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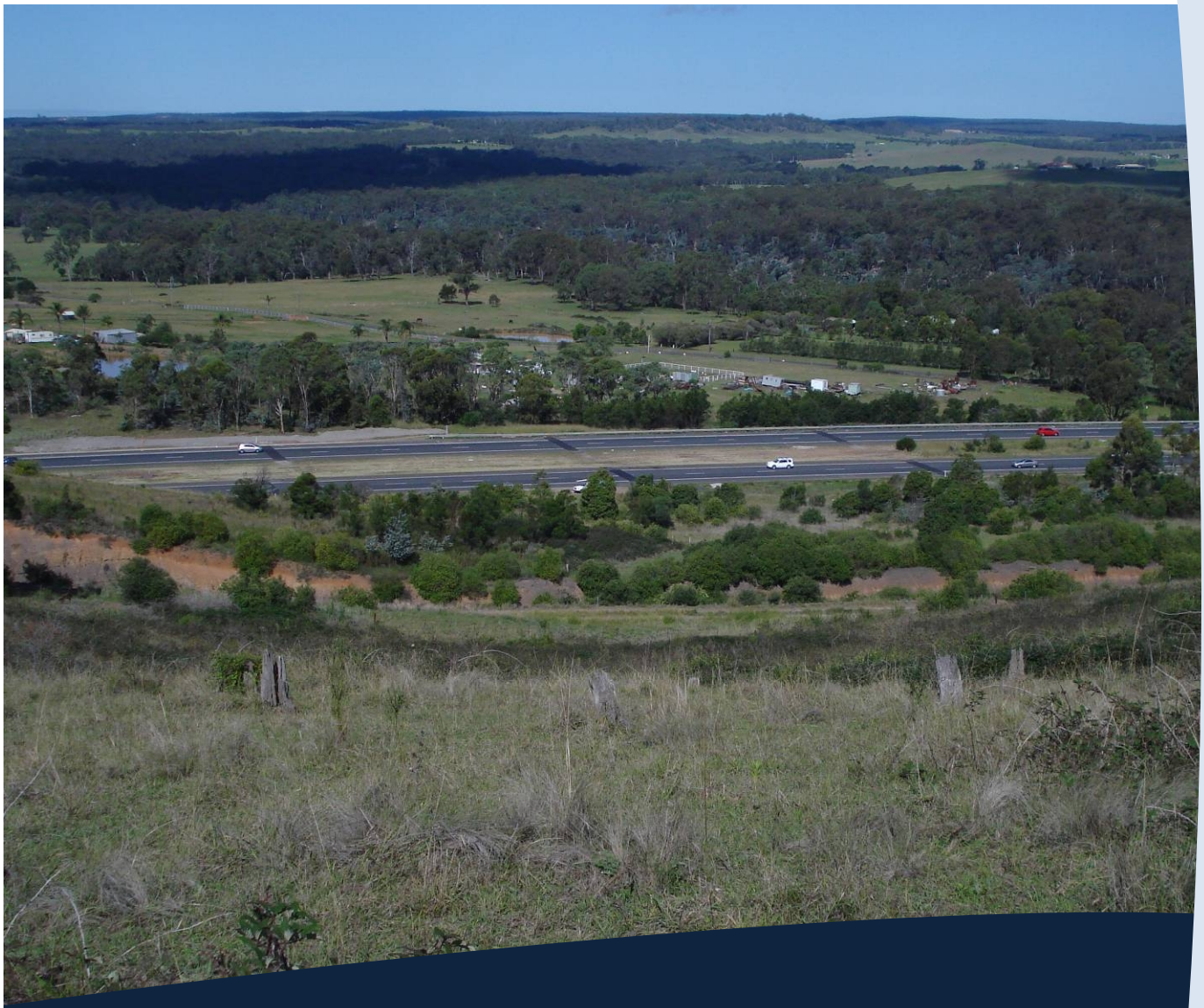

Environmental Assessment

Appin Colliery Area 7
Goaf Gas Drainage Project

Job Number 109033-02 / Report 001 Rev 1

Prepared for BHP Billiton Illawarra Coal

June 2009

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Document Control

Version	Date	Author		Reviewer	
Rev P2	20 May 2009	Peter Chudleigh	PCC	David Laing	DFL
Rev P3	22 May 2009	Peter Chudleigh	PCC	David Laing	DFL
Rev P4	26 May 2009	Peter Chudleigh	PCC	David Laing	DFL
Rev 0	27 May 2009	Peter Chudleigh	PCC	David Laing	DFL
Rev 1	26 June 2009	Peter Chudleigh	PCC	David Laing	DFL

Prepared by
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STATEMENT OF CERTIFICATION

Environmental Assessment prepared under Part 3A of the Environmental Planning and Assessment Act 1979

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Project to which the Environmental Assessment relates:

Project Description:	Appin Colliery Area 7 Goaf Gas Drainage Project

Applicant's Name:	BHP Billiton Illawarra Coal
Applicant's Address:	BHP Billiton Illawarra Coal Administration Centre Old Port Road Port Kembla NSW 2505

Certification:

I certify that I have prepared this Environmental Assessment and to the best of my knowledge:

- It has been prepared in accordance with Part 3A of the EPAA 1979 and the Regulations
- It has been prepared in accordance with the Director General Requirements dated 2 February 2009
- It does not contain information that is either false or misleading.

Signature:

Date: 26 June 2009

Executive Summary

BHP Billiton Illawarra Coal Pty. Ltd. (BHPBIC) owns Appin Colliery that operates under Consolidated Coal Lease (CCL) 767. To meet customer requirements BHPBIC intend to mine Appin Area 7 Longwalls 703 – 710 within CCL 767. BHPBIC has Subsidence Management Plan (SMP) approval to mine Longwalls 701 to 704, granted by the Department of Primary Industries in December 2006, and is seeking SMP approval to mine Longwalls 705 to 710 to the north of the same mining domain. BHPBIC has mined Longwalls 701 and 702 in accordance with the abovementioned SMP approval. Longwall 703 is planned to commence in November 2009.

This Environmental Assessment (EA) seeks Part 3A approval for surface works associated with the drainage of goaf gas from Appin Area 7 Longwalls 703 to 704. Goaf gas is the accumulation of coal seam methane in the area of collapsed rock strata associated with the extraction of coal by the longwall mining method. If unmanaged, goaf gas can enter the ventilation system within the mine and cause underground safety and operational issues. BHPBIC propose to use plant to draw the goaf gas to the surface to limit the potential for gas build up in the Mine Ventilation Air (MVA) and ultimately its emission to the atmosphere. Goaf gas primarily consists of methane, which is a Greenhouse Gas.

This EA discusses the different options proposed as part of this project for the management of extracted goaf gas from Longwalls 703 to 704. These are in order of preference:

1. Capture and reuse for alternative energy generation at the Energy Developments Limited (EDL) Power Stations located at Appin West Mine Pit Top and Appin No.2 Shaft, and/or
2. Onsite flaring; and
3. Onsite venting.

BHPBIC wish to link the proposed Appin Area 7 Longwalls 703 to 704 goaf gas drainage reticulation network to the existing gas drainage network underground, allowing the utilisation of the extracted goaf gas to be reused at the EDL Power Stations to generate electricity. Should this option prove unfeasible or unreliable, BHPBIC have proposed alternative or contingency options for the extracted goaf gas. Due to this, this EA assesses impacts from all three of the proposed management options.

BHPBIC have consulted with and obtained written agreements from all landowners on who's land the proposed development will occur. The results of this landowner negotiations have had a direct impact on the design and location of the above ground infrastructure. The current proposal takes into account all landowner and agency requirements, and meets BHPBIC's needs whilst having a minimal environmental impact.

This EA reviews and assesses the project in accordance with relevant legislation and published guidance relevant for New South Wales. The need for the project and alternative options are addressed to confirm that the proposal is the preferred option in relation to environmental, mine safety and economic impacts.

An environmental risk assessment identifies the primary and secondary impacts from the proposed project and this, along with the Director-General's Requirements, has directed the assessments in this EA.

This EA describes the existing environment in the works locations and all aspects of the proposed development. This allows the EA to address potential environmental impacts. The goaf gas drainage project is minor in scale resulting in minimal environmental impacts due to the temporary nature of the works, proposed management and mitigation measures, and long-term agricultural land use of the project area.

This EA assesses the project in relation to the following environmental impacts:

- Greenhouse gas (GHG) emissions
- Air quality

- Noise
- Erosion & sediment control
- Water resources
- Flora and fauna
- Aboriginal cultural and European heritage
- Risks & hazards
- Waste management
- Visual
- Site rehabilitation
- Traffic
- Cumulative impacts.

These assessments confirm that with the implementation of the mitigation and management measures proposed in this EA, the project will have no significant environmental impact. This finding is supported by specialist consultant reports for flora & fauna, Aboriginal cultural heritage, noise, air quality and GHG emissions.

This EA provides a statement of commitments to which BHPBIC agree to comply upon approval. These commitments ensure BHPBIC undertake the proposed works whilst minimising environmental impacts. This EA concludes that the proposed development is acceptable because it has minimal environmental impacts and is necessary to enable BHPBIC to continue its mining operations at Appin Colliery in a safe and efficient manner. This is desirable due to economic and employment benefits to the State Government and local economy.

This EA recognises that the borehole drilling works over Longwall 703 described herein may already have a separate approval granted by the Department of Primary Industries – Minerals under the Mining Act 1992 and Exploration Licence No. A396.

The proposed Longwall 703 drilling program includes four vertical holes drilled down to the roof of the Bulli coal seam and one Medium Radius Drilling (MRD) steered hole drilled from the surface down and horizontally within the base of the Scarborough Sandstone. The vertical holes will be geophysically logged, providing necessary geological and geotechnical information on the strata in the area and in particular the sandstone horizon in which the horizontal MRD hole is targeted within. Information from the vertical holes will be used to detail the design of the MRD horizontal hole. The horizontal exploration hole is planned to pass through a number of inferred structural and geological features that are required to be investigated for both position and the geotechnical character to determine the possible impact on the management of the Appin underground coal mine.

Upon approval of this Part 3A application, the boreholes associated with the Longwall 703 drilling program will be converted as required to goaf gas drainage wells for the purpose of the Appin Area 7 Goaf Gas Drainage Project to minimise impacts associated with drilling additional wells.

The BHPBIC “Bulli Seam” Major Project for ongoing mining operations at Appin and West Cliff Collieries will ultimately incorporate the requirements of this application into it. However, this application for approval of the Appin Area 7 Longwalls 703 to 704 goaf gas drainage project is necessary to implement the proposed works before mining of Longwall 703 is scheduled to commence in November 2009.

The information and assessments provided in this EA demonstrate the proposal has no significant environmental impacts and is necessary for safe and efficient mining operations. In accordance with this, the Minister for Planning is requested to approve this proposal.

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B. Goaf Gas Layout Plans

C. Greenhouse Gas Assessment

D. Flora & Fauna Assessment

E. Cultural Heritage & Archaeology Assessment

F. Aboriginal Cultural Heritage Management Plan

G. Noise Assessment

H. Air Quality Assessment

I. Agency Correspondence

1 Introduction

This section describes the background to the proposal and the reason for change.

1.1 Background

In December 2006 the Department of Primary Industries granted BHP Billiton Illawarra Coal Pty Ltd (BHPBIC) Subsidence Management Plan (SMP) approval for their Appin Area 7 Longwalls 701 to 704. Appin Area 7 forms part of Appin Mines' mining operations and is wholly within Consolidated Coal Lease (CCL) 767. These longwalls will extract coal within the Bulli Coal Seam at an approximate depth of 500m below surface ground level. These longwalls are approximately 6km north-west of the township of Appin. **Figure 1.1** shows a map of the general area of activities described in this report and **Annex B** shows the goaf gas drainage layout plans.

BHPBIC has mined Longwalls 701 and 702 in Appin Area 7 in accordance with SMP approval. Longwall 703 is planned to commence in November 2009. In order to ensure safe and efficient mining of Longwalls 703 and 704, BHPBIC require surface equipment to drain methane gas from the goaf area of the mine. This methane gas is referred to as "goaf gas". This infrastructure constitutes development of land requiring development approval under the *Environmental Planning & Assessment Act 1979 (EP&A Act 1979)*.

This Environmental Assessment (EA) forms part of the development approval process by describing and assessing BHPBIC's proposal to install temporary gas extraction boreholes and mobile surface extraction plants and ancillary equipment to drain goaf gas from Longwalls 703 and 704. This is a typical activity associated with underground coal mining. If methane gas drainage does not occur, this can result in increased risk to the safety of the underground workers, delays in the mining schedule due to high gas concentrations within the mine, and the increased emission of Greenhouse Gasses in mine ventilation air.

The borehole drilling works over Longwall 703 described herein may already have a separate approval granted by the Department of Primary Industries – Minerals under the Mining Act 1992 and Exploration Licence No. A396. The Longwall 703 drilling program includes four vertical holes drilled down to the roof of the Bulli coal seam and one Medium Radius Drilling (MRD) steered hole drilled from the surface down and horizontally within the base of the Scarborough Sandstone. The vertical holes will be geophysically logged, providing necessary geological and geotechnical information on the strata in the area and in particular the sandstone horizon in which the horizontal MRD hole is targeted within. Information from the vertical holes will be used to detail the design of the MRD horizontal hole. The horizontal exploration hole is planned to pass through a number of inferred structural and geological features that are required to be investigated for both position and the geotechnical character to determine the possible impact on the management of the Appin underground coal mine.

Upon approval of this Part 3A application, the boreholes associated with the Longwall 703 drilling program will be converted to goaf gas drainage wells for the purpose of the Appin Area 7 Goaf Gas Drainage Project.

BHPBIC have commissioned Cardno Forbes Rigby (Cardno) to prepare this EA in relation to the proposed Appin Area 7 Goaf Gas Drainage Project.

1.2 Major Project Classification

The Department of Planning (DoP) has reviewed the Preliminary Environmental Assessment (Cardno, 2008) and accepted the Part 3A application. The Minister for Planning has confirmed the development is a 'Major Project' under *SEPP (Major Projects) 2005* via release of the Director-General's Requirements (DGR's). Due to this, the Minister for Planning will assume the responsibility of consent authority.

1.3 Director-General's Requirements

The DGR's are included in full in **Annex A**, and **Table 1.1** presents a summary. This table also provides information on the section of this Environmental Assessment that addresses each DGR.

Table 1.1 – Director General's Requirements & Location Addressed in EA

Requirement	Comments & Location in EA
General Requirements	
An executive summary, a detailed description of the project, including the need for the project, alternatives considered, various components of the project, the likely inter-relationship between the proposed project and existing or approved mining operations in the region, likely staging of the project and plans of any proposed building works.	Executive summary presented at start of report.
A risk assessment of the potential environmental impacts of the project, identifying the key issues for further assessment, issues raised during consultation.	Environmental risk assessment presented in **Section 7**.
A detailed assessment of the key issues specified below, and any other significant issues, which includes: • a description of the existing environment, using sufficient baseline data • an assessment of the potential impacts of all stages of the project, taking into consideration any relevant policies, guidelines, and statutory provisions and • a description of the measures that would be implemented to avoid, minimise, mitigate, rehabilitate/remediate, monitor and/or offset the potential impacts of the project, including detailed contingency plans for managing any significant risks to the environment.	Detailed assessment of the existing environment, potential impacts and management and mitigation measures presented in **Sections 7 and 9**.
A statement of commitments, outlining all the proposed environmental management and monitoring measures.	Statement of commitments presented in **Section 11**.
A conclusion justifying the project on economic, social and environmental grounds, consideration whether the project is consistent with the objects of the EP&A Act 1979.	Conclusion and discussion presented in **Section 12**.
A signed statement from the author of the EA, certifying that the information contained within the document is neither false nor misleading.	Signed statement from the author if this EA is presented immediately after the front cover page.
Key Issues	
Greenhouse Gas (GHG) emissions	**Section 8.2 and Annex C**
Air Quality	**Section 8.3 and Annex H**
Noise	**Section 8.4 and Annex G**
Erosion and Sediment Control	**Section 7.5**
Water Resources	**Section 7.6**
Biodiversity (Flora and Fauna)	**Section 8.7 and Annex D**
Aboriginal and Non-Aboriginal Heritage	**Section 8.8 and Annex E**
Risks and Hazards	**Section 8.9**
Waste	**Section 8.10**
Visual	**Section 8.11**
Rehabilitation	**Section 8.12**

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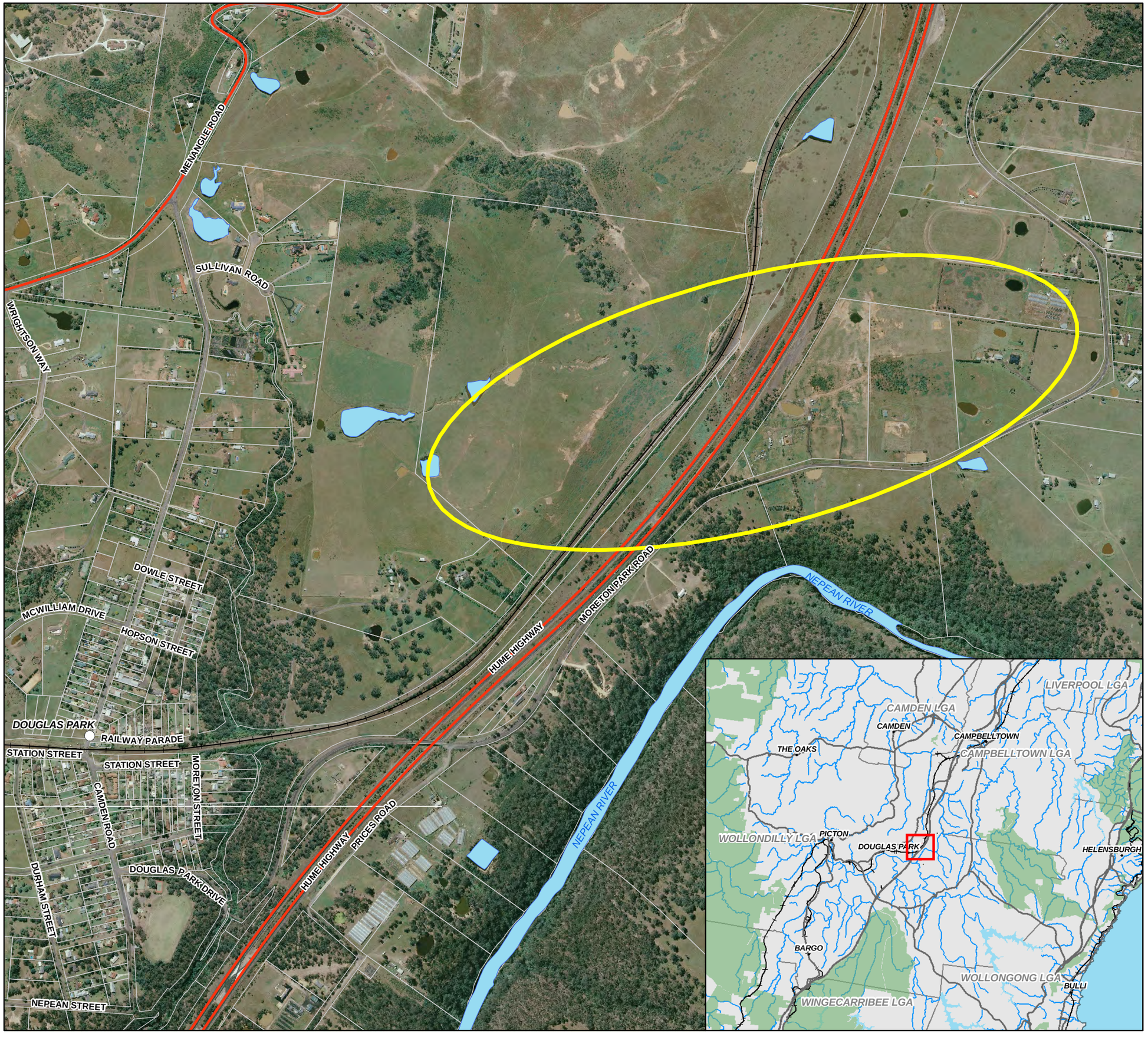
General Location Plan

APPIN AREA 7 GOAF
GAS DRAINAGE PROJECT



Legend

- Major Roads
- Railway
- Waterbodies
- Cadastre
- General Works Area

FIGURE 1.1

N
W E
S

Scale 1:10,000 (at A3)

Metres
0 125 250 500

Cardno Forbes Rigby

Map Produced by Cardno Forbes Rigby Pty Ltd
Date: 24 June 2009
Coordinate System: Zone 56 MGA/GDA 94
GIS MAP REF: 109033-02_2803_general_location_plan.mxd 03

Data sourced from Department of Lands (LPI) unless otherwise stated.
Aerial imagery supplied by BHPBIC

1.4 Project Team

BHPBIC has engaged a project team to assess the proposal in accordance with the DGR's and provide reporting to support this Environmental Assessment. The project team comprises the following companies that are responsible for the nominated roles:

Cardno – Project Management, preparation of the EA including: Executive Summary, Project Description & Justification, Conclusion and the following assessments: Environmental Risk, Planning, Greenhouse Gas (GHG) Assessment (**Annex C**), Water Resources, Erosion and Sediment, Visual Impact, Waste and Traffic.

Biosis Research – Flora & Fauna Assessment and Cultural Heritage and Archaeology Assessment (**Annexes D and E**).

Wilkinson Murray – Noise Assessment (**Annex G**).

PAE Holmes – Air Quality Assessment (**Annex H**).

1.5 Components, Staging and Anticipated Timing

BHPBIC aim to implement the project at the earliest opportunity to prevent impacts on coal extraction and supply. At this stage, the project is anticipated to be implemented prior to the commencement of mining Longwall 703 that is anticipated to be November 2009. **Table 1.2** shows the programme of works and proposed indicative timing:

Table 1.2 – Anticipated Timing of the Part 3A Application

Stage		Due Date
1.	Prepare Preliminary Environmental Assessment	December 2008
2.	Submission PEA to Department of Planning	December 2008
3.	Director-General's Requirements	February 2009
4.	Submission of Environmental Assessment to DoP for Adequacy Review	May 2009
5.	Public Exhibition and Agency Consultation	July 2009
6.	Completion of DoP assessment	July - August 2009
7.	Minister's Decision	August- September 2009

1.6 Report Structure

The report structure is as follows:

- **Section 2** – provides a description of the project site.
- **Section 3** – details the regulatory framework relevant to the proposal.
- **Section 4** – details consultation carried out and responses received.
- **Section 5** – provides an overview of justifications for the proposed development.
- **Section 6** – explains the proposed development.
- **Section 7** – assesses the proposed development against key environmental impacts and identifies mitigation measures.

- **Section 8** – assesses the proposed development against secondary environmental impacts and identifies mitigation measures.
- **Section 9** – provides an Environmental Risk Assessment.
- **Section 10** – details construction management.
- **Section 11** – provides the statement of commitments.
- **Section 12** – concludes the EA.
- **Section 13** – lists the references used in the preparation of this report.

2 Site Description & Context

This section describes the locations for the proposed surface equipment to provide a context for the development.

2.1 Location

The proposed goaf gas drainage surface facilities will be located across a number of paddocks on private landholdings. The land is within Consolidated Coal Lease CCL767 in an area approximately 2km northeast of the township of Douglas Park, in NSW. The goaf gas drainage equipment covers several properties, as it must follow the underground mine workings to provide adequate goaf gas drainage capability for Longwalls 703 and 704.

2.2 Site Description

The proposed project area is located within the South Campbelltown Mine Subsidence District in the Southern Coalfield of NSW, approximately 2km northeast of the township of Douglas Park. The topography varies from gently undulating to hilly, with the exception of the Nepean River Gorge, where the surface level drops quite steeply to the river forming a steeply incised gorge with several cliff lines and steep slopes. Much of the land throughout the whole of the works area has been cleared for grazing, rural residential or similar agricultural purposes. Much of the land is used for light grazing by cattle and horses. The area primarily consists of small rural residential blocks used for mixed agricultural purposes with associated infrastructure and man-made farm dams (refer **Figure 5.1** and **Annex B**).

The natural features of the works area comprise the Nepean River and associated ephemeral creeks and tributaries, which act as drainage lines into the River. There is some remnant riparian vegetation along the Nepean River Gorge and associated tributaries.

The man made infrastructure present within the works area includes the Hume Highway, Moreton Park Road, Douglas Park Trig Station, the Main Southern Rail Line and other local roads, residential dwellings and farm dams.

2.3 Current & Adjoining Land Uses

Land use over the works area includes:

- Stock grazing
- Rural residential
- Community centre
- Mixed agriculture
- Small business such as pet boarding kennels.

2.4 Development Constraints

The site specific surface development constraints of the works area include residential dwellings and associated buildings and sheds, driveways, local roads and farm dams.

The layout of the goaf gas drainage infrastructure has been designed to accommodate the surface development constraints, to minimise disruption to private landowners and to minimise the impact to environment whilst maximising the goaf gas drainage capability for the desired longwalls (refer **Figure 5.1** and **Annex B**).

3 Regulatory Framework

This section outlines the current regulatory framework within which BHPBIC operate and assesses relevant policies.

3.1 Federal Legislation

3.1.1 Environmental Protection & Biodiversity Conservation Act 1999

The *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act 1999) applies to matters of national environment and heritage significance. This Act requires approval from the Department of the Environment, Water, Heritage and the Arts for any action that has, will have, or is likely to have a significant impact on the seven listed matters of national environmental significance.

The seven matters are:

1. World Heritage properties
2. National Heritage places
3. Wetlands of international importance
4. Threatened species and ecological communities
5. Migratory species
6. Commonwealth marine or land areas
7. Nuclear actions (including uranium mining).

Appin Area 7 is not a World Heritage site, a National Heritage place nor does it include any wetlands of international importance. The landscape is highly disturbed, cleared agricultural land providing limited habitat for threatened species, ecological communities or migratory species. Appin Area 7 is not within or adjacent to a Commonwealth marine or land area and no nuclear actions are in operation or proposed.

Flora, fauna and cultural heritage studies have been completed for this project and a review of these studies concludes that the proposed development does not have a significant impact on the seven listed matters of national environmental significance. Up to 0.16ha of poor quality Cumberland Plains Woodland may need to be cleared. BHPBIC proposed to rehabilitate this site with Cumberland Plains Woodland species on completion of this project. Given that the impacts assessment concluded that this project does not significantly the Cumberland Plains Woodland then no further assessment under the EPBC Act 1999 is required.

3.2 NSW Legislation

This section provides an assessment of relevant state planning controls and strategic planning guidance.

3.2.1 Environmental Planning & Assessment Act 1979

The *Environmental Planning and Assessment* (EP&A) *Act 1979* legislates the planning process for the consideration of all developments within New South Wales. The Department of Planning (DoP) administers this Act and it defines the relevant consent authority for proposed developments.

The EP&A Act defines numerous objectives. The objectives relevant to the proposed goaf gas drainage project are to encourage:

- The proper management, development and conservation of natural and artificial resources, including agricultural land, natural areas, forests, minerals, water, cities, towns and villages for the purpose of promoting the social and economic welfare of the community and a better environment.
- The promotion and co-ordination of the orderly and economic use and development of land.
- Protection of the environment, including the protection and conservation of native animals and plants including threatened species, populations and ecological communities, and their habitats.
- Ecologically sustainable development (ESD).

The development relates to the mining of coal, which is a natural resource. The development application process ensures the development progresses in a co-ordinated and orderly process to minimise impacts to the environment whilst providing economic benefit to the local communities and to NSW as a whole.

The flora and fauna assessment for this project demonstrates that the proposed development will not have any significant impacts on native plants or animals or their habitat. Mitigation and management measures are proposed to ensure impacts on flora and fauna are minimised.

The proposed development meets relevant criteria of ESD. This is because:

- The extraction plants and associated boreholes are temporary and BHPBIC will fill and seal boreholes to relevant requirements as they become redundant. Site rehabilitation will ensure the environment is returned back to the pre-development condition or to meet landowner specific requirements.
- Rehabilitation will meet inter-generation equity aims and assist to maintain biological diversity and ecological integrity.
- There are environmental goals and controls in place that ensures BHPBIC minimise environmental impacts during the short duration of the Project
- The Project will abate approximately 196,000 tonnes CO_2-e per year of Greenhouse Gas emissions that would otherwise be released to the atmosphere in mine ventilation air.

This review shows that the proposed goaf gas drainage development accords with the objects of the EP&A Act.

3.2.2 Environmental Planning & Assessment Regulation 2000

This project is progressing in accordance with the clauses in Part 1A of the *Environmental Planning & Assessment Regulations 2000* (the Regulations). DoP will notify the public of the proposed development via a notice in a local newspaper and relevant documentation will be available to the public via the internet.

3.2.3 Mining Act 1992

The *Mining Act 1992* currently regulates mining activities associated with Appin Colliery. The Act requires individuals or companies to obtain approval for exploration, leases relating to mining activities and directs matters that the Minister must take into account prior to granting an authority to carry out mining activities. It also controls exploration and mining activities through consent conditions.

Part 11 of the *Mining Act* relates to the protection of the environment. Clause 238 empowers the Minister, or delegated consent authority, to include conditions on any exploration or mining authority to ensure the protection of flora, fauna, fish, fisheries, scenic attractions and features of Aboriginal,

architectural, archaeological, historical or geological interest. Clause 239 of the *Mining Act* permits conditions relating to the rehabilitation of land affected by exploration or mining to be included on any consent.

Appin Colliery operates under various leases granted under Part 6 of the *Mining Act 1992*. Existing operations at the Colliery are in accordance with the terms and conditions of the following Mining Leases CCL767 and Exploration Licence No. A396. The proposed goaf gas drainage development is in accordance with, and required for, normal mine related operations and will be carried out wholly within these leases.

BHPBIC will remediate all disturbed areas in co-operation with each landowner and will reinstate the disturbed land back to pre-development conditions.

The *Mining Act* does not prohibit the development of the proposed goaf gas drainage infrastructure and the areas to accommodate the proposed development do not contain flora with high ecological value. Approximately 0.16 ha of Cumberland Plains Woodland that is currently in poor condition may be impacted by the proposal. Any cleared Cumberland Plains Woodland will be rehabilitated with Cumberland Plains Woodland species at the completion of the project The land has been significantly disturbed for agricultural purposes, however there is some potential to impact on aboriginal archaeological deposits. A detailed Aboriginal cultural heritage assessment has been undertaken and management actions developed in consultation with relevant Aboriginal stakeholders. Furthermore, there will be no impact on any of the other matters, which are regulated by the *Mining Act*.

The *Mining Act* does not provide specific approval for the implementation of the proposed goaf gas drainage. Additionally, from 2010 onwards the primary regulation of all mines will be under the EP&A Act via approvals under Part 3A. BHPBIC are preparing their Part 3A application for ongoing mining activities within the Bulli Coal Seam at Appin and West Cliff Collieries, which is called the 'Bulli Seam' Major Project (Document No. PDR-R01-F 00234637).

3.2.4 Water Act 1912

A licence or permit is required for the majority of groundwater use across NSW. The Department of Water & Energy (DWE) administers the *Water Act*. Rural landowners have the following groundwater use rights; domestic and stock use, native title rights for personal, domestic and non-commercial uses. As BHPBIC do not benefit from these rights, any interception, extraction or use of groundwater for the goaf gas drainage project that falls within the remit of the Act would need approval from DWE.

The *Water Act 1912* regulates both groundwater and surface water use in NSW. This provides control, licensing and permits relating to:

- Water rights and related works
- Artesian wells
- Flood control works
- Water management authorities.

This Act is applicable to the land on which the proposed goaf gas drainage works are proposed but the development only has minor applicability to the *Water Act*.

The goaf gas drainage project does not propose to intercept, extract or use groundwater. Due to this, BHPBIC do not propose any works defined under clause 10(1) of the *Water Act* and therefore do not require a licence or permit under Part 2.

BHPBIC require the installation of boreholes to drain the goaf gas from the underground mining areas. Clause 112 in Part 5 of the *Water Act* could be understood to require BHPBIC to obtain consent under the Water Act before drilling the borehole if it intersects with groundwater. This is

because the borehole could possibly be used to extract groundwater. **Section 7.6** of this report advises that all the goaf gas boreholes will be fully encased (refer **Section 7.6.3**) to ensure isolation and prevent interconnection from/of aquifers. This results in the borehole being unable to be used for the extraction of groundwater even if aquifers are intersected, thus, the boreholes do not meet the definition of a "bore" in Clause 105 resulting in these works not being controlled by Part 5 of the *Water Act*.

Clause 165A in Part 8 of the *Water Act* specifies that approval is necessary for any earthwork, embankment or levee that is, or forms part of, a river or lake or is within a floodplain. Additionally for any type of works that may affect water flow to or from a river or lake or that may prevent flooding. Only, 'earthworks' are applicable to the proposed works for the goaf gas drainage project and as these are not within a river, lake or floodplain, approval is not required under Clause 165A.

As none of the proposed works affect groundwater or meet the definitions of controlled activities under Parts 2, 5 and 8 of the *Water Act,* a water licence is not necessary for the proposed goaf gas drainage project.

3.2.5 Water Management Act 2000

The Department of Water & Energy's website provides guidance and information in relation to water licensing and the remit of the *Water Management Act 2000*.

The *Water Management Act 2000* governs the issue of new water licences and the trade of water access licences and allocations for those water sources (rivers, lakes and groundwater) in NSW where water sharing plans have commenced.

Water access licences under the *Water Management Act 2000* differ from licences under the *Water Act 1912*. They:

- Provide a clearly-defined share of the available water in a particular water source that can be sustainably extracted
- Provide a clearly-defined entitlement that is separate from land ownership
- Separate the entitlement to access water from the approvals associated with supply works and the use of water
- In the case of 'continuing' water access licences (licences granted in perpetuity), allow for the licence and water allocation available under that licence to be bought and sold fully or in parts and for the licences to be subdivided, consolidated and changed (e.g. for category, zone, water source)
- Are listed on a public Water Access Licence Register".

Once a water sharing plan commences, all existing *Water Act* licences are converted to water access licences and approvals under the *Water Management Act* (source: DWE website, http://www.dwe.nsw.gov.au/water_trade/wma2000_licence.shtml).

The *Water Management Act* provides the framework for assessing areas seen to be suitable for water management, implementing the water management process and determining applications to use groundwater. Provisions in the Act relating to approvals and controls only apply to areas with an approved water management plan or water sharing plan.

A review of the DWE website indicates that the area in which the goaf gas drainage works are proposed does not have a water management or water sharing plan. Due to this, the proposed works do not require approval under the *Water Management Act*.

In addition to the *Water Management Act* not being applicable to the locality for the proposed goaf gas drainage works, approval is not required due to Clause 75U of the *EP&A Act*. Part 1(h) of Clause

75U exempts projects to which Part 3A of the EP&A Act apply from requiring approval under Clause 89 (water use), 90 (water management works) and 91 (activities) of the *Water Management Act*.

3.2.6 Protection of Environment Operations Act 1997

The *Protection of Environment Operation* (POEO) *Act 1997* is the key piece of the NSW Government's legislation with respect to protection of the environment. The Department of Environment and Climate Change (DECC) administer this Act. The POEO Act permits the granting of Environmental Protection Licences (EPL) to regulate industrial activity.

Appin Colliery Pit Top operates in accordance with emission levels set by the DECC under Environmental Protection Licences EPL No. 398 and 758. Appin Colliery requires an EPL because it meets the criteria of a 'scheduled activity' in Schedule 1 of the POEO Act.

The proposed goaf gas drainage development does not require an EPL because the proposed works do not meet any of the definitions Schedule 1 of the POEO Act. The closest scheduled activities are 'Extractive Activities' or 'Mining for Coal'. The goaf gas works are not captured by either because the extractive activities do not apply to methane gas and the drainage operations do not involve the mining, processing or handling of coal. Appin Mine holds two EPLs for the premises at Appin East (EPL No. 758) and Appin West (EPL No. 398).

Energy Developments Limited (EDL) operate gas fired power stations at the Appin West pit top and Appin No.2 shaft. Goaf gas from this project will be reticulated to these premises. Both EDL premises operate in accordance with EPL No. 5357 and 5482.

Additionally, environmental assessments in **Section 5** demonstrate that the goaf gas drainage project has minimal environmental impacts.

3.2.7 National Parks & Wildlife Act 1974

DECC administers the *National Parks & Wildlife Act* (NP&W Act) 1974. This act regulates:

- Conservation of nature
- Conservation of objects, places and features of cultural value
- Public appreciation, understanding and enjoyment of nature and cultural heritage
- Land reserved under this Act.

When determining applications under this Act the consent authority must consider these objectives, the public interest and appropriate management of the subject land of the application. This Act controls activities in designated Parks, Reserves and Aboriginal areas.

The NP&W Act does not affect the proposed goaf gas drainage development because the proposed works will not be within a park, a reserve or a heritage area designated under Part 4 of the Act. The proposed locations for the goaf gas drainage works have previously been significantly disturbed from agricultural and clearing activities and, as demonstrated in the flora and fauna report, do not provide habitat for protected plants or animals. This ensures the proposed activities are in compliance with Parts 7, 8, and 8A of the NP&W Act.

An Aboriginal cultural heritage assessment has been undertaken for the Project site in accordance with Part 6 of the NP&W Act. Several Aboriginal artefacts were identified on the surface and may be impacted by the construction of the gas reticulation system. Where it is possible to do so, Aboriginal sites will be avoided by the development, however where impacts may occur these will be managed in accordance with an Aboriginal Cultural Heritage Management Plan that has been prepared in consultation with Registered Aboriginal Stakeholders

3.2.8 Threatened Species Conservation Act 1995

The *Threatened Species Conservation Act 1995* (TSC Act) protects threatened species, communities and critical habitat in NSW. This Act protects species, populations and ecological communities that are considered endangered, vulnerable or extinct.

Rigorous assessment of activities that may have an impact on protected animals, plants or locations ensures justifications are strong enough to permit the impact to progress. The TSC Act links with the EP&A Act to ensure consideration of these matters during the determination of a development application.

The proposed areas to be disturbed are small and the flora and fauna report for this project confirms the specific locations for development activities do not contain any:

- Endangered species, populations or communities listed in Schedule 1 of the TSC Act
- Critically endangered species or ecological communities listed in Schedule 2 of the TSC Act
- Vulnerable species or ecological communities listed in Schedule 3 of the TSC Act.

The Project may involve clearing of 0.16 ha of Cumberland Plains Woodland that is currently in poor condition. Any clearing of the Cumberland Plains Woodland community will be rehabilitated with Cumberland Plains Woodland species at the completion of the Project.

Assessment of any impacts on threatened species or Endangered Ecological Communities is in accordance with Clause 5A of the EP&A Act for the works proposed in this Major Project application. Biosis Research has undertaken a Flora & Fauna Impact Assessment of the proposed goaf gas drainage works and this states:

*Based on the impact assessments following the Part 3A Guidelines of the EP&A Act for Threatened Species Assessment, the proposal is unlikely to reduce the long-term viability of, accelerate the extinction of and/or adversely affect critical habitat for threatened species and/or populations within the Study Area. (Biosis Research, 2009a; **Annex D**).*

Due to this assessment, no further flora or fauna assessments under the TSC Act or EP&A Act are necessary.

3.3 State Environmental Planning Policies (SEPPs)

3.3.1 State Environmental Planning Policy (Major Projects) 2005

The DoP confirms an application under Part 3A of the EP&A Act is the appropriate method to achieve approval for the proposed goaf gas drainage project via issue of the DGR's. The Director General of DoP has declared the proposed works are a 'Major Project' under *SEPP (Major Projects) 2005*, and as such, is the consent authority on behalf of the Minister for Planning.

Appin Colliery is an important economic site to NSW and additional development associated with this location is in accordance with the following aim of *SEPP (Major Projects) 2005*:

"To facilitate the development, redevelopment or protection of important urban, coastal and regional sites of economic, environmental or social significance to the State so as to facilitate the orderly use, development or conservation of those State significant sites for the benefit of the State".

3.3.2 State Environmental Planning Policy (Mining, Petroleum, Production & Extractive Industries) 2007

This SEPP is in place due to the importance of mining to NSW. It sets out aims and objectives to support the mining industry. The aims of the SEPP are:

- To provide for the proper management and development of mineral, petroleum and extractive material resources for the purpose of promoting the social and economic welfare of the State.
- To facilitate the orderly and economic use and development of land containing mineral, petroleum and extractive material resources.
- To establish appropriate planning controls to encourage ecologically sustainable development through the environmental assessment, and sustainable management, of mineral, petroleum and extractive material resources.

This SEPP provides conditional approval for types of related activities without requiring approval under the EP&A Act and guidance to consent authorities on relevant matters for consideration during the determination of a related application.

The proposed goaf gas drainage development is not an exempt, complying or prohibited development as defined by this SEPP. Clause 7(3)(a) of this SEPP identifies developments relating to extractive industry on land on which development for the purposes of agriculture or industry may be carried out with development consent.

Clause 12 of this SEPP details matters which the consent authority must consider prior to issuing a decision regarding an application under the EP&A Act. **Table 3.1** lists and considers these matters in relation to the proposed development.

Table 3.1 – Consideration of Clause 12 of the Mining SEPP

Clause 12 Requirements	BHPBIC Compliance
12(a)(i) - Consideration of existing and approved uses of land in the vicinity of the development.	The existing land use is approved for coal mining and ancillary services in accordance with CCL 767. Land use in the vicinity of the proposed development consists primarily of agriculture and rural residential lots.
12(a)(ii) - Consideration of significant impact on uses that is likely to be the preferred use of land in the vicinity of the development.	The proposed development will not have a significant impact on land use as the surface infrastructure footprint is small and temporary in nature.
12(a)(iii) - Any ways in which the development may be incompatible with any of those existing, approved or likely preferred uses.	As the surface infrastructure has a small footprint, is only temporary in nature and will be adequately fenced to restrict access to each site, the proposed development will be compatible with the surrounding land use.
12(b) - Evaluate and compare the respective public benefits of the development and the land uses referred to above.	The proposed development is necessary to support ongoing mining activities at Appin Colliery, which has significant economic benefits to the surrounding communities and the state in terms of employment and earned revenue. BHPBIC will compensate each landowner whose property will support surface infrastructure associated with the development.
12(c) - Evaluate any measures to avoid or minimise incompatibility between proposed activity and existing use.	There is no significant incompatibility. This is because the land take is so small that it does not restrict agricultural activities on the land. The temporary nature of the proposed development allows the site to accommodate for other uses after drainage of the goaf gas.

Clause 14 of this SEPP directs consent authorities to consider the following matters in relation to the protection of the environment prior to determining a development application under the EP&A Act:

- Impacts on significant water resources, including surface and groundwater resources, are avoided, or are minimised to the greatest extent practicable
- Impacts on threatened species and biodiversity, are avoided, or are minimised to the greatest extent practicable
- Greenhouse gas (GHG) emissions are minimised to the greatest extent practicable
- An assessment of greenhouse gas emissions from the development.

The proposed development intends to avoid impacts to water resources if possible. If this is not possible BHPBIC will take all reasonable measures to minimise the impact to the greatest extent practicable. Potential impacts on water resources are addressed in **Section 8.6**.

The flora and fauna survey undertaken as part of this assessment demonstrates that impacts on threatened species and biodiversity are minimal (Biosis Research, 2009a; **Annex D**).

The project has minimal GHG emissions and will result in a significant net reduction of GHG emissions from Appin Colliery as the majority of the extracted goaf gas is proposed to be reused by the EDL Power Stations to generate electricity. This significantly reduces the impact on climate change by converting the methane gas to carbon dioxide and water vapour via combustion and reducing the NSW reliance on electricity from coal fired power stations (Cardno, 2009; **Annex C**).

Further information on the GHG impacts from the proposed project is available in **Section 8.2** and **Annex C**.

Clause 15 states that a consent authority must consider if the mining related application proposes efficient recovery of the mined resource. The goaf gas drainage development will ensure that coal resources within Longwalls 703 to 704 can be mined on schedule, without cessation or slowing of operations to allow the gas concentration levels to reduce. In effect, this development optimises efficiency of resource recovery.

Assessment of the goaf gas development in relation to Clause 16 of this SEPP is not applicable because this development does not propose to transport any materials.

Clause 17 states that a consent authority must have regard to a potential requirement for the rehabilitation of land following conclusion of mining related activities. BHPBIC will rehabilitate the land upon decommissioning of each borehole and extraction plant locale.

This EA demonstrates the proposed goaf gas drainage development fully complies with relevant sections of SEPP (Mining, Petroleum and Extractive Industries) 2007.

3.4 Regional Environmental Plans (REPs)

3.4.1 Sydney Regional Environment Plan No. 20 Hawkesbury – Nepean River

The goaf gas development is within the area to which this Sydney Regional Plan (SREP) applies. SREP No. 20 Map 39 confirms this as the area for works is within the boundary of the SREP as defined by the heavy black line (refer **Figure 3.1**). The aim of this SREP is to "protect the environment of the Hawkesbury-Nepean River system by ensuring that the impacts of future land uses are considered in a regional context" (Clause 3, SREP No. 20).

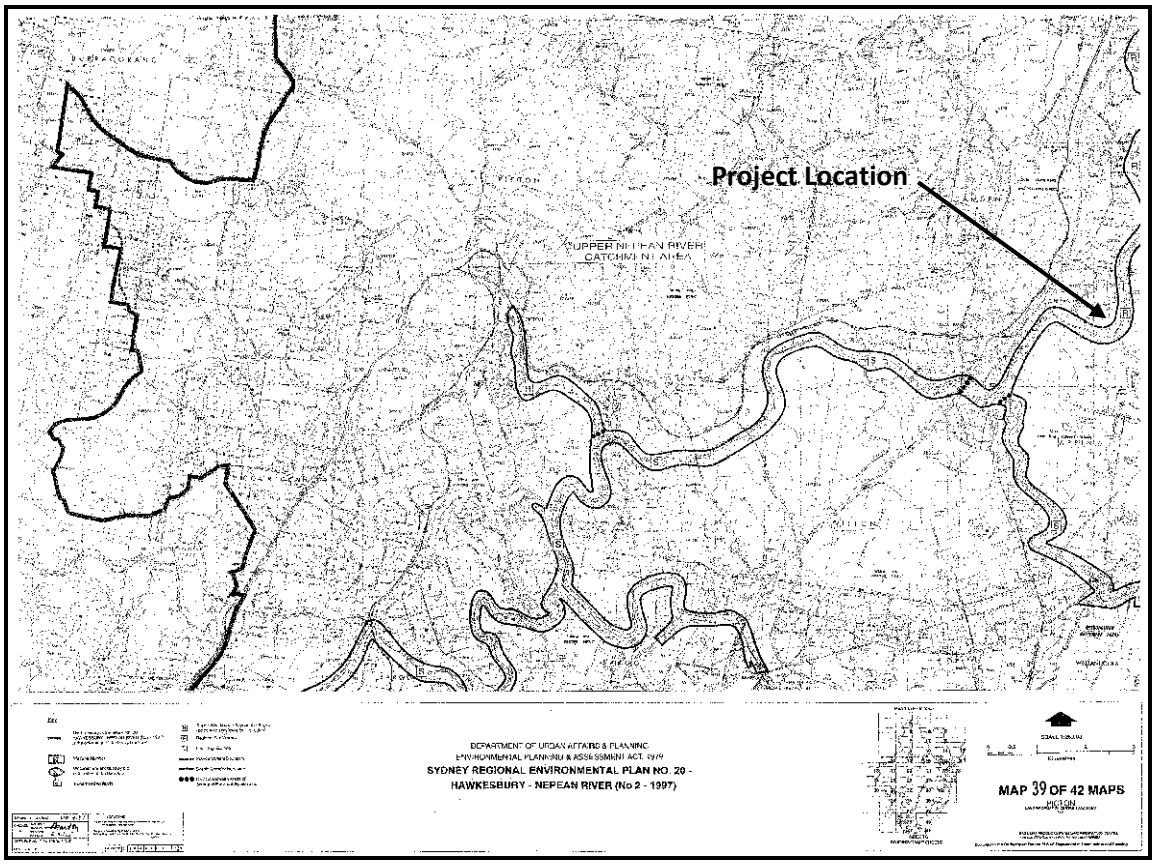


Figure 3.1 – Map 39 of SREP No. 20 Hawkesbury-Nepean River

The proposed goaf gas works meet this aim as this EA considers associated impacts in a regional context. However, the minor nature of this development and the very small extent result in this proposal having no significant impact on anything more than a localised context. The environmental assessments in this report demonstrate that the proposal has minimal impacts even on a local scale.

Clause 6 of the SREP contains specific planning policies and recommended strategies in relation to a variety of potential environmental impacts. **Table 3.2** identifies impacts that are relevant to the proposed goaf gas project and provides an assessment.

Table 3.2 – Consideration of Clause 6 of SREP No. 20

Clause 6 Requirements	BHPBIC Compliance
6(5) – Cultural Heritage	The EA includes an Aboriginal heritage assessment. This demonstrates that the proposal has a minimal affect any cultural items or areas.
6(6) – Flora & Fauna	The EA includes a flora and fauna assessment. This demonstrates that the proposal does not significantly affect any plant, animal or habitat. The location of works is in areas disturbed by previous agricultural or residential activities and developments.

Part 3 of the SREP provides guidance on the permissibility of certain types of development within the SREP boundaries. This goaf gas project is not a type of development that is included in Part 3. Due to this exclusion, the Wollondilly Local Environmental Plan 1991 will define permissible developments, which is discussed in **Section 3.5.1**.

The minor nature of the goaf gas drainage proposal results in the works meeting the requirements of the SREP No.20.

3.5 Local Planning Controls

3.5.1 Wollondilly Local Environmental Plan 1991

The Wollondilly Local Environmental Plan (LEP) 1991 provides planning guidance and controls across the Wollondilly Local Government Area (LGA). The majority of developments requiring consent in this area must meet the requirements and standards in this document to achieve approval. This section assesses the proposed goaf gas drainage project against the requirements of the Wollondilly LEP.

The LEP has numerous aims and objectives in Clause 2, many of these are not relevant to this BHPBIC proposal. The project does meet the following two LEP aims or objectives:

- Aim (J) - to reduce the incidence of rural land use conflict by introducing appropriate planning controls.
- Aim (M) – to maintain the rural natural landscape character of the Wollondilly local government area by providing a balance between agricultural and other land uses.

The proposal meets these aims or objectives because the works will not conflict with rural land use or significantly impact on the rural natural landscape due to the small area of impact and temporary nature.

The LEP controls developments by zoning the LGA according to appropriate land uses. All of the areas that will accommodate surface works for this BHPBIC project are zoned 1 (a1) (Rural "A1" Zone) under the Wollondilly LEP 1991 (refer **Figure 3.2**).

BHPBIC propose to under bore the Main Southern Rail Line and the Hume Highway to join the drainage infrastructure of Longwalls 703 and 704 together allowing a single extraction plant to be located on the western side of both the Rail Line and Highway on the property described as Lot 2 DP 576136. This connection underneath the Highway and Rail Line will also allow the extracted goaf gas from both longwalls to be conveyed to the EDL Power Stations for reuse. The LEP zones the rail line 5 (b) (Special Uses "B" (Railway) Zone) and the freeway 9 (b) (Arterial Road Reservation Zone). The proposed development will only be assessed against the Rural A1 zone as there are no surface works, and therefore no impacts, in the other two zones.

Clause 10 of the Wollondilly LEP 1991 provides the zoning table; this identifies the objectives of the Rural A1 Zone.

Zone No 1 (a1) (Rural "A1" Zone)

1 Objectives of zone

The objectives of this zone are:

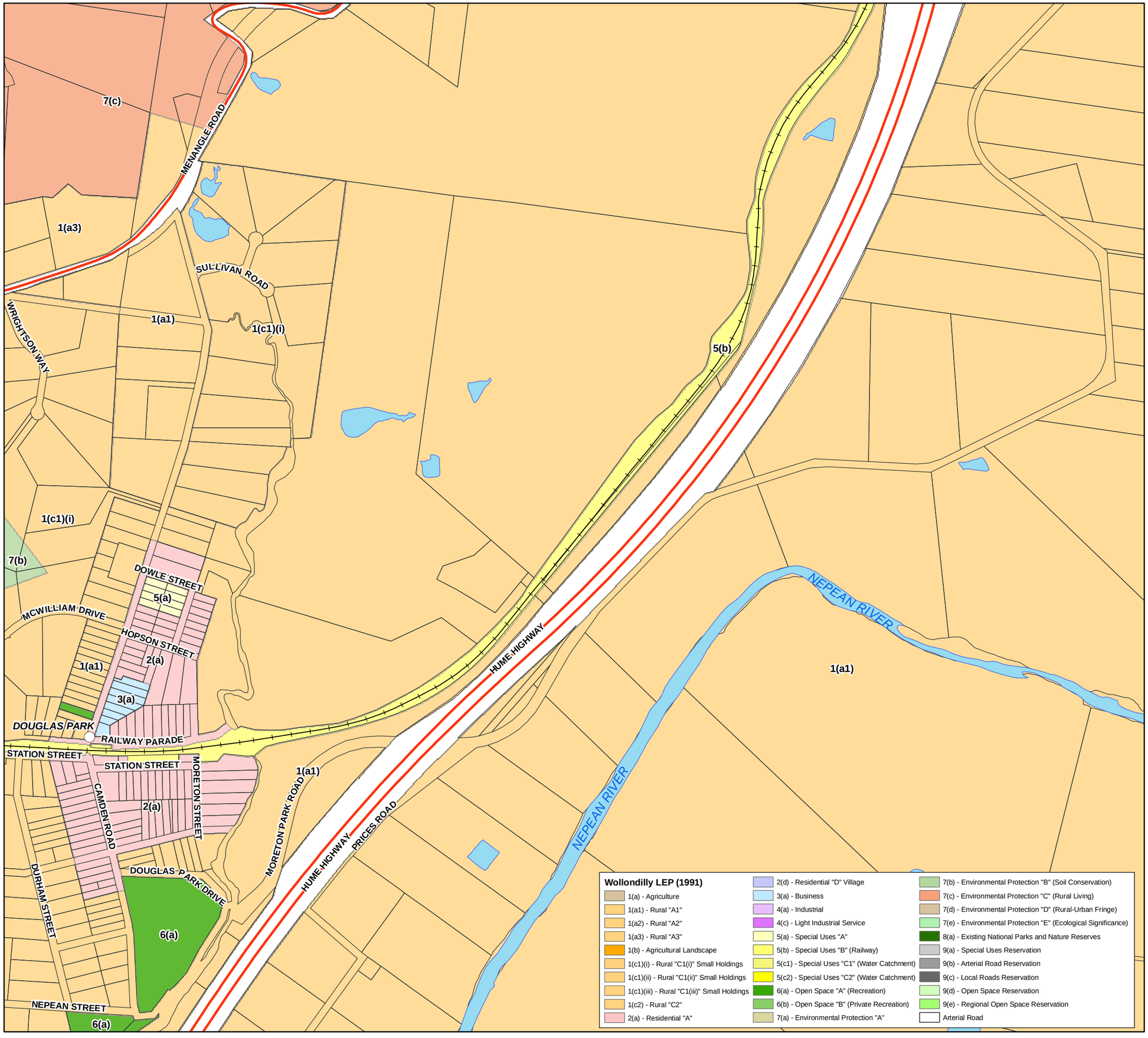
(a) to protect the agricultural potential of rural land and to prevent fragmentation of viable rural holdings, and

(b) to prevent inappropriate, premature and sporadic subdivisions and to ensure consolidation of urban areas so as to enhance the prospect of economic provision of services, and

(c) to prevent, on the fringe of urban areas, subdivision of land into small lots which would prejudice the proper layout of additional urban areas as a result of natural growth, and

(d) to retain the scenic quality and overall character of the land, and

(e) to encourage agricultural activities that are within the rural capability of the land.



bhpbilliton
ILLAWARRA COAL

Zoning Plan

APPIN AREA 7 GOAF
GAS DRAINAGE PROJECT

Legend

- Major Roads
- Railway
- Waterbodies
- Cadastre

FIGURE 3.2

N
W E
S

Scale 1:10,000 (at A3)

Metres
0 125 250 500

Cardno Forbes Rigby

Map Produced by Cardno Forbes Rigby Pty Ltd
Date: 27 May 2009
Coordinate System: Zone 56 MGA/GDA 94
GIS MAP REF: 109033-02_2804_zoning_plan.mxd 02

The proposed project meets objectives (a) and (d) and does not prevent the locality from meeting aim (e) because the proposed works will not fragment rural holdings, have a significant impact on the scenic quality or character of the area and the small area of works still allows the land to be used for agricultural activities.

As the proposed project does not propose any subdivision, aims (b) and (c) are not relevant. The zoning table for the Rural A1 Zone identifies that mining activities are permissible with development consent.

Clause 20 of the LEP applies to the area in which this BHPBIC development is proposed. This clause relates to mine subsidence districts and ensures consideration of impacts to underground mining for all proposals in these districts. As the goaf gas drainage works relate to underground mining activities these will not have any negative impacts on future mining proposals, resulting in the development complying with Clause 20.

As the proposed project is required to ensure the reliability of ongoing underground mining activities associated with Appin Colliery and as the proposal is such a minor development with no significant environmental harm, the proposal is in accordance with the Wollondilly LEP.

3.5.2 Wollondilly Draft Local Environmental Plan 2009

Wollondilly Shire Council's website advises the following:

"The amended Draft Wollondilly Local Environmental Plan 2009 was reported to Council in August this year [2008], where Council resolved to endorse the changes and resolved to place the amended draft plan on public exhibition once the Department of Planning enables Council to do so. Council is also in the process of preparing a new Draft Development Control Plan to accompany the Draft LEP".

Council is waiting for the Department of Planning to give Council the approval to place the Draft LEP on public exhibition. We anticipate that the Draft LEP and Draft DCP will be placed on exhibition before mid 2009". (Source: http://www.wollondilly.nsw.gov.au/planning/1328/12638.html).

The Draft LEP 2009 is not available for review at this time and will not have any statutory weight until it is placed on public exhibition. However, discussions with Council's Strategic Planners indicate that the LEP 2009 does not propose to rezone areas zoned rural under the Wollondilly LEP 1991. Due to this, the proposed project is likely to be permissible under the new LEP.

3.5.3 DCP 36 Development in Rural Areas

The purpose of this Development Control Plan (DCP) is to ensure that development carried out in rural zoned areas does not detract from rural amenity. To help achieve this, the plan provides controls and guidelines in relation to subdivision, agriculture, residential, non-residential developments, and services.

The DCP has controls relating to protection of the natural environment. It seeks to ensure that development takes account of the physical constraints of the land and to promote development in harmony, rather than in conflict, with the environment. Such controls relate to:

- Erosion and sediment control
- Tree preservation
- Heritage.

The proposed project is in accordance with this DCP as relevant erosion and sediment control measures will protect the environment during construction and operation of the extraction plants. The

development will require clearing of approximately 0.16ha of Cumberland Plain Woodland (CPW) on the property described as Lot 7 DP250231, which is owned by BHPBIC. BHPBIC will replace any cleared CPW with local native species characteristic of CPW after the cessation of the goaf gas drainage project.

There are 20 Aboriginal cultural heritage sites situated within the Study Area. Four of these sites; Mountbatten 1 (52-2-3674), Moreton Park Road IA-1 (52-2-3671), Moreton Park Road IA-2 (52-2-3672) and Moreton Park Road OCS-1 (52-2-3673) may be impacted by the installation of the surface pipeline reticulation system. An Aboriginal Cultural Heritage Management Plan (ACHMP) has been developed in consultation with Registered Aboriginal Stakeholders. This Plan outlines the management of Mountbatten 1 (52-2-3674), Moreton Park Road IA-1 (52-2-3671), Moreton Park Road IA-2 (52-2-3672) and Moreton Park Road OCS-1 (52-2-3673), and any other Aboriginal cultural material uncovered during construction for the proposed project. The actual impacts to the Aboriginal heritage sites will be minimal. The ACHMP will ensure that all impacts to the Aboriginal heritage sites are minimised and managed appropriately.

4 Consultation

This section describes the consultation undertaken for the EA and responses.

4.1 Statutory

4.1.1 Department of Planning

BHPBIC have consulted with the Department of Planning (DoP) prior to the lodgement of the Preliminary Environmental Assessment and during the preparation of the DGR's. BHPBIC have responded to any questions and this EA meets the DGR's. BHPBIC will remain in consultation with DoP during the adequacy review, public exhibition and assessment of this EA to ensure timely provision of information and resolution of any concerns.

4.1.2 Department of Environment and Climate Change

The DoP consulted with the Department of Environment and Climate Change (DECC) during the preparation of the DGR's. The DECC requirements were the same as those for the West Cliff Goaf Gas Drainage Project and as these are understood by BHPBIC there was no requirement for in-depth consultation at this stage of the project. In order to ensure the EA thoroughly covers DECC requirements, BHPBIC requested additional guidance in February 2009. DECC advised they would like to see the goaf gas used to produce electricity as this reduces GHG emissions.

4.1.3 Department of Primary Industries

BHPBIC have consulted with the Department of Primary Industries (DPI) regarding this project. DPI are aware of the works and the proposal to mine Longwalls 703 and 704 due to their approval of the Appin Area 7 Longwalls 701 to 704 Subsidence Management Plan (SMP). As noted in **Section 1.1** BHPBIC are also consulting with DPI as they are the approval authority for a separate approval relating to the Longwall 703 Borehole Exploration Program, proposed by BHPBIC.

4.1.4 Department of Water & Energy

DoP consulted with the Department of Water & Energy (DWE) during the preparation of the DGR's. DWE provided thorough feedback in relation to their concerns and expectations. This EA fully assesses all matters contained in DWE's letter dated 23 December 2008. Due to the high level of information in DWE's letter, there has been no necessity for further consultation during the preparation of this EA. DWE will review the EA during the public exhibition period and BHPBIC will respond to any requests for additional information or clarification.

4.1.5 Mine Subsidence Board

BHPBIC have worked with the Mine Subsidence Board during the preparation and subsequent approval of the Appin Area 7 Longwalls 701 to 704 Subsidence Management Plan (SMP) and associated Property Subsidence Management Plans (PSMPs). The Board has not made BHPBIC aware of any additional concerns or requirements in relation to developments associated with the mining of Longwalls 703 and 704.

4.1.6 Roads and Traffic Authority

BHPBIC have consulted with the Roads and Traffic Authority (RTA) with respect to the proposed project and the potential impacts to the Hume Highway. BHPBIC will seek consent from the RTA to carry out the necessary activities within the road reserve for the under boring of the Hume Highway to connect the goaf gas drainage infrastructure for both Longwalls to the existing underground connection to the EDL Power Station. The RTA have not objected to the proposal to under-bore the Hume Highway.

4.1.7 Australian Rail Track Corporation

BHPBIC propose to bore a goaf gas drainage line under the Main Southern Rail Line to join the two drainage aspects of this project. This proposal requires approval from Australian Rail Track Corporation (ARTC) to ensure no impact on the rail line. BHPBIC are conducting ongoing consultation with the ARTC regarding this matter and are working towards obtaining this approval as there have been no objections to date.

4.1.8 Integral Energy

BHPBIC are in consultation with Integral Energy and propose to connect the preferred extraction plant located on the property described as Lot 2 DP576136, to the existing 11kVA mains located on the adjacent property described as Lot 1 DP576136. BHPBIC are conducting ongoing consultation with Integral Energy regarding this matter and are working towards obtaining this approval as there have been no objections to date.

4.1.9 Wollondilly Shire Council

Illawarra Coal has informally discussed this project with senior staff from Wollondilly Shire Council during project development. No formal consultation has occurred or feedback has been offered by Wollondilly Shire Council.

Refer to **Annex I** for further detail of agency consultation.

4.2 Community

BHPBIC makes the community aware of proposed developments relating to Appin Colliery via the Appin Area Community Working Group (AACWG; BHPBIC, 2009). Additionally the PEA and DGR's are available on the DoP web site (DoP, 2009) and this EA is available via the BHPBIC website (http://www.bhpbilliton.com).

4.2.1 Appin Area Community Working Group.

The BHPBIC website advises:

"The Appin Area Community Working Group (AACWG) is a community consultative forum working with Illawarra Coal.

Established in 1998 (known then as the West Cliff Community Forum), the Group's purpose is to enable an ongoing, two-way flow of information between the community and Illawarra Coal. The AACWG's focus is to ensure the sustainability of the community around Illawarra Coal's operations. This includes environmental, social and economic sustainability.

The Appin Area includes the towns and communities of Appin, Douglas Park, Wilton, Menangle and the southern parts of Campbelltown.

The Group is regarded as important both by the community and Illawarra Coal to share information, achievements and concerns".

BHPBIC and the AACWG discussed the proposed general matters relating to the goaf gas drainage project at the meeting on the 16 December 2008 and 16 June 2009. This made the AACWG aware that BHPBIC is reviewing options to drain the goaf gas from Appin Colliery Area 7 Longwalls 703 and 704. The AACWG also discussed the possibility of sending the goaf gas to the EDL methane fired power station to produce electricity. The proposal did not raise objections from the community group. BHPBIC also has information publicly available at the BHPBIC Appin Community Office located at the Appin shops. The AACWG will remain informed by BHPBIC throughout the approval and construction process.

BHPBIC also operates a 24 hours, 7 days per week community telephone service for the community to contact BHPBIC to advise of concerns, discuss BHPBIC operations and request information. Information on the Appin Area 7 Goaf Gas Drainage project is available via this service, and it can be contacted on 1800 102 210.

4.3 Affected Landholders

BHPBIC has consulted with, and obtained written agreement from, all landowners on which the proposed goaf gas drainage activities will take place.

BHPBIC has also informed some nearby neighbours of the proposal.

5 Existing Environment and Proposed Development

This section describes the existing environment associated with this application and the proposed development.

5.1 Existing Environment

5.1.1 Appin Area 7

Appin Area 7 is located to the northeast of Douglas Park in the Wollondilly LGA. It includes a section of the Nepean River (south of Ousedale Creek to the north of Leafs Gully), part of Foot Onslow Creek, Navigation Creek, Harris Creek and a number of unnamed creeks and drainage lines associated with these creek lines and the Nepean River.

Appin Area 7 includes an area to the west of the Nepean River that extends to the foothills of the Razorback Range. This area is largely cleared for agricultural purposes and is traversed by both the Hume Highway and the Main Southern Railway. Appin Area 7 also includes a smaller area to the east of the Nepean River although Longwalls 703 - 704 do not extend into this area.

Much of the land throughout the whole of Appin Area 7 has been cleared for grazing (the land is used for light grazing by cattle and horses), rural residential or similar purposes. The topography of the land is generally flat to undulating, with the exception of the Nepean River Gorge and the foot slopes of the Razorback Range. The closest point of this catchment area to the project area is at Broughtons Pass Weir, which is located approximately 5 kilometres to the south.

Appin Area 7 encompasses land owned by private landowners, commercial landowners and state government.

5.1.2 Project Area

The works proposed for the goaf gas drainage project described herein will cover only a small portion of Appin Area 7. The works footprint will be concentrated primarily within the land area over Longwalls 703 and 704. The general layout and works footprint of the proposal is illustrated in **Figure 5.1** and **Annex B**. However, it is noted that the works would be staged such that individual wells come on line in series and are then de-commissioned in a progressive fashion as each well becomes redundant. As such, the extent of operations relating to the proposal will not cover the entire works footprint at any stage of the project.

Affected properties falling within the footprint of the proposed goaf drainage work includes the following properties described as:

- Lot 1 DP576136
- Lot 2 DP576136
- Lot 1 DP915066
- Lots 6 and 7 DP250231
- Lot 1, 2 and 3 DP838568.

Details of consultation with affected land holders are provided in **Section 4.3**.

Land use within the project area is consistent with that generally found within Appin Area 7, being rural residential and mixed agriculture. The only public roads within the project area are Moreton Park Road and the Hume Highway. The Main Southern Rail Line also pass through the project area (refer **Figure 5.1**). Further details of the project area are provided in **Section 2**.

5.2 Existing Goaf Gas Drainage

There is no existing goaf gas drainage infrastructure or operation for Appin Area 7 to date. There is an existing approved goaf gas drainage plant located at West Cliff Colliery Area 5, draining goaf gas from Longwalls 32, 33 and 34 (*West Cliff Mine Surface Goaf Gas Drainage Project Environmental Assessment, OEC 2008*).

5.3 Proposed Goaf Gas Drainage

Every coal mine with high coal seam gas concentrations has to put in place procedures for controlling the concentrations of methane gas. BHPBIC propose to drain goaf gas from the goaf areas of Appin Mines' Area 7 Longwalls 703 and 704 by drilling boreholes between the goaf and the surface ground level. The goaf gas will be drawn up the boreholes by an extraction plant located on the surface, to ensure underground concentrations remain well below 1.25% and minimising gas within the goaf from entering the workings of the mine and the Mine Ventilation Air (MVA).

The objectives of the goaf gas drainage project are to:

- Implement a procedure to safely drain the goaf gas;
- Safely capture, reticulate and manage the goaf gas;
- Minimise impacts on cultural heritage and the natural and man-made environment; and
- Minimise Greenhouse Gas (GHG) emissions.

This section provides an overview of the construction, operational and decommissioning phases of the project.

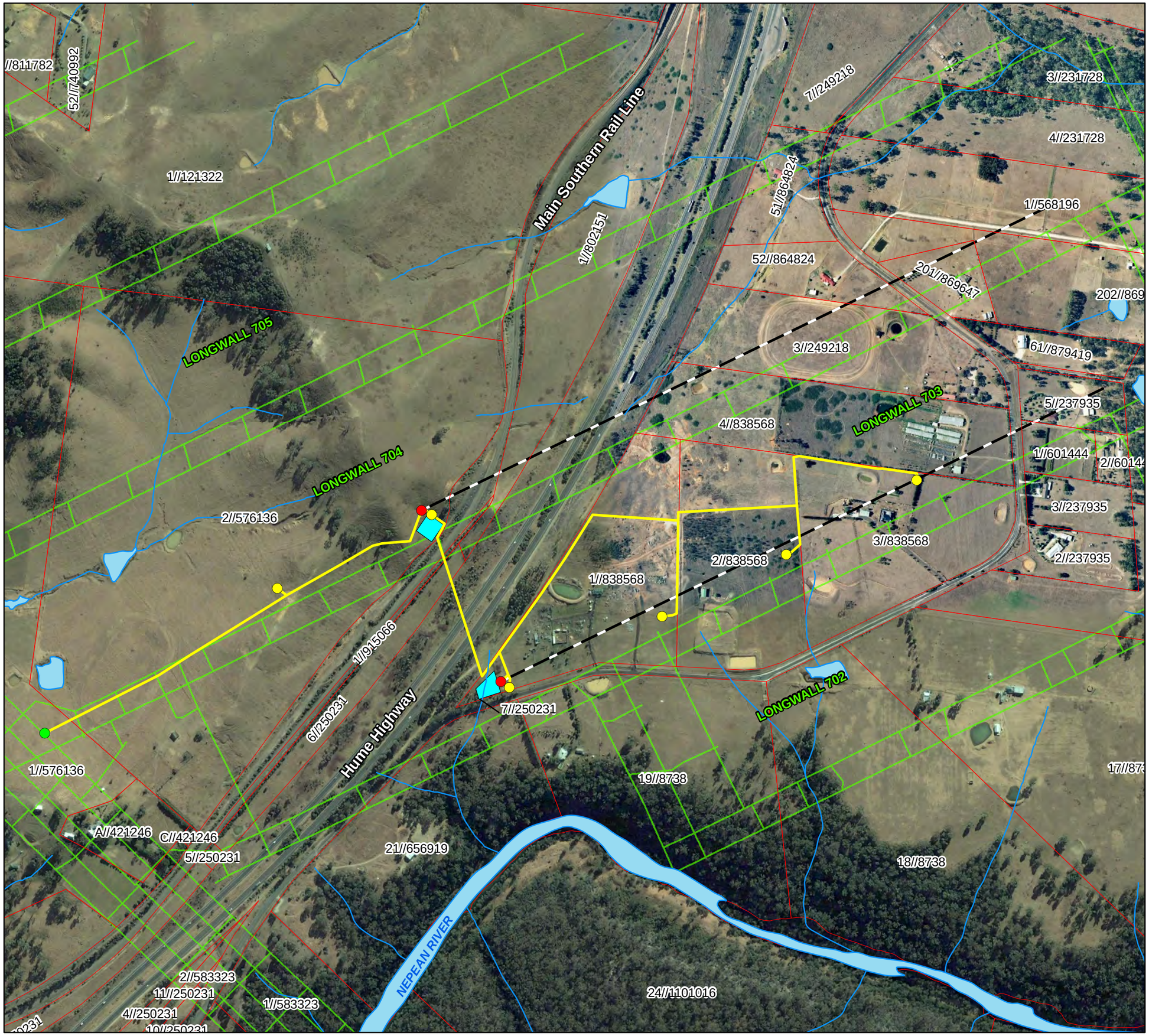
5.3.1 General Overview

The proposal will consist of a series of boreholes drilled to a depth of ~500m through which methane gas will be drained from the goafs of Longwalls 703 and 704 via a surface pipeline reticulation system connected to the extraction plant. After being extracted by the extraction plant, the majority of the methane gas is proposed to be piped back underground to the existing underground connection to the EDL Power Station where it will be re-used to generate electricity.

Irrespective of the goaf gas management option, a small amount of goaf gas will be required to be vented to the atmosphere as a safety precaution via a vertical gas discharge stack. If borehole gas flows exceed the capacity of the extraction plants and associated management infrastructure and/or during plant breakdown/maintenance periods, the excess goaf gas will be required to be vented onsite. If the proposed underground connection to the EDL Power Stations is unreliable or unfeasible and large quantities of goaf gas is continually vented to the atmosphere for prolonged periods, BHPBIC may implement large capacity flaring units to flare the goaf gas onsite (refer **Section 5.3.5**).

The layout of the boreholes, surface pipeline reticulation system and proposed extraction plants are shown in **Figure 5.1** and **Annex B**. The general layout has been determined based on landowner agreements and existing site constraints and has sought to avoid existing infrastructure, including farm dams, roads/highways, access roads and buildings, whilst minimising the impact to the environment, Aboriginal and non-Aboriginal cultural items.

BHPBIC has consulted with and obtained written agreements from landowners/landholders on which the development is proposed prior to this application. The proposed infrastructure will be temporary and appropriately de-commissioned and the site rehabilitated upon completion of the project. The facilities only require a small area that is usually in an open paddock and sited to avoid and/or minimise environmental impacts. The surface facilities will be fenced to restrict access to these sites.



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General Layout Plan

APPIN AREA 7 GOAF GAS DRAINAGE PROJECT

Legend

- MRD Borehole - 2
- Vertical Borehole - 6
- Downhole - 1
- Longwalls
- MRD Planview Trajectory
- Surface Pipeline Reticulation System
- Watercourses (LPI)
- Proposed Extraction Plant Locations
- Cadastre (LPI) 1/838568 Lot//DP
- Waterbodies (LPI)

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FIGURE 5.1

Scale 1:7,000 (at A3)

Metres
0 125 250

Cardno Forbes Rigby

Map Produced by Cardno Forbes Rigby Pty Ltd
Date: 26 June 2009
Coordinate System: Zone 56 MGA/GDA 94
GIS MAP REF:
109033-02-2805_Area7_Goaf_Gas_Drainage_Project.mxd 03

Aerial Photography supplied by Google Earth Pro and associated third party suppliers

Unless noted, all data provided by BHP

5.3.2 Gas Extraction Plants

The extraction plants use a vacuum pump to draw a controlled flow of methane gas from both the vertical wells and MRDs boreholes. The extraction plant has the following components:

- Vacuum pump with electric motor and inlet/outlet manifolds
- Gas/water separator,
- Flow control re-circulation
- Remote discharge stack, and
- Surface pipeline reticulation system associated with vent stack and connection to well heads.

For the proposed project, the preferred option consists of a single gas extraction plant to be installed on the property described as Lot 2 DP576136, as shown in **Figure 5.1**. The proposed extraction plant will be situated in a centralised location so that it may draw gas from multiple wells for both Longwalls 703 and 704, which are proposed to be connected by a surface pipeline reticulation system. Refer to **Figure 5.2** for a diagram of a typical extraction plant compound layout.

In order for the one extraction plant, located on Lot 2 DP576136, to extract goaf gas from both longwalls, BHPBIC propose to under bore the Hume Highway and the Main Southern Rail Line in order to connect the extraction plant to the reticulation pipeline and wells servicing Longwall 703.

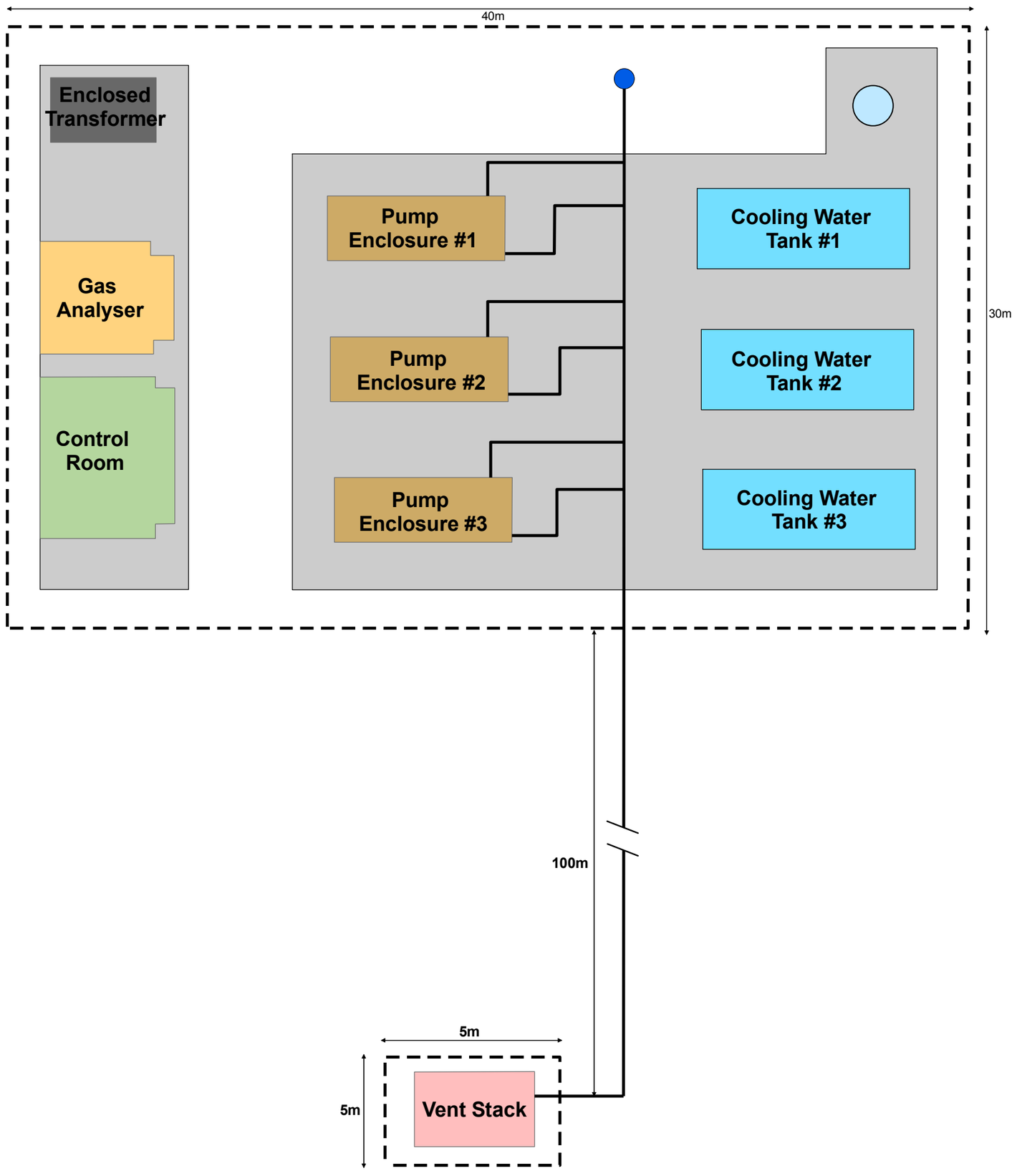
This represents the preferred option for the proposed project as it will cause the least disruption to property owners and impact to the environment. BHPBIC has consulted with and obtained written agreements from all affected landowners, and will seek relevant approvals from the Roads and Traffic Authority (RTA) and the Australian Rail Track Corporation (ARTC) for the proposed works.

Figure 5.3 represents the general area of the preferred extraction plant location within Lot 2 DP576136. For the proposed project, a mobile, semi-trailer mounted extraction plant is proposed to be used, as shown in **Figure 5.4**. Access to the plant compound will be restricted via the use of fencing around the plant compound, which has a maximum area of approximately 30m x 40m.

BHPBIC are in consultation with Integral Energy and propose to connect the preferred extraction plant located on the property described as Lot 2 DP576136, to the existing 11kVA mains located on the adjacent property described as Lot 1 DP576136.

Electrical power is proposed to be provided to the preferred extraction plant via underground power cables located adjacent to the section of the surface pipeline reticulation system easement from the downhole on the property described as Lot 1 DP576136 to the extraction plant located on the property described as Lot 2 DP576136 (refer **Figure 5.1**).

The use of electrical power for the preferred extraction plant will further minimise GHG and noise emissions associated with proposed project and this represents BHPBIC's preferred option. If the connection to the electricity grid at the preferred extraction is unreliable or unfeasible, BHPBIC propose to use an on-board diesel or duel fuel (gas/diesel) generator to power the plant.



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Typical Extraction Plant Compound Layout

APPIN AREA 7 GOAF GAS DRAINAGE PROJECT

Legend

- Well Head
- Reserve Water Tank
- Pipe
- Fence
- Border
- Control Room
- Cooling Water Tank
- Enclosed Transformer
- Gas Analyser
- Pump Enclosure
- Vent Stack

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FIGURE 5.2

This Plan is not to Scale

Cardno Forbes Rigby

Map Produced by Cardno Forbes Rigby Pty Ltd
Date: 29 June 2009
GIS MAP REF: 109033-02-2808_GeneralAssembly.mxd 02

Figure 5.3 – Proposed Preferred Extraction Plant Location with Lot 2 DP576136

Figure 5.4 – Typical Trailer Mounted Gas Extraction Plant

A second back up or contingency extraction plant has been also proposed to be installed on the property described as Lot 7 DP250231 (refer **Figure 5.5**), should under boring the Hume Highway and Main Southern Rail Line not be approved or prove unreliable or unfeasible. The contingency extraction plant may also be established for a short period if construction of the under-bore of the Hume Highway and Main Southern Rail Line has not yet been completed. Any goaf gas extracted during this period would be vented to atmosphere. Should the contingency extraction plant be utilised, the plant itself will be of similar capacity and reliability to that used for the preferred option, though it will be powered by an onboard diesel or duel fuel generator.

Figure 5.5 – Proposed Contingency Extraction Plant Location within Lot DP250231

Both the preferred and contingency extraction plant sites may require the importation of fill (most likely crushed sandstone or coalwash) and some minor "cut and fill" or excavation for site establishment purposes.

If the contingency extraction plant is required to be utilised due to the unsuccessful under boring of the Highway and Rail Line, the management of the goaf gas extracted by this extraction plant will slightly alter from that of the preferred extraction plant option.

Without the section of the reticulation pipeline crossing underneath the Highway and Rail Line and thus connecting the goaf gas drainage infrastructure for both longwalls to the one preferred extraction plant located on Lot 2 DP576136, the contingency extraction plant located on Lot 7 DP250231 will be required to extract goaf gas from the infrastructure servicing Longwall 703 (refer **Figure 5.1**).

There is no downhole available above Longwall 703 to connect into the underground connection to convey the extracted goaf gas to the EDL Power Stations for reuse. Therefore, without the ability to send the majority of the extracted goaf gas from the contingency extraction plant to the EDL Power Stations via the connection underneath the Hume Highway and Main Southern Rail Line to the downhole on Lot 1 DP576136, the majority of this extracted goaf gas will be either flared or vented directly to the atmosphere at this site.

The implementation of flaring units and ventilation discharge stacks for both the preferred extraction plant and contingency extraction plant options is discussed further in **Section 5.3.5**.

The extraction plants will be remotely operated by the mine and will not be permanently manned. Sufficient monitoring and safety systems will be installed such that the safe operation of the plant can be ensured for the duration of the project. Radio communications will be used to communicate with the plant and control operations.

The extraction plants will be in operation for 24 hours per day, seven days per week. The diesel or duel fuel generator powering the plant will require filling each week by a mobile diesel tanker. Expected fuel usage is in the order of 3500 L/week.

The extraction plants will have a maximum capacity of 800L/s. The plant will extract gas from multiple vertical wells and MRD boreholes at the same time as each well will come online in series as the longwall face passes beneath each well and the goaf area is created. Expected lifetime of each of the vertical wells is approximately 12 weeks and each of the MRD boreholes is approximately 44 weeks.

The vast majority of the goaf gas extracted via the extraction plant is proposed to be reticulated back underground via the downhole on Lot 2 DP576136 to the existing underground connection to the EDL Power Stations.

However, irrespective of the goaf gas management option implemented, a small amount of goaf gas may be required to be vented to the atmosphere as a safety precaution via a vertical gas discharge stack. If well/borehole gas flows exceed the capacity of the extraction plants and associated management infrastructure and/or during plant breakdown/maintenance periods, the excess goaf gas will be required to be vented onsite, via the discharge stack. If the proposed underground connection to the EDL Power Stations is unreliable or unfeasible and large quantities of goaf gas is continually vented to the atmosphere for prolonged periods, BHPBIC may implement large capacity flaring units to flare the goaf gas onsite (refer **Section 5.3.5**).

5.3.3 Boreholes and Well Heads

Methane gas is proposed to be drained from the goaf areas of the longwalls via boreholes. Two types of boreholes have been proposed for this project:

- Six vertical boreholes, comprising a 250mm vertical borehole drilled to within 5m of the top of the Bulli coal seam roof (average depth 500m). A seventh vertical borehole will be drilled over the workings of Longwall 704 in this same fashion; however, this borehole will not be utilised as a goaf gas drainage well but as a downhole to convey the extracted gas back underground to the existing connection to the EDL Power Stations (refer **Section 5.3.4**).
- Two Medium Radius Drilled (MRD) boreholes, comprising a 250mm borehole that starts vertically and is steered to a near horizontal alignment for some distance within the Scarborough Sandstone section of the strata above the coal seam roof. The MRD borehole will have a number of branches to improve gas flow which end approximately 5m above the coal seam roof.

An illustration showing the two types of boreholes is provided in **Figure 5.6** and **Figure 5.7** and the locations of the boreholes is shown in **Figure 5.1** and **Annex B**.

This EA recognises that the four vertical wells and one MRD borehole over Longwall 703 may already have a separate approval granted under the *Mining Act 1992*.

The Longwall 703 Borehole Exploration Program includes four vertical boreholes drilled down to the roof of the Bulli coal seam and one MRD steered hole drilled from the surface down and horizontally within the base of the Scarborough Sandstone. The vertical boreholes will be geophysically logged, providing necessary geological and geotechnical information on the strata in the area and in particular the sandstone horizon in which the horizontal MRD hole is targeted within. Information from the vertical holes will be used to detail the design of the MRD horizontal hole. The horizontal exploration hole is planned to pass through a number of inferred structural and geological features that are

required to be investigated for both position and the geotechnical character to determine the possible impact on the management of the Appin underground coal mine.

Upon approval of this Part 3A application, the boreholes associated with the Longwall 703 Borehole Exploration Program will be converted to goaf gas drainage wells for the purpose of the Appin Area 7 Goaf Gas Drainage Project.

The MRD boreholes will be cased and grouted with welded or threaded steel casing from the ground surface of the borehole to the end of the radial or build section where the horizontal alignment of the borehole starts, an approximate depth of 450m underground (refer **Figure 5.6**).

The vertical boreholes will be cased with steel casing and grouted from the ground surface of the well to the top of the Bulgo Sandstone section of the strata above the coal seam, an approximate depth of 250m underground (refer **Figure 5.7**).

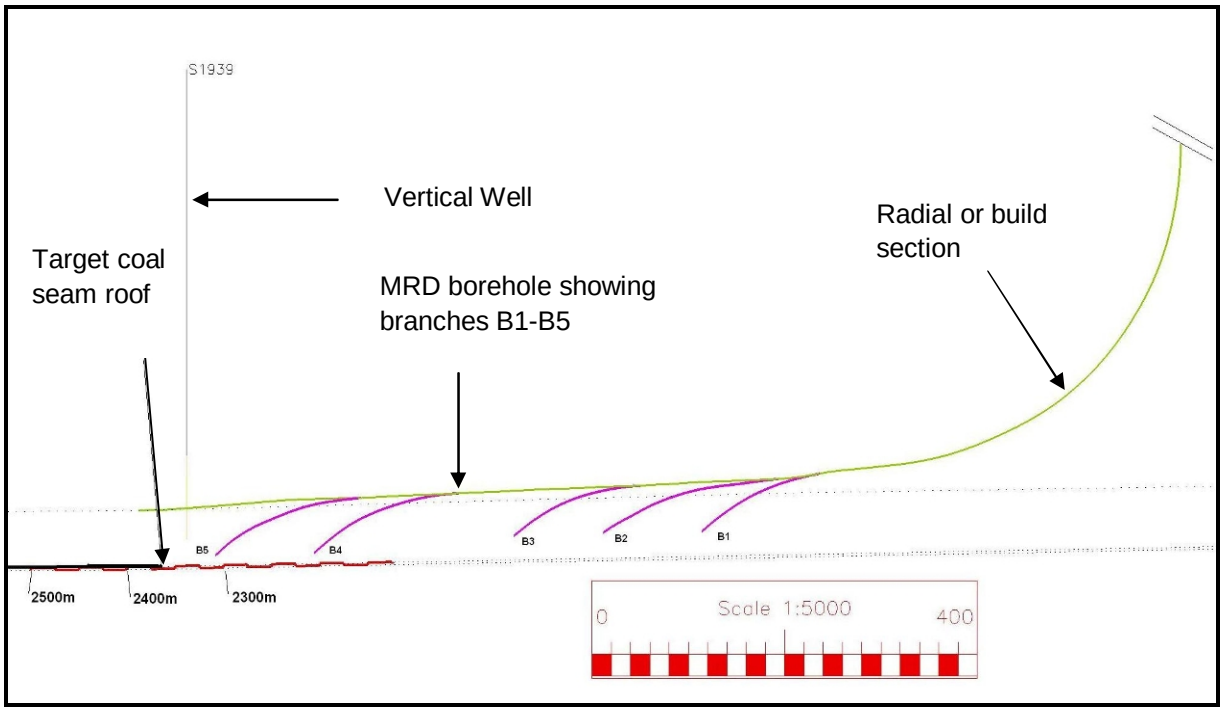


Figure 5.6 – Example Cross Sections of a MRD Borehole

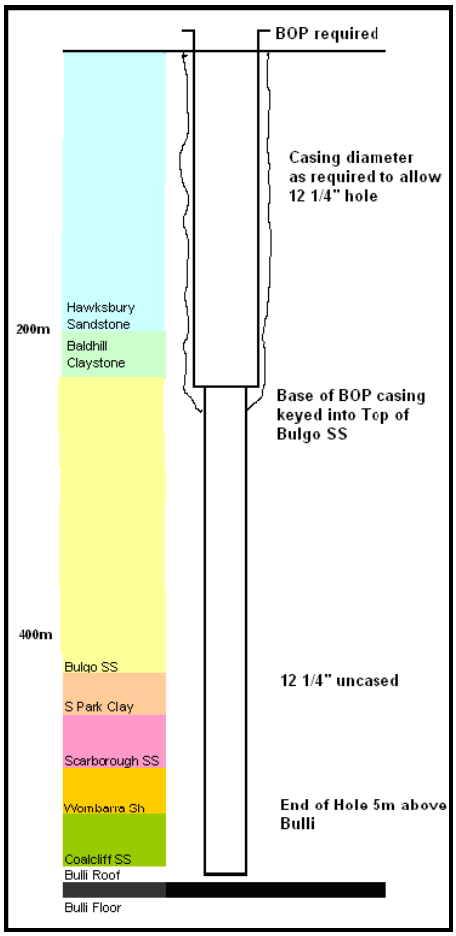


Figure 5.7 – Detail of a Vertical Well

The vertical wells/boreholes and MRD boreholes are drilled from the surface using a mobile drilling rig. A temporary fence would surround the rig and associated equipment during drilling.

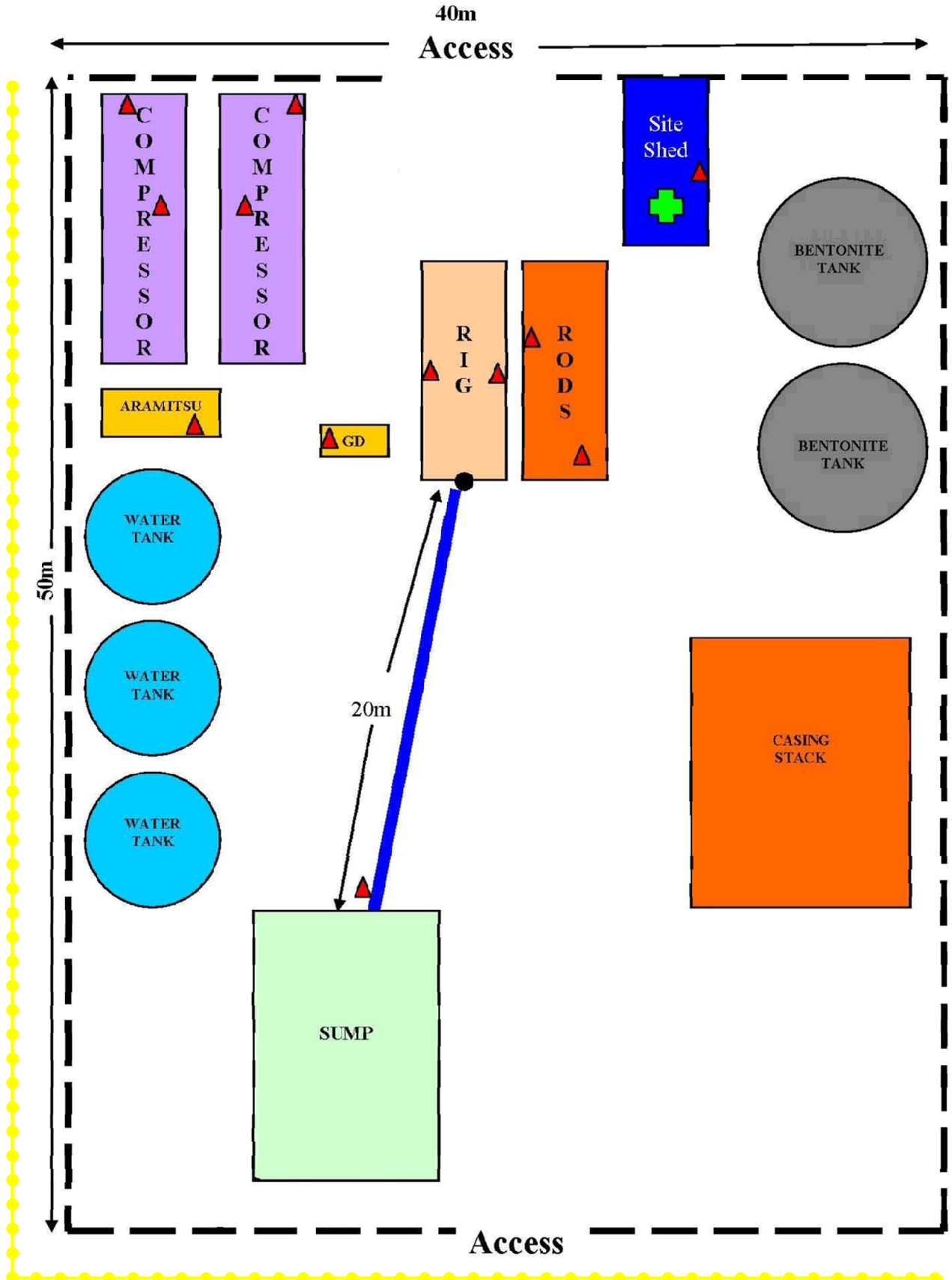
The duration of drilling for each of the two types of boreholes is as follows:

- Vertical wells – duration approximately three weeks; operational hours six days/week during daylight hours.
- MRD boreholes – duration approximately six weeks; operational hours 24 hours/day, seven days/week.

