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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 chainage¹ [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

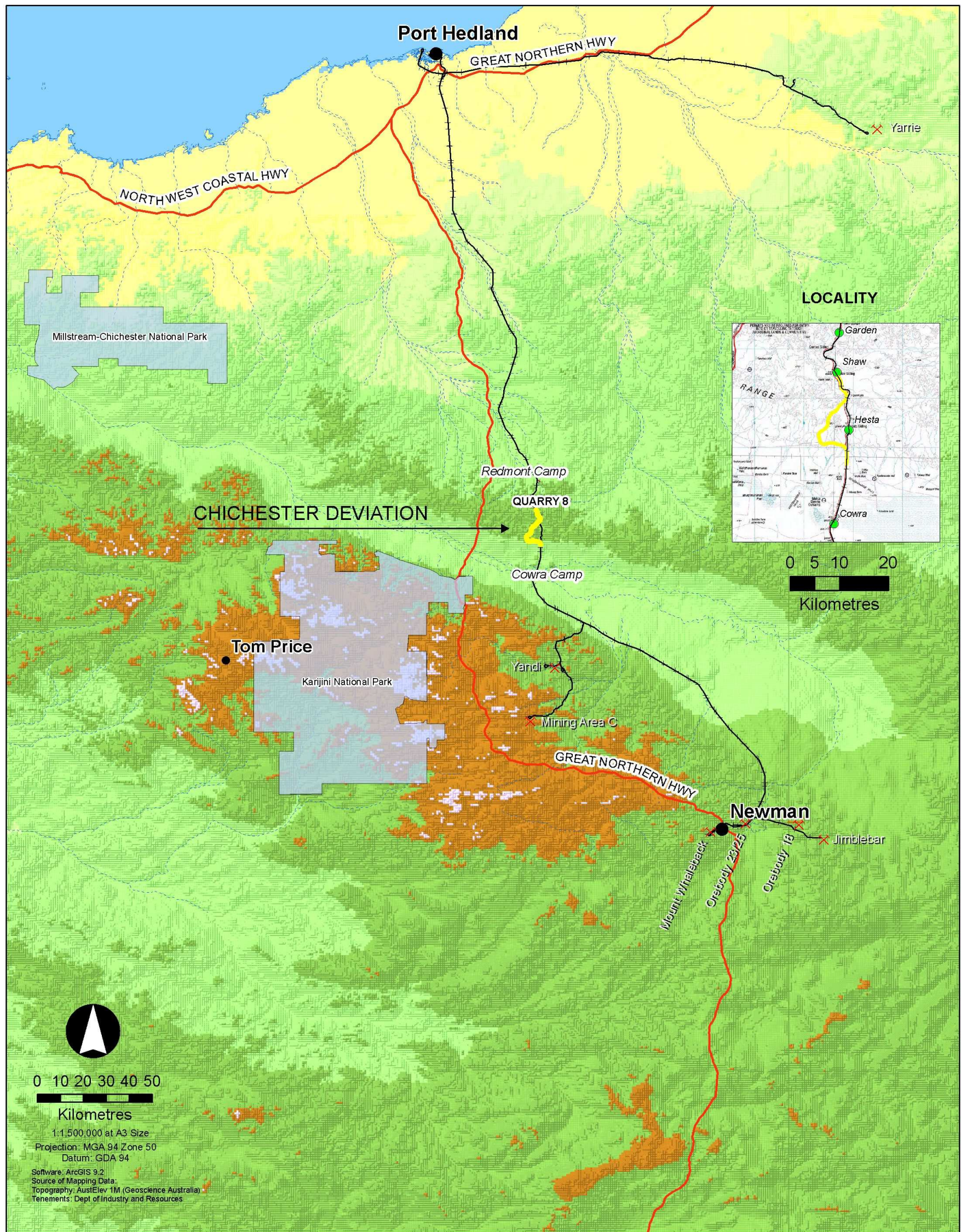
Legislation	Regulatory Authority	Application & Relevance
<i>Rights in Water and Irrigation Act 1914</i>	Department of Water (DoW)	Legislative obligations and potential liabilities for the interference with any watercourse.
<i>Wildlife Conservation Act 1950</i>	Department of Environment and Conservation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



Legend:

- | | | | |
|---------------|----------------|---|-------------|
| Proposal Area | National Parks | GENERALISED TERRAIN (metres above sea level) | |
| BHPB Mainline | Town | 0 - 110 | 440 - 660 |
| BHPBIO Mines | Highway | 110 - 220 | 660 - 880 |
| | Drainage | 220 - 440 | 880 - 1,200 |



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)	<ul style="list-style-type: none"> • 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)	<ul style="list-style-type: none"> • 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)	<ul style="list-style-type: none"> • 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)	<ul style="list-style-type: none"> • 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).

