pilosa	
Gomphrena celosioides	Gomphrena Weed
Gossypium hirsutum	Upland Cotton
Indigofera oblongifolia	
Indigofera sessiliflora	
Jatropha gossypifolia	Bellyache Bush
Lactuca saligna	Wild Lettuce

Scientific Name	Common Name
Lactuca serriola	Prickly Lettuce
Lamarckia aurea	Goldentop
Lepidium didymum	
Leptochloa fusca subsp. *uninervia*	
Leucaena leucocephala	Leucaena
Malvastrum americanum	Spiked Malvastrum
Malvastrum coromandelianum	
Melochia pyramidata	
Merremia dissecta	
Moringa oleifera	
Opuntia stricta	Common Prickly Pear
Oxalis corniculata	Yellow Wood Sorrel
Parkinsonia aculeate	Parkinsonia
Paspalum fasciculatum	
Passiflora foetida	Stinking Passion Flower
Pennisetum setaceum	Fountain Grass
Phoenix dactylifera	Date Palm
Phyla nodiflora	
Phyla nodiflora	
Physalis angulata	
Polypogon monspeliensis	Annual Beardgrass
Portulaca oleracea	Purslane
Prosopis glandulosa x velutina	
Prosopis pallida	Algaroba
Pupalia lappacea	
Ricinus communis	Castor Oil Plant
Salvinia molesta	Salvinia
Senna occidentalis	Coffee senna
Setaria italica	Italian Millet
Setaria sphacelata	South African Pigeon Grass
Setaria verticillata	Whorled Pigeon Grass
Sigesbeckia orientalis	Indian Weed
Sisymbrium orientale	Indian Hedge Mustard
Solanum nigrum	Black Berry Nightshade
Solidago Canadensis	Goldenrod
Sonchus oleraceus	Common Sowthistle
Stylosanthes guianensis	Stylo
Stylosanthes hamata	Verano Stylo
Tamarindus indica	Tamarind
Tamarix aphylla	Athel Pine
Trianthema portulacastrum	Giant Pigweed
Tribulus terrestris	Caltrop
Vachellia farnesiana	Mimosa Bush
Washingtonia filifera	