For the drilling of each vertical borehole, a single pond will be excavated within each drilling compound to act as a drilling sump. The approximate dimensions of the pond/sump are 15m length x 5m width x 3m depth and the approximate volume of water used throughout the drilling process of approximately 2 weeks is 10,000L per vertical borehole over the two week drilling period (refer **Section 8.6** for details on water resources).

For the drilling of each MRD borehole, which is a much more intensive drilling process, two ponds of similar dimensions as for the vertical boreholes will be excavated within each drilling compound to act as drilling sumps. The approximate volume of water used throughout the MRD drilling process is therefore 20,000L per MRD borehole over approximately six weeks (refer **Section 8.6** for details on water resources).

Figures 5.8 and **5.9** illustrate the typical layouts of a vertical borehole drilling compound layout and an MRD borehole drilling compound layout respectively.



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Typical Vertical Borehole Drilling Compound Layout

APPIN AREA 7 GOAF
GAS DRAINAGE PROJECT

Legend

- Fire Extinguisher
- Well Head
- First Aid
- Sediment Fence
- Fencing
- Blooie Line

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FIGURE 5.8

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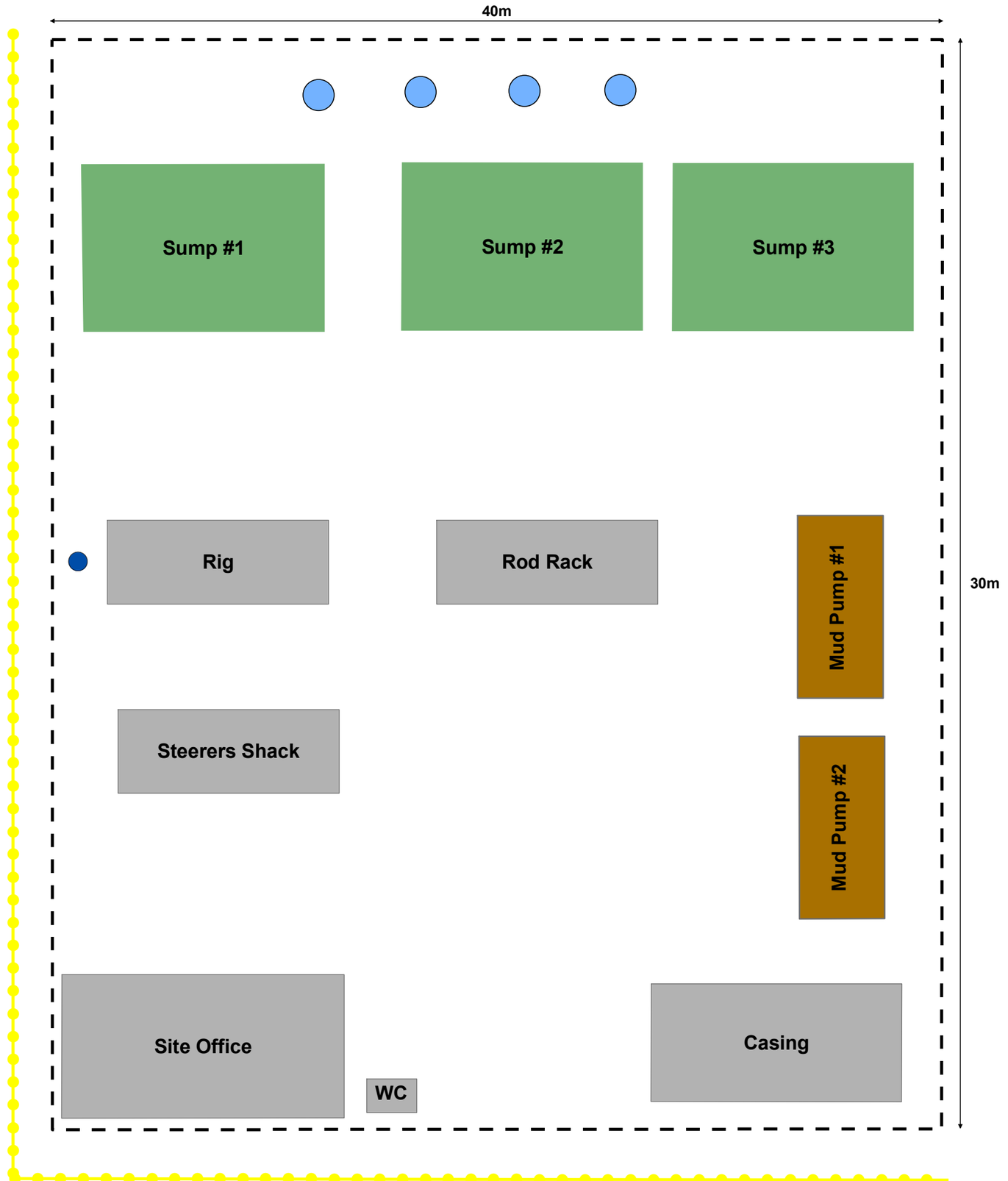

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Typical MRD Borehole Drilling Compound Layout

APPIN AREA 7 GOAF GAS DRAINAGE PROJECT

Legend

- Well Head
- Water Tank
- Fencing
- Sediment Fence
- Sump
- Mud Pump
- Car Park
- Other Buildings

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FIGURE 5.9

This Plan is not to Scale

Cardno Forbes Rigby

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Date: 29 June 2009
GIS MAP REF: 109033-02-2807_DrillingCompound.mxd 02

Water used in both vertical and MRD drilling will be delivered to site by water truck and sourced from an Authorised user of Sydney Water.

The spoil from drilling of the boreholes will stockpiled onsite in the sumps provided for each drilling compound. These sumps will be dredged on a regular basis and the spoil from each borehole is proposed to be trucked to the West Cliff Emplacement Area at the West Cliff Mine for reuse as capping material on the rehabilitated stages of the Emplacement Area or for site rehabilitation purposes as part of the proposed project.

Approximate quantities of spoil produced from each borehole may be in the order of five tonnes per day over a period of two weeks for each vertical borehole and six weeks for each MRD borehole.

On the surface, the two borehole types will appear identical. At each wellhead, the following equipment is installed:

- Shut-off valve
- Non-return valve
- Flame trap
- Gas monitoring fittings
- Polyethylene pipeline to transfer the gas to the extraction plant via the surface reticulation system,
- Noise wall
- Fencing to prevent unauthorised access.

The wellheads are located at the top of the wells and boreholes on the surface. At the wellhead is a 250mm ANSI 300lb gate valve, used as the main isolation (i.e. shut off) valve. Above this are a 90 degree elbow and 10 inch butterfly valve, then a flanged adapter to the 14 inch victualic pipe line and black polyethylene reticulation pipeline. The gas flow passes through a flow measurement venturi device to monitor flow rates and the flame arrestor. It is anticipated that each vertical well may generate an average flow of around 400L/s of goaf gas for a period of approximately 4 to 12 weeks, although it is noted that well flows may be highly variable. The MRD boreholes will be online for a much longer period than the vertical wells, due to their length. Expected MRD boreholes drainage timeframe is approximately 44 weeks per borehole. Refer to **Figure 5.10** for a typical well head installation.

Figure 5.10 – Typical Wellhead Installation

5.3.4 Surface Pipeline Reticulation System

A surface pipeline reticulation system will be installed to allow the extraction of goaf gas from multiple wells from the one extraction plant. A section of this pipeline reticulation system will also transfer the extracted goaf gas back underground via the proposed downhole on the property described as Lot 1 DP576136, to join the existing connection to the EDL Power Stations (refer **Figure 5.1** and **Annex B**).

As discussed in **Section 5.3.2**, a section of the surface pipeline reticulation system is proposed to cross underneath the Hume Highway and Main Southern Rail Line to connect the drainage infrastructure for both longwalls to the preferred extraction plant located on Lot 2 DP576136 (refer **Figure 5.1**). This connection underneath the Highway and Rail Line will allow the use of the one preferred extraction plant and the majority of the extracted goaf gas from both longwalls to be conveyed to the EDL Power Stations via the abovementioned downhole. BHPBIC have consulted with the RTA and ARTC in relation to the proposed under boring works (refer **Section 4.3** and **Annex I**).

This connection is proposed to be constructed by under-boring the Highway and main Southern Rail Line to a depth of approximately 10m below the road infrastructure. Works will be undertaken outside the road reserve and on properties ,described as Lot 7 DP250231 or Lot 2 DP576136 within the nominated extraction plant locations (refer **Figure 5.1** and **Annex B**). Expected timeframes for under-boring is approximately 10 days and this will occur during daylight hours, six days per week. BHPBIC will apply to the RTA for s138 approval under the Roads Act for this activity.

The horizontal borehole underneath the Highway and Rail Line will be approximately 300mm in diameter and will be cased with black polyethylene pipeline for the entire length.

The spoil from the under-boring will be managed in the same fashion as that of the vertical and MRD boreholes, in that it is proposed to be trucked to the West Cliff Emplacement Area for reuse as

capping material for the rehabilitated stages of the Emplacement Area or for site establishment or rehabilitation purposes as part of the proposed project.

Selection for the location of the proposed pipelines is the shortest distance between surface wells to permit the interconnection to the preferred extraction plant location whilst minimising disruption to the property owner and impact to the environment. The majority of the surface pipelines follow existing boundary fence lines and the approximate total length of surface pipeline to be laid for the proposal is 3700m. BHPBIC has obtained written approval from all relevant property owners for this infrastructure and associated works.

Pipes will range from 250mm at the wells up to 600mm for the main trunk pipeline to the extraction plant. Minor trenching works will be undertaken and the proposed surface pipeline reticulation system will be located within the trench just below the surface ground level where possible. The trench will then be backfilled to cover the pipeline and allow access over the pipeline easement. Approximate dimensions of the trenches are 650mm in width and 1400mm in depth.

5.3.5 Best Practice Management of Extracted Goaf Gas

Extracted gas from the goaf area of Longwalls 703 and 704 will be managed via the following three methods, commensurate with current industry best practice, in order of preference:

- Electricity Generation – the vast majority of goaf gas is proposed to be piped to the EDL Power Stations and reused for electricity generation, and/or
- Onsite Flaring – gas may be flared onsite at the using mobile flaring units, and
- Onsite Venting – a small amount of goaf gas will be vented onsite at the extraction plant via a remote ventilation stack.

The vast majority of the extracted goaf gas is proposed to be piped to the EDL Power Station for utilisation as electricity generation via the downhole located on the property described as Lot 2 DP576136.

A small amount of goaf gas may be vented to the atmosphere via a remote ventilation stack, regardless of the management option selected by BHPBIC, for emergency venting upon failure/shut down of gas surface management equipment or in the event that gas flow exceeds the capacity of the extraction plant. A breakdown of the likely distribution of goaf gas for the preferred goaf gas management option is provided in **Table 5.1**.

Table 5.1 – Likely Distribution of Gas Streams for Preferred Goaf Gas Management Option

Extraction Phase	Percentage of Extracted Gas	
	EDL Power Station	Onsite Venting
MRD and Vertical Boreholes	99%	1%

As discussed in **Section 5.3.2**, if the under boring of the Hume Highway and Main Southern Rail Line is not approved or proves unfeasible or unreliable, BHPBIC propose to install a second extraction plant on the property described as Lot 7 DP250231. As the contingency extraction plant will not be connected to the downhole on Lot 1 DP576136 and thus the underground connection to the EDL Power Stations, the extracted goaf gas from the contingency extraction plant may be managed by flaring the majority of it onsite, via the use of large capacity flaring units. A breakdown of the likely distribution of goaf gas for the contingency goaf gas management option is provided in **Table 5.2**.

Table 5.2 – Likely Distribution of Gas Flow Streams for Contingency Extraction Plant Location

Extraction Phase	Percentage of Extracted Gas	
	Flared Onsite	Onsite Venting
MRD and Vertical Boreholes	99%	1%

A description of each of the processes listed above is provided in the following sections. Further details on the related GHG emissions are provided in **Section 8.2** and **Annex C**.

Electricity Generation

BHPBIC currently supply coal seam methane gas to the EDL Gas Fired Power Station located at Appin West Mine Pit Top and Appin No. 2 Shaft. The EDL operated power stations consist of a series of gas engines that generate electricity. EDL supply electricity to BHPBICs mining activities and to the NSW grid, thus reducing demand on coal fired power stations for the production of electricity.

The preferred extraction plant and associated pipeline reticulation system is proposed to be connected to the existing underground system which contains a connection to EDL via the underground workings. The downhole on Lot 1 DP576136 (refer to **Figure 5.1** and **Annex B**) will connect into the existing underground system to allow the goaf gas extracted from Longwalls 703 and 704 to be utilized by EDL for re-use as electricity generation. This is the preferred option for the management of the goaf gas.

The EDL Power Stations have sufficient capacity to utilise this additional goaf gas as it is currently supplemented by external natural gas sources where mine/goaf gas is not readily available. The goaf gas from this specific project will therefore displace the externally sourced natural gas required to make up sufficient volumes, thus reducing EDLs and the projects GHG emissions.

This electricity generation process burns methane to minimise greenhouse gas emissions and uses the heat generated to create electricity. This reduces BHPBIC's net use of electricity drawn from the grid as well as minimising GHG emissions and represents BHPBICs preferred option for the management of the goaf gas from Longwalls 703 to 704.

Ventilation

Irrespective of the goaf gas management option implemented, a small amount of goaf gas will be required to be vented to the atmosphere as a safety precaution, such as emergency venting upon failure/shut down of gas surface management equipment or in the event that gas flow exceeds the capacity of the extraction plant. Venting occurs via a vertical gas discharge stack.

The vertical gas discharge stack is approximately 12m in height, and is proposed to be located at a minimum distance of 100m from the extraction plant. The discharge stack would be located in a fenced off compound of approximately 25m^2 in area. The ventilation stack will be connected to the extraction plant via a pipeline located in a trench just below the surface.

Figure 5.11 shows a typical vertical gas discharge stack.

Figure 5.11 – Typical Vertical Gas Discharge Stack

Flaring

Should the contingency extraction plant location be utilised and/or large quantities of goaf gas is continually vented to the atmosphere for prolonged periods, BHPBIC may implement large capacity flaring units within the contingency extraction plant compound located on the property described as Lot 7 DP250231 to flare the goaf gas onsite.

Purpose built enclosed gas combustion units burn the gas cleanly and in a controlled manner. The flame is not visible as the combustion is completely enclosed and controlled within the stack (refer to **Figure 5.12**).

Figure 5.12 – Typical Enclosed Flaring Units

The capacity of the proposed flaring system will be in the order of 800L/s, which meets the expected maximum flow rate of the extraction plant. In the event that flow rates exceed 800L/s, or a flaring unit breakdown/maintenance occurs, a small amount of venting to the atmosphere will occur via the ventilation stack to maintain safety.

The flare units are essentially a refractory lined stainless steel stack approximately 8m high and 1.4m in diameter. A small centrifugal fan in each unit is capable of drawing up to 1,000m^3/hr of gas at around 15kPa suction pressures. The goaf gas from the extraction plant is injected into the base of the stack through a series of burners and during combustion the methane within the goaf gas is converted to carbon dioxide and water vapour.

A number of monitoring and safety devices are fitted to each flare unit, including:

- Draegar Polytron methane sensor;
- Stack flame detector (UV light); and
- Flashback temperature sensor.

Output from these devices is monitored by a small PLC unit, which will trip a solenoid activated shutoff valve if threshold levels are reached. Additional protection from flashback is provided by a flame arrestor in the discharge pipeline.

5.3.6 De-Commissioning and Site Rehabilitation

The surface infrastructure associated with the proposed project are temporary in nature will be removed after operations cease.

De-commissioning of wells and boreholes will be undertaken in accordance with *EDG01 Borehole Sealing Requirements on Land* prepared by the Department of Mineral Resources NSW (1997). All wells and boreholes will be sealed and reinstated in accordance with the guidelines upon completion of operations.

All surface impacts will be rehabilitated to the pre-project land use at the completion of the project or to the respective landowner's specific requirements. The extent of physical disturbance is relatively minor and rehabilitation works may consist of hydroseeding to stabilize any exposed soils, or revegetated with locally native species, depending upon site specific requirements. For example, a small amount of vegetation clearing will be required for the installation of the Longwall 703 MRD borehole drilling compound on the property described as Lot 7 DP250231. BHPBIC will rehabilitate this site with the same native species proposed to be removed, upon completion of the proposed project.

Further detail on de-commissioning and site rehabilitation requirements are provided in **Sections 8.7** and **8.12**.

5.3.7 Anticipated Project Timeline

Table 5.3 below shows the anticipated timeframes of the various phases of the proposed project:

Table 5.3 – Anticipated Project Timeline*

Project Phase	Start Date	End Date
Site establishment of drilling compounds and drilling of MRD and vertical boreholes and downhole	August 2009	March 2010
Under-bore of Hume Highway and Main Southern Rail Line	October 2009	December 2009
Site establishment for extraction plant/s and surface pipeline reticulation system construction works	November 2009	December 2009
Goaf gas drainage phase	December 2009	December 2011
De-commissioning and site rehabilitation	December 2011	February 2012

* These anticipated timeframes are indicative only and will be influenced by mining schedules and other factors.

6 Project Justification

This section justifies the proposed development.

6.1 Need for the Project

The Bulli Coal Seam mined by BHPBIC within Appin Mines' Area 7 contains methane gas that is released during the longwall mining process. The goaf is formed by the stratum that collapses after the progress of the longwall machinery through the longwall mine and fracturing of the earth in the goaf gives rise to the potential for methane to rapidly flow into the mine ventilation system. The presence of methane gas within the MVA, depending upon its concentrations, can pose a significant risk to human and environmental health and safety.

Where concentrations of methane gas exceed 1.25% and flow into the mine ventilation system, significant risks to occupational health and safety arise in relation to air quality for mine workers. Where concentrations of methane exceed 5% it forms an explosive mixture. In the event that concentrations of gas in the ventilation air increase, mining operations may have to slow or cease altogether to enable adequate ventilation. As such, the presence of concentrations of methane gas above 1.25% can have a significant impact on mining operations. Additionally, there is potential for methane to escape from the seam and associated strata and make its way into the atmosphere via the emission of mine ventilation air, thereby contributing to project related emissions of greenhouse gases.

The goaf gas drainage of Appin Area 7 Longwalls 703 to 704 is to allow safe and efficient mining of these longwalls to occur. The project is justified for the following reasons:

1. It will allow the continued safe mining of longwalls in Appin Area 7.
2. It will increase the efficiency of the mining of Longwalls 703 to 704, reducing the risk of downtime from delays due to high gas levels within the mine.
3. It will allow BHPBIC to continue to meet customer demand for coal from the Appin Colliery.
4. The boreholes and gas extraction plants will be temporary in nature, small in footprint, fully fenced to restrict access and located in significantly disturbed, cleared agricultural areas.
5. Significantly reduce the emission of Greenhouse Gas.

6.2 Alternatives Considered

Due to the inherent safety and operational risks, it is considered that there is no feasible alternative to extraction of gas from the goaf areas. There were a number of specific options considered for the alternative management of the gas following extraction from the goaf. These were:

1. Re-use for electricity generation at the EDL Power Station at Appin Colliery and/or
2. Onsite flaring and
3. Onsite venting to the atmosphere.

These options were assessed as part of the Preliminary EA (Cardno, 2008). The outcome of that assessment was that Option 1 i.e. re-use of the drained goaf gas for electricity generation at the EDL Power Stations was the preferred option.

Re-use of the goaf gas for electricity generation forms the major component of the proposal and BHPBIC's preferred option. However, in reality the proposal will incorporate Option 3 as a necessary safety precaution and may include Option 2. The inclusion of Option 2 i.e. flaring the goaf gas will be

as a contingency measure if the underground connection conveying the drained goaf gas from Longwalls 703 and 704 to the EDL Power Station is unreliable or unfeasible.

It is therefore proposed that the goaf gas be extracted from Longwalls 703 and 704 and conveyed to the EDL Power Stations for re-use as electricity generation with provision of ventilation and flaring capacities at each extraction plant location. The gas flows representing the full capacity of the extraction plant; 800 L/s, will therefore be utilised by the EDL Power Stations. Where the gas flows from the boreholes exceeds the operational capacity of the extraction plant, the excess gas will be released to the atmosphere via venting or consumed via flaring until such time as the flows reduce to the extraction plants capacity levels.

Notwithstanding this, the preferred option for the proposed project is the majority of the goaf gas drained from both longwalls to be directed to the EDL Power Stations for reuse with the provision for onsite venting for safety reasons.

6.3 Consequences of Not Proceeding

This section discusses the “do nothing” approach which in this case is not mining Longwalls 703 and 704 within Appin Area 7.

The extraction of underground coal reserves from Longwalls 703 to 704 is necessary to ensure continuity of coal supply to customers and achieve business objectives for Illawarra Coal. At the same time, it provides financial benefits at international, national, state and local levels. Illawarra Coal provides 90% of the coal for the Australian Steel Industry. About 60% of the high quality coal produced is blended with Wongawilli Seam coal to supply a specific coal product, the Illawarra Coal blend, to the BlueScope and OneSteel Steelworks. The remainder is exported to overseas steel makers.

The proposed extraction of coal from Longwalls 703 to 704 represents a continuing significant operating investment in the Southern Coalfield of New South Wales. Continuing benefits occur through continuity of employment, expendable income, export earnings and government revenue.

The consequences of not mining Longwalls 703 to 704 include loss of coal production from Appin Colliery and potential closure of Illawarra Coal operations. Losses from a major supply of Bulli Seam coal from the Illawarra Coal operations has the potential to severely disrupt or prevent the production of the Illawarra Coal blend, which is the basis of Illawarra Coal customer requirements. This would lead to higher un-employment levels within New South Wales, reduced expendable income for the international, national, state and local economies and reduced export earnings and government revenue.

The benefits of the proposed project which therefore allows the continued safe and efficient mining of coal from the Appin Colliery justifies why not mining Longwalls 703 and 704 is not a feasible option.

7 Environmental Risk Assessment

This section identifies risks associated with the proposed development and the identified management measures.

7.1 Introduction

The basis for identification of environmental risks/impacts is an appreciation of the site location and an understanding of the technology utilised in the goaf gas drainage process. This understanding is achieved through discussion with operational experts from BHPBIC and associated contractors. This environmental risk assessment provides direction and context for the identification of environmental impacts from the proposed project.

This risk assessment is based on an index formed from the perceived likelihood of an occurrence, and the subsequent consequence of that occurrence using the process outlined in the Australian Standard AS/NZS 4360:2004 Risk Management. Both likelihood and consequence are measured on a scale of 1 to 5 (with 1 corresponding to improbable/negligible and 5 corresponding to frequent/catastrophic). A subsequent index was developed and all identified risks classified as belonging to either 'Low', 'Moderate' or 'High' risk categories in **Table 7.1**. This is a conservative index, emphasising the number of Moderate and High risks identified.

Table 7.1 – Environmental Risk Assessment Matrix

	Consequence				
Likelihood	**Insignificant**	**Minor**	**Moderate**	**Major**	**Catastrophic**
Improbable	Low	Low	Low	Moderate	Moderate
Remote	Low	Low	Low	Moderate	High
Occasional	Low	Moderate	Moderate	High	High
Probable	Moderate	Moderate	Moderate	High	High
Frequent	Moderate	High	High	High	High

7.2 Risk Categories

Table 7.2 considers and assesses the following environmental risks and impacts:

- GHG Emissions
- Air Quality
- Noise and Vibration
- Cultural Heritage
- Water Resources
- Flora and Fauna
- Waste
- Risks and Hazards
- Erosion and Sediment Control
- Rehabilitation
- Visual, and
- Traffic.

Table 7.2 – Environmental Risk Assessment

Environmental Impact	Process / Activity	Potential Impacts from Proposed Development	Risk
Air Quality	Flaring goaf gas to reduce GHG emissions (if used).	The gases have the potential to increase global warming impacts.	LOW As emissions levels are small and the sites are away from sensitive receivers. Mitigation measures will be used. Refer to Section 8.3.
	Discharges from the ventilation stacks.	Discharges from the vent stacks are a potential odour source.	
	Pollutant emissions from the diesel generator (if used).	These emissions can increase global warming and cause air pollution.	
	Site implementation.	Dust will be generated during site implementation.	
Noise and Vibration	Movement of machinery and trucks associated with construction and laying of the goaf gas reticulation pipeline.	Short term reduction in residential amenity due to an increase in noise levels at and within residential properties near the pipeline locations.	MODERATE The project noise assessments indicate that the majority of noise impacts can be mitigated. Noise management is necessary in relation to noise levels that do not meet criteria.
	Noise from machinery during drilling of the MRD borehole and vertical wells.	Potential for sleep disruption from the MRD borehole drilling as this will operate 24 hours.	
	Operation of the electricity generator and vacuum pump at the goaf gas extraction locations.	Longer term (1 year) increase in noise levels due to 24 hour, 7 day per week operation of the goaf gas extraction equipment.	
Soils and Water Quality	Soil surfaces left exposed during the construction phase resulting in erosion and sedimentation.	Movement of water into natural watercourses or farm dams causing siltation and impacting on water quality, resulting in detrimental impacts on flora and fauna.	LOW Due to proposed mitigation measures. Refer to Section 8.5 and 8.6
	Pollution of surface water run-off from equipment, chemicals or litter from the goaf gas drainage works.	Damage to local ecosystems.	LOW Due to proposed mitigation measures. Refer to Section 8.5 and 8.6.
	Potential to uncover some previously unidentified contaminated soils during the works.	Release of possible contamination contained in the soil and mobilisation to other undisturbed areas or watercourses.	LOW Refer to Section 8.5 and 8.6
	Drilling and establishment of boreholes.	Interception of aquifers occasioning contamination, or drainage, of groundwater.	LOW Due to proposed

Environmental Impact	Process / Activity	Potential Impacts from Proposed Development	Risk
			mitigation measures. Refer to Section 8.5 and 8.6
Flora and Fauna	Goaf gas drainage compound installation requiring the removal of vegetation.	Removal of native vegetation and animal habitat resulting in the reduction of the quality of the natural ecosystems in the project area.	LOW As the ecosystem in the project area is significantly disturbed and due to proposed mitigation measures. Refer to Section 8.7.
	Trenching for the goaf gas pipeline disturbing native vegetation.		
	Clearing of vegetation for the goaf gas drainage compounds.		
Cultural Heritage	Trenching works for the goaf gas pipeline.	Items or locations of cultural heritage may be damaged or destroyed during works for the goaf gas drainage project.	LOW Appropriate mitigation measures are proposed and works in areas of concern will be monitored by Aboriginal representatives. Refer to Section 8.8.
	Site implementation works for the goaf gas drainage compounds.		
Hazards and Risk	Drainage of goaf gas from the target coal seam.	Lightening strike occasioning ignition, or spontaneous combustion, of flammable methane gas leading to fire or explosion and resultant risk to life and private property.	LOW Refer to Section 8.9
	Storage and use of fuel and chemicals onsite.	Escape of fuel or oil into the surrounding environment resulting in pollution and damage.	LOW Due to provision of safe storage & refuelling locations. Refer to Section 8.9.
	Interception of existing below-ground utilities by boreholes.	Disconnection of essential utilities to local properties.	LOW Suitable searches undertaken prior to commencement of drilling. Refer to Section 8.9.

Environmental Impact	Process / Activity	Potential Impacts from Proposed Development	Risk
Waste	Generation of waste from construction and de-commissioning activities.	Waste not being contained and disposed of in an appropriate fashion, resulting in the presence of waste on private landholdings within the project area.	LOW Refer to Section 8.10
Visual Amenity	Existence of goaf gas drainage infrastructure creating a blight on the landscape.	Reduction in the visual quality of the area for residents and visitors.	LOW Site location and existing screening will mitigate visual impacts. Refer to Section 8.11.
Traffic	Establishment of pipeline underneath the Hume Highway and Main Southern Rail Line.	Blockage of transport infrastructure including the rail line, Hume Highway, Moreton Park Road and/or local access roads.	LOW As under boring will negate any traffic impacts. Refer to Section 9.1.3.
	Movement of construction traffic.	Increased travel times for local traffic and increased risk of accident on existing roads.	LOW As the number of vehicles associated with the drainage project are low. Refer to Section 9.1.3.

8 Key Environmental Impacts

This section identifies and assesses key environmental impacts.

8.1 Overview of Environmental Impacts

The environmental assessment of the proposed goaf gas drainage is divided over two sections of this report. **Section 8** reviews key environmental issues as identified by the DGR's. **Section 8** reviews secondary environmental issues that BHPBIC consider important for a full assessment of the project. **Table 8.1** identifies the environmental issues under assessment in each section of this EA.

Table 8.1 – Overview of Environmental Impacts

Key Environmental Impacts	Secondary Environmental Impacts
GHG Emissions	Traffic
Air Quality	Cumulative Impacts
Noise	
Heritage	
Water Resources	
Flora and Fauna (Biodiversity)	
Waste	
Risks and Hazards	
Erosion and Sediment Control	
Rehabilitation	
Visual	

8.2 Greenhouse Gas Emissions

Cardno was engaged by BHPBIC to prepare a GHG Assessment (GGA) for the proposed project. This GGA has been prepared in accord with the Director-General Requirements (DGRs) for the project, which were issued to BHPBIC by the NSW Department of Planning (DoP) on the 2 February 2009. This section of the EA summarises this assessment. The full GGA is provided in **Annex C**.

8.2.1 Project Context

BHPBIC has SMP approval to mine Longwalls 701 to 704 in Appin Mine's Area 7 and is now seeking SMP approval to mine Longwalls 705 to 710 to the north of the abovementioned longwalls within this mining domain.

The mining of coal within the coal seams underground releases gases, which have been trapped within the coal seam pores by the chemical process of adsorption and/or absorption, produced by the coalification process. These gases consist primarily of methane which is a Greenhouse Gas (GHG) that has a Global Warming Potential (GWP) of 21.

BHPBIC use in-seam drilling to drain methane contained within the Bulli Coal Seam prior to mining. Seam gas from the strata underlying the longwall is drained by cross measure boreholes. The in-seam and cross measure gas drainage produces high purity methane gas. These measures are known as pre-mine drainage. Post mining drainage is used to minimise the gas content within in the Mine Ventilation Air (MVA) and this is known as goaf gas drainage i.e. the gas is removed from the goaf area within the mine after the coal has been extracted.

If unmanaged, goaf gas can enter the mine ventilation system and cause safety and operational issues, including the risk of an uncontrolled underground explosion. The MVA is emitted to the atmosphere at upcast ventilation shafts. MVA from Appin Mine has a methane concentration in the order of 0.8%. In order to limit the potential for gas build up in the mine ventilation system and mitigate safety and operational risks, and also to reduce GHG emissions, BHPBIC propose a gas extraction system to draw the goaf gas to the surface, and a gas utilisation system to reduce GHG emissions

Current best practice for the management of GHG emissions from underground coal mines involves the following approaches:

- Prevent GHGs emissions into the atmosphere;
- Capture and utilisation for beneficial use; and
- Minimise GHGs emissions into the atmosphere.

BHPBICs proposed management methods for the extracted goaf gas are in line with current best practice. Extracted gas from the goaf area of the mine will be processed via a combination of the following three methods (in order of preference):

1. Electricity Generation – gas will be piped to the EDL Power Station at Appin Colliery and used for electricity generation; and/or
2. Onsite Flaring – gas will be flared onsite at the extraction plant using a mobile flaring unit if ongoing venting occurs; or
3. Onsite Venting – gas will be vented onsite at the extraction plant using a ventilation stack.

The majority of the extracted gas is proposed to be reticulated to the EDL Power Station for electricity generation. In the event that flow rates exceed the capacity of the extraction plant, power station and reticulation system, a small amount of venting to the atmosphere will occur to maintain safety. If ongoing venting occurs, BHPBIC will consider the installation of on-site flares co-located with the extraction plant to abate GHG emissions.

BHPBICs preferred management option i.e. the majority of extracted gas reticulated to the EDL Power Station for use in electricity generation adheres to the second approach for current best practice for the management of GHG emissions. As part of this management option, BHPBIC propose to capture the extracted goaf gas and reticulate it to the EDL Power Station for utilisation in alternative energy generation, which is a beneficial use as it reduces demand on coal fired power stations for the generation of electricity.

Whilst prevention of all GHG emissions is not possible for the proposed project, BHPBIC will minimise GHG emissions from the proposed project. BHPBIC will achieve this through maximizing the reticulation of extracted goaf gas to the EDL Power Station, which will therefore minimise GHG emissions to the atmosphere. BHPBIC may also implement onsite flaring units to further minimise GHG emissions, subject to unit availability and feasibility, though this is a contingency measure only and not the preferred management option.

Further detail on the proposed goaf gas management methods, demonstrating compliance with current best practice is presented below.

Electricity Generation

The EDL Power Stations have sufficient capacity to utilise this additional goaf gas as it is supplemented by external natural gas sources where mine/goaf gas is not readily available. The goaf gas from this specific project will therefore displace the externally sourced natural gas required to make up sufficient volumes, thus reducing EDL's and the Project's GHG emissions.

This electricity generation process burns methane to minimise greenhouse gas emissions and uses the heat generated to create electricity. As EDL supply some of this electricity to BHPBIC for their mining operations, this reduces BHPBIC's net use of electricity drawn from the grid as well as minimising GHG emissions.

Methane in both the EDL Gas Fired Power Stations (and any flare units) is oxidised to carbon dioxide according to **Equation 1**.

Equation 1 – Methane Oxidation

$$CH_4 + 2O_2 \rightarrow CO_2 + 2H_2O + \text{heat}$$

$$1 \text{ mole } CH_4 \rightarrow 1 \text{ mole } CO_2$$

$$1 \text{ tonne } CH_4 \rightarrow 2.75 \text{ tonne } CO_2$$

(21 t $CO_{2\text{-}e}$) (2.75 t $CO_{2\text{-}e}$)

Carbon dioxide (CO_2) is 21 times less potent a GHG than methane (CH_4). This is based on methane's Global Warming Potential (GWP) of 21 and carbon dioxides GWP of 1. Both utilisation by EDL and flaring of the goaf gas effectively reduces GHG emissions by 18.25 tonnes of carbon dioxide equivalent units (t CO_2-e) per tonne of methane converted to carbon dioxide.

The gas engines used in the EDL Power Station maximise methane conversion whilst maintaining NOx and other air pollutant levels below the limits prescribed in their Environment Protection Licences. The supply of the goaf gas from this project to the EDL Power Station will not result in any additional NOx or other air pollutant emissions above their consented licence limits as the goaf gas from this project will displace the required amounts of natural gas sourced externally.

Onsite Flaring

Flaring the goaf gas from the extraction plant may occur onsite via a mobile flaring unit situated within the extraction plant compound. The procedure known as flaring operates by surface level equipment burning the goaf gas as it is extracted from the goaf. The flaring of goaf gas is desirable as the combustion of methane produces carbon dioxide and water, therefore lowering the GWP of the discharged gas and overall GHG emissions (see Equation 1 and associated explanation above).

Should the contingency extraction plant location be utilised and large quantities of goaf gas is continually vented to the atmosphere for prolonged periods, BHPBIC may implement large capacity flaring units within the contingency extraction plant compound located on the property described as Lot 7 DP250231 to flare the goaf gas onsite.

The capacity of the proposed flaring system will be in the order of 800L/s, which meets the expected maximum flow rate of the extraction plant. In the event that flow rates exceed 800L/s, or flaring unit breakdown and/or maintenance occurs, a small amount of venting to the atmosphere via the discharge ventilation stack will occur to maintain safety.

Onsite Venting

Emergency venting of goaf gas from the extraction plant will occur via a discharge stack, to be located remote from the extraction plant compound. The discharge of goaf gas to the atmosphere is the least desirable application for the gas because the goaf gas has a high concentration of methane, which has a higher GWP than carbon dioxide (NGA, 2008).

Discharge occurs via a vertical discharge stack situated at least 100m from the extraction plant for safety reasons. Irrespective of the goaf gas management option selected, a vertical gas discharge stack will be required for emergency venting upon failure/shut down of gas surface management equipment or in the event that gas flow exceeds the capacity of the utilisation or flaring system.

If all the goaf gas extracted during this project was vented, this would have the same GHG outcome as the current situation of goaf gas is emissions via mine ventilation air.

8.2.2 Potential Impacts

The GGA states that the potential impacts of GHG emissions associated with the proposed project are that they may contribute to climate change as a result of global warming. Potential impacts from the proposed project therefore include:

- Changes to temperature and precipitation and
- Rising sea levels.

The GGA however, states that the proposed project will result in a significant net reduction in GHG emissions from Appin Mine and therefore has a positive impact on the environment in terms of GHG emissions for NSW and Australia.

8.2.3 Extracted Gas Flow Properties and Proposed Distribution

Coal seam gas from the Bulli Seam comprises primarily of methane (>85%), carbon dioxide (~8%), and a number of other gases including oxygen, nitrogen, hydrogen, ethane, propane, argon, and butane. A typical breakdown of coal seam gas composition is provided in **Table 8.2**. The energy content of the goaf gas is approximately 35 MJ/m^3 (Heggies, 2008).

Table 8.2 – Typical Composition Coal Seam Gas from the Bulli Coal Seam

Gas	O_2	Ar	CH_4	CO	CO_2	H_2	C_2H_6	Propane	n-butane	i-butane
%	0.03	3.06	86.80	0.00	7.75	0.19	1.72	0.56	0.12	0.16
%	0.03	2.99	86.91	0.00	7.76	0.19	1.73	0.54	0.12	0.16

(Source: Heggies (2008))

Estimates of cumulative Specific Gas Emissions (SGE) for previously mined Appin Longwalls 402 to 405 showed that SGE were in the range of 35 to 40m^3/t ROM coal mined (Self, 2004). This value is representative of the volume of gas that is liberated from the Bulli Seam and surrounding strata per tonne of ROM coal mined at Appin Colliery. Based on this SGE, it is estimated that the total volume of gas that will be liberated by the mining of Longwalls 703 to 704 is within the range of approximately 230 to 265 million m^3.

Approximately 5 to 10% of SGE leave via the goaf wells, approximately 25 to 30% is captured in floor holes drilled into the underlying strata (if used), and the remaining 60 to 65% is diluted in the Mine Ventilation Air (MVA) system (Heggies, 2008).

It is noted however, that baseline emissions used in this assessment were estimated using the National Greenhouse Accounts methodology (NGA, 2008) for calculating fugitive emissions from underground coal mining. The use of the NGA Factors methodology was specifically requested in the DGR's issued for this project, and is described in more detail in **Annex C**.

BHPBIC's preferred management strategy for the proposed project is to convey extracted goaf gas from both longwalls to the EDL Power Station at Appin for use in energy generation. However, this will only be achievable if approval is granted to under-bore the Hume Highway and Main Southern Rail Line to connect the drainage network from Longwall 703 to that of Longwall 704. If the Hume Highway and Main Southern Rail Line under-bore is not approved, only extracted gas from Longwall 704 will be piped to EDL, with the extracted gas from Longwall 703 proposed to be flared and vented onsite. This is because the connection to the existing underground EDL drainage network is only available via the downhole above the workings on the western side of the Hume Highway. In either

case, it is likely that a small amount of gas will be vented onsite in the event of plant breakdown, or the extracted gas flow rate exceeding system capacity to accept the gas.

A breakdown of the likely distribution of gas for each of these scenarios is provided in **Table 8.3**. The GHG emission outcome for both scenarios is the same.

Table 8.3 – Likely Distribution of Gas Flow Streams

Extraction Phase / Operational Scenario	Percentage of Extracted Gas		
	Electricity Generation	Onsite Flaring	Onsite Venting
MRD & Vertical Boreholes, with Approval to Under-bore Hume Highway and Main Southern Rail Line	99%	0%	1%
MRD & Vertical Boreholes, without Approval to Under-bore Hume Highway and Main Southern Rail Line	52%	47%	1%

The volume of gas that will be extracted has been estimated based on the anticipated extraction flow rate and duration of 800L/s and 1.7 years, respectively.

It is anticipated that the average gas flow rate per borehole will be approximately 400L/s. However, it is likely that the extraction plant will extract gas from a number of boreholes (simultaneously) at any one time. Therefore, it is assumed that the extraction plant will be operating at maximum capacity of 800L/s over the duration of the drainage phase, which is estimated to be approximately 1.7 years or 89 weeks. This equates to a total gas extraction volume via the goaf gas drainage system of approximately 43 million m^3.

8.2.4 Methodology and Assessment

Consistent with the protocols of IPCC, UNFCCC, and NGA Factors (2008), three scopes of GHG emissions have been defined for this project. These include Scope 1, Scope 2, and Scope 3 emissions, each of which is defined below:

- **Scope 1** – Scope 1 emissions include direct emissions from sources within the boundary of an organisation such as fuel combustion and manufacturing processes.
- **Scope 2** – Scope 2 emissions include indirect emissions from the consumption of purchased electricity, steam or heat produced by another organisation. Scope 2 emissions result from the combustion of fuel to generate electricity, steam, or heat and do not include emissions associated with the production of fuel. Scopes 1 and 2 are carefully defined to ensure that two or more organisations do not report the same emissions in the same scope.
- **Scope 3** – Scope 3 emissions include all other indirect emissions that are a consequence of an organisation's activities but are not from sources owned or controlled by the organisation. Examples of Scope 3 emissions include indirect emissions associated with the extraction/production of fuels used onsite fuel extraction and line loss associated with the consumed electricity, transport of product outside the organisation, and emissions associated with end use of product.

The Scope 1, 2 and 3 emissions identified from the proposed project are described in **Table 8.4**.

Table 8.4 – Scope 1, 2 & 3 Emissions from Appin Area 7 Goaf Gas Drainage Project

Scope 1 Emissions	Scope 2 Emissions	Scope 3 Emissions
• Diesel combustion during construction and installation works; • Drilling of MRD boreholes and vertical wells; • Diesel combustion during transportation of plant and materials; • Fuel combustion during employee travel associated with construction / installation works; • Diesel combustion resulting from ongoing power supply to the goaf extraction plant and flaring units; • Production of CO_2 and N_2O during onsite flaring of the extracted gas; and • Emission of CO_2 and CH_4 during from onsite venting of extracted gas directly to the atmosphere.	N/A	• Production of CO_2 and N_2O during combustion of extracted gas at EDL's Appin Colliery Power Station; and • Indirect extraction emissions associated with all Scope 1 fuel combustion emissions listed in column 1 (these emissions occur during the extraction and transportation of fuels used for energy).

There are no Scope 2 emissions associated with the project as it has been conservatively assumed that all power supply requirements will be met using onsite diesel generators.

Baseline Emissions

Baseline fugitive emissions for the mining of Longwalls 703 and 704 were estimated using the NGA Factors (2008) methodology for estimating fugitive emissions from underground coal mining, using the emissions factor for gassy underground coal mines. This methodology accounts for release of methane and carbon dioxide during the mining process due to the fracturing of coal seams, overburden and underburden strata (NGA, 2008).

Baseline emission estimates represent the emissions that are likely to occur due to the mining of Longwalls 703 and 704 without the implementation of the goaf gas extraction and utilisation project (i.e. all gas would be vented directly to the atmosphere via the MVA). The estimated baseline emissions are provided in **Table 8.5**.

Table 8.5 – Baseline Emissions

Operation	Total Emission (kt CO_2-e)	Equivalent Annual Emission (kt CO_2-e/yr)
Baseline Fugitive Emissions from Appin Mine due to Mining of Longwalls 703 to 704	2028	1193

Project and Appin Mine Fugitive Emissions

BHPBIC propose to connect the preferred extraction plant located on the property described as Lot 2 DP576136, to the existing 11kVA mains located on the adjacent property described as Lot 1 DP576136. The GGA has taken a conservative approach in assessing GHG emissions associated with proposed project and has therefore assumed the worst case scenario in that the preferred extraction plant and contingency extraction plant (if utilised) will be powered by a diesel generator.

Should the preferred extraction plant be able to be powered by electricity and not diesel, the actual GHG emissions associated with the operation of the extraction plant will be significantly lower; however, the GHG emissions determined by the GGA has assumed the use of diesel fuel for operation of the extraction plant/s.

Emissions associated with the project have been categorised into Scope 1 and Scope 3 emissions. Scope 3 emissions arise due to the extraction and transportation of fuels used for energy, and combustion of extracted gas at the EDL Power Station, which is under the jurisdiction of a third party.

Project emissions associated with both the construction and operational phase of the project are summarised in **Table 8.6**

Table 8.6 – Project Emissions

Operation	Scope 1 Emissions (kt CO_2-e)	Scope 3 Emissions (kt CO_2-e)	Total Emissions (kt CO_2-e)	Equivalent Annual Emission (kt CO_2-e/yr)
Project Emissions (Construction / Setup / Installation Works)				
Diesel Combustion During Construction / Setup / Installation Works	0.078	0.006	0.084	0.049
Petrol Fuel Combustion from Employee Travel	0.0062	0.0005	0.0067	0.0039
Project Emissions (Operational)				
Emissions from EDL Combustion and Onsite Venting	4.0	58.0	62.0	36.5
Extraction Plant and Flaring Unit Power Supply (Diesel Combustion)	0.899	0.1	0.9	0.5
Total Project Emissions	**4.9**	**58.1**	**63.0**	**37.1**

The total post-project emissions, including those that will occur via the Appin Mine MVA, are provided in **Table 8.7**.

Table 8.7 – Total Post-Project Emissions from Appin Mine

Operation	Scope 1 Emissions (kt CO_2-e)	Scope 3 Emissions (kt CO_2-e)	Total Emissions (kt CO_2-e)	Equivalent Annual Emission (kt CO_2-e/yr)
Total Project Emissions (Goaf Gas Drainage and Utilisation Project)	4.9	58.1	63.0	37.1
Post Project Fugitive Emissions (Appin Mine MVA)	1631	N/A	1631	959
Total Post-project Emissions at Appin Mine	**1636**	**58.1**	**1694**	**996**

8.2.5 Actual Impacts

The project will result in an overall net reduction in GHG emissions at Appin Mine of 334,000 t CO_2-e over the 1.7 year project duration, which is equivalent to an annual average of 196,000 t CO_2-e/yr. This is due to the destruction of methane and conversion to CO_2 that takes place during combustion for power generation at EDL and/or onsite flaring. Without the proposed project, this methane would be emitted to the atmosphere in the Appin MVA via upcast ventilation shafts.

The estimated net reduction in emissions predicted to occur at Appin Mine as a result of the proposed project is provided in **Table 8.8** below.

Table 8.8 – Appin mine GHG Emissions Reductions Resulting from the Project

Operation	Total GHG Emissions (kt CO_2-e)	Equivalent Annual GHG Emission (kt CO_2-e/yr)
Baseline Emissions	2028	1193
Total Post-Project Emissions	1694	996
Net Reduction in Appin Mine Emissions due to Goaf Gas Extraction and Utilisation Project	334	196

8.2.6 Alternatives for the Utilisation of Goaf Gas

The DGRs also requested the GGA look at the alternative for the utilisation of the extracted goaf gas. The alternatives identified as part of the GGA are as follows:

Increased Flare Capacity

Previous goaf gas drainage applications have used smaller capacity flaring units than those proposed for in this project. Flaring unit capacity in previous projects has generally been in the order of 125 L/s per unit. As part of this project, BHBPIC may use a state of the art flaring unit with a capacity of 800L/s in order to and minimise the amount of gas vented directly to the atmosphere, and maximise the amount of goaf gas extracted and oxidised, where ongoing venting occurs. The capacity of the proposed flare (if needed) is matched to the capacity of the extraction plant.

Installation of VAMP Plants at other BHPBIC Upcast Ventilation Shafts

The success of the trial VAMP plant at West Cliff Colliery has highlighted the feasibility of installing similar plants at other BHPBIC upcast ventilation shaft sites. It may be feasible, depending on environmental policy and economic conditions, to implement similar technology at other upcast ventilation shafts to firstly abate the methane within the MVA and secondly utilise the waste heat produced from the abatement process to power a turbine and produce energy.

Whilst VAMP plants provide a means of utilising the small percentage of coal seam gas present in MVA, they do not provide a feasible alternative to goaf gas extraction and as such the proposed project is still required to extract gas from the goaf to maintain a safe methane concentration in the MVA.

Increased Power Generation Capability at the EDL Power Stations

The Appin and Douglas EDL Power Stations have capacities of 54 and 40MW, respectively, and utilise a combined total of over 650,000m^3 of methane per day (Heggies, 2008). The Appin Area 7 goaf gas extraction project proposes to extract seam gas at a maximum rate of 800L/s, which equates to 69,120m^3 per day. As such, the existing EDL Power Station at Appin has sufficient capacity to utilise the extracted gas from Longwalls 703 and 704, and the amount of extracted goaf gas that can

be reused for electricity generation at EDL is not governed by power station capacity. Where there is a shortfall in the available extracted seam gas, the additional amount of gas is made up using sourced externally natural gas. Therefore the goaf gas extracted as part of the proposed project will displace the use of externally sources natural gas.

Therefore, an increase in power station capacity would not facilitate an increase in potential reuse of extracted gas from the proposed project. Furthermore, the project proposes to convey as much of the extracted gas as possible to the EDL, the amount of which will be maximised if approval is granted to under-bore the Hume Highway and Main Southern Rail Line. This will provide a connection between the surface drainage networks for Longwalls 703 and 704 and facilitate drainage of extracted goaf gas from Longwall 703 extracted gas to EDL (in addition to the extracted goaf gas from Longwall 704).

8.2.7 Conclusion

The GGA concludes:

This assessment shows that the project is likely to result in a net reduction in GHG emissions of approximately 334 kt CO_2-e (an annual equivalent of 196 kt CO_2-e based on a project timeframe of 1.7 years), which represents a reduction of 0.15% of the NSW total annual GHG emissions. The utilisation of extracted coal seam gas at the EDL Power Station is also estimated to result in a minimum GHG emission offset of approximately 44 - 89 kt CO_2-e/yr.

There is no reason for GHG emissions to constrain the proposed development as the works proposed in this Major Project application are assessed as having a positive impact in terms of reducing the GHG emissions from Appin Mine.

8.3 Air Quality

Cardno commissioned PAEHolmes to undertake an Air Quality Impact Assessment for the proposed surface goaf gas drainage project. The air quality assessment is based on the use of a computer-based dispersion model, AUSPLUME, to predict off-site impacts due to the proposed site operations. To assess the effect the potential pollutants have on existing air quality, the dispersion model predictions have been compared to relevant regulatory air quality criteria.

The assessment is based on a conventional approach following the procedures outlined in the NSW Department of Environment and Climate Change's (DECC) document titled "Approved Methods for the Modelling and Assessment in NSW" (DECC, 2005).

This section of the EA summarises this assessment. The full Air Quality Impact Assessment is provided in **Annex H**.

8.3.1 Existing Environment

Meteorological Conditions

Suitable meteorological data, from 1995, is available from a weather station operated by the DECC at Appin. The station was approximately six kilometres to the east of the Project area but has since been decommissioned. Data for 2008 has also been made available from the Energy Development Limited premises at Appin, approximately five kilometres southeast of the project area.

For both 1995 and 2008, winds were predominantly from the south-southeast and this wind direction is present in all seasons. Annually, calm conditions (winds less than or equal to 0.5 m/s) were measured for 3.4% of the time in 1995 and for 0% of the time in 2008. Airborne pollutants disperse more slowly in calm conditions, therefore it would be anticipated that the 1995 data may return a more conservative prediction of ground level pollutant concentrations than the 2008 data

Figures 8.1 and **8.2** show the annual and seasonal wind roses for Appin from 1995 and 2008 respectively.

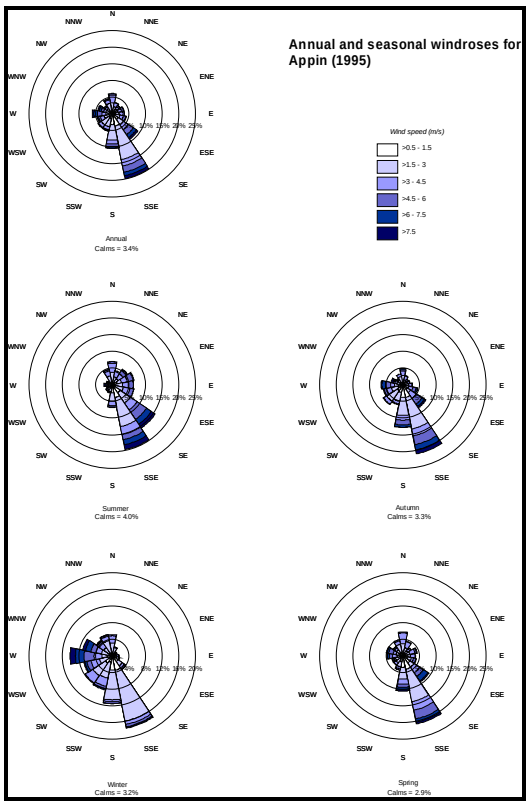


Figure 8.1 – Annual & Seasonal Wind Roses for Appin 1995

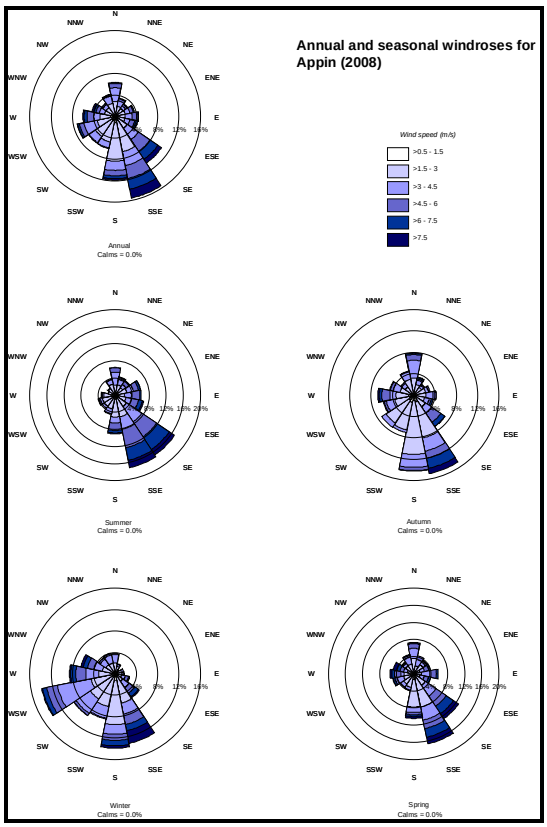


Figure 8.2 – Annual & Seasonal Wind Roses for Appin 2008

Climatic Conditions

The Bureau of Meteorology (BoM) also collects climatic information in the vicinity of the study area. The closest BoM station to the Project site is Picton, located approximately 11 km to the west. Temperature and humidity data consist of monthly averages of 9 am and 3 pm readings. Also presented are monthly averages of maximum and minimum temperatures. Rainfall data consist of mean monthly rainfall and the average number of rain days per month.

A range of climatic information collected from Picton is presented in **Table 8.9** (Bureau of Meteorology, 2009).

Table 8.9 – Climate Information for Picton

Element	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Mean 9 am dry-bulb temperature (deg C)	21.8	21.5	19.9	16.8	12.2	9.4	7.7	10.4	14	17.3	19	21	15.9
Mean 3 pm dry-bulb temperature (deg C)	26.4	25.4	24.5	22.5	18.3	15.7	15.6	16.2	19	21.3	23.1	25.6	21.1
Mean daily maximum temperature (deg C)	29.3	28.6	27	23.7	20.2	17.3	16.8	18.2	21.4	24	26.3	28.5	23.4
Mean daily minimum temperature (deg C)	15.2	15.4	13.1	9.2	5.7	3.2	1.7	2.9	5.2	8.8	11.5	14	8.8
Mean rainfall (mm)	87.5	89	88.1	69.6	57.7	65.3	50.8	44.9	44.8	65.2	71.9	70.2	804.9
Mean number of rain days ≥ 1 mm	6.9	6.9	7.2	5.7	5	5.4	4.6	4.9	5.2	6.3	6.7	6.5	71.3

Existing Air Quality

The DECC have previously operated an air quality monitoring station at Appin which measured NO_2. **Table 8.10** shows the measured NO_2 concentrations for the most recent year of data available (1997).

Table 8.10 – Monitoring of Nitrogen Dioxide at Appin in 1997

Month	Measured NO_