	<ul style="list-style-type: none"> 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)	<ul style="list-style-type: none"> 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	<ul style="list-style-type: none"> 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	<ul style="list-style-type: none"> 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)

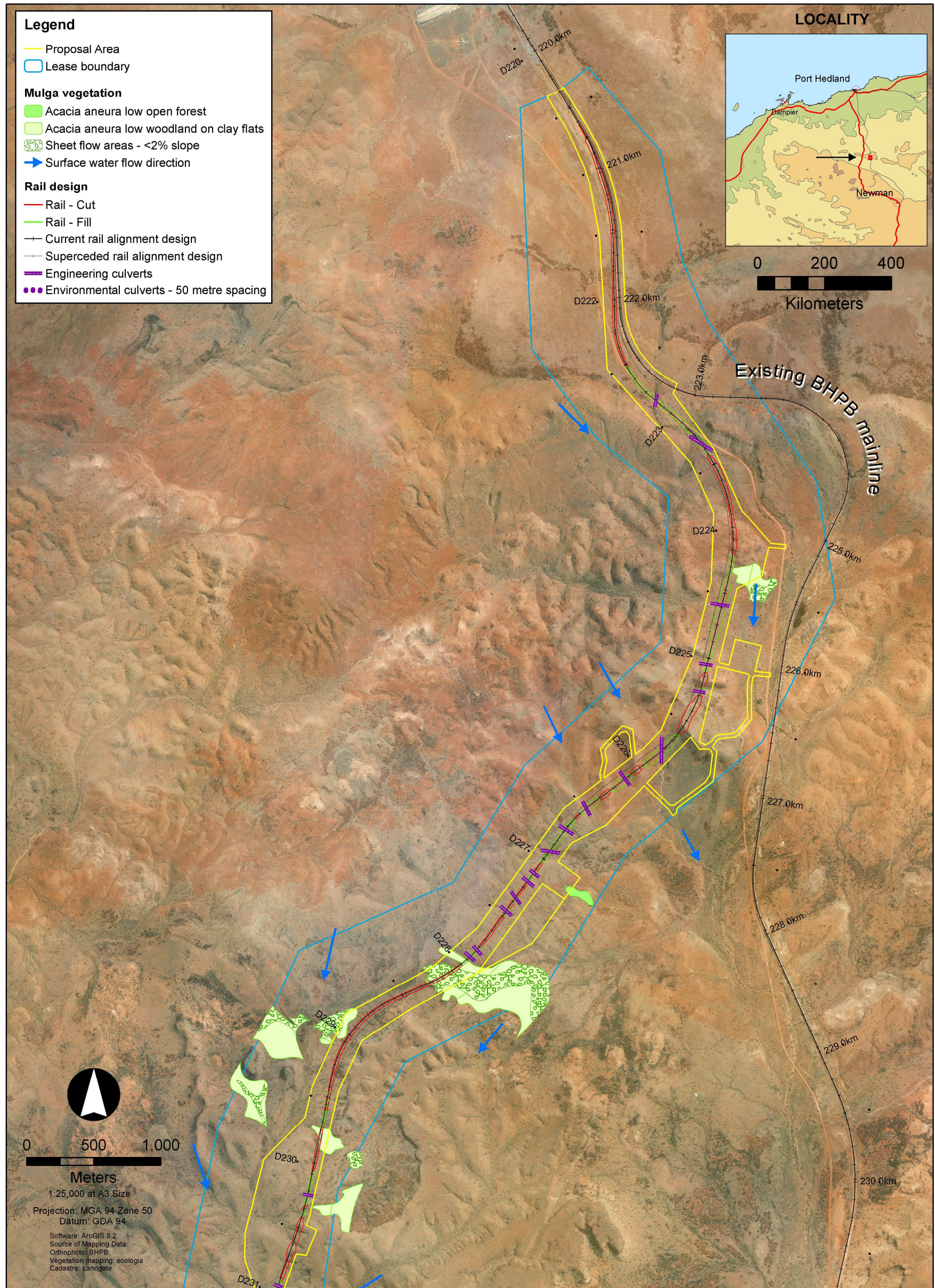
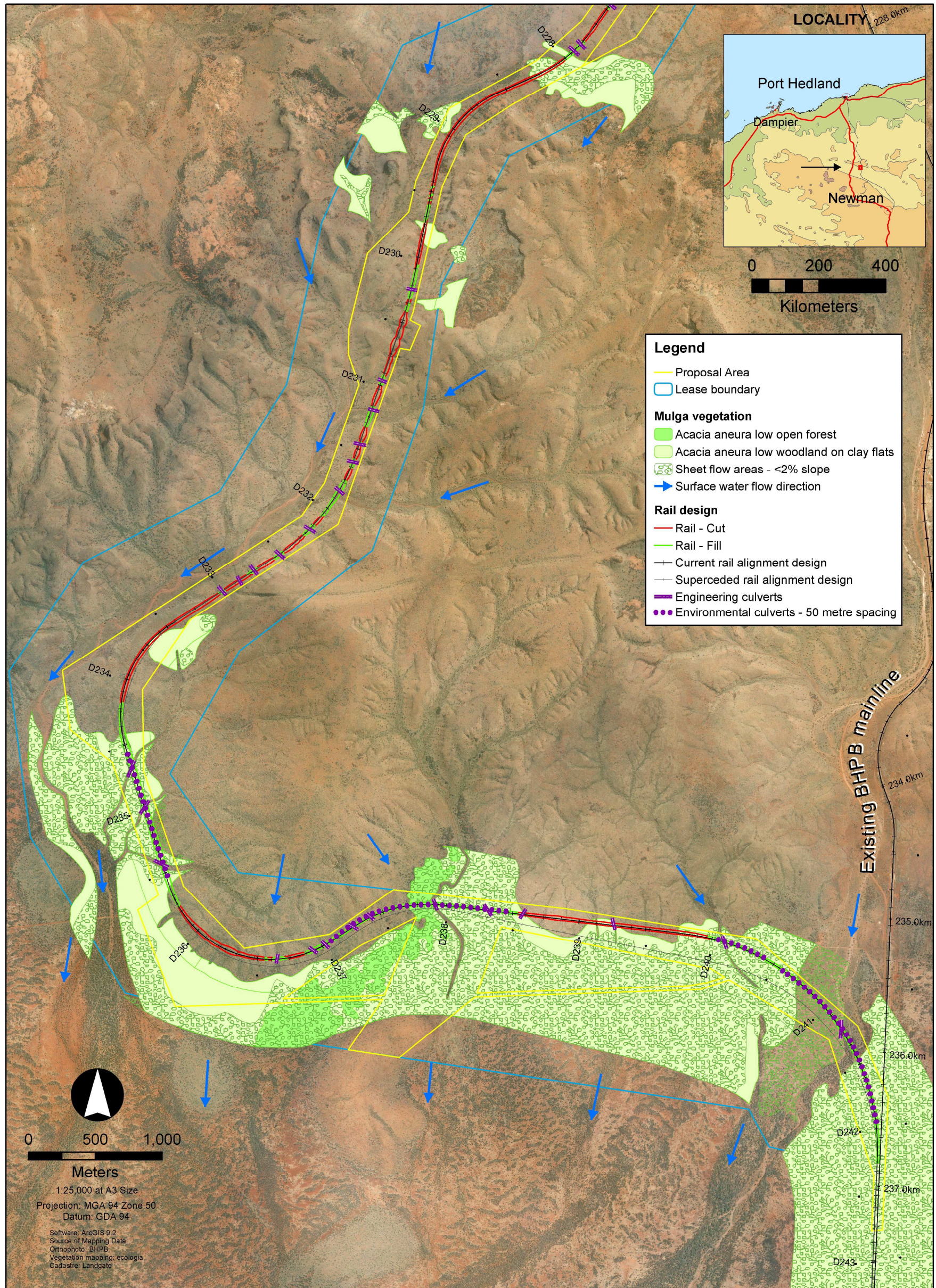


Figure 2.1 – Location of Sheetflow Dependent Mulga

(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	<ul style="list-style-type: none"> • 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	<ul style="list-style-type: none"> • 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	<ul style="list-style-type: none"> • 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	<ul style="list-style-type: none"> • 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	<ul style="list-style-type: none"> Construction and Operational phases.
Responsibilities	<ul style="list-style-type: none"> 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	<ul style="list-style-type: none"> 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 <i>Dangerous Goods Safety Act 2004</i>.
Performance Indicators	<ul style="list-style-type: none"> 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	<ul style="list-style-type: none"> 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.

	<ul style="list-style-type: none"> Visual inspection of site offices and laydown areas to verify that chemicals and hydrocarbons are being managed in accordance with the <i>Dangerous Goods Safety Act 2004</i>.
Reporting	<ul style="list-style-type: none"> 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	<ul style="list-style-type: none"> Construction and Operational phases.
Responsibilities	<ul style="list-style-type: none"> 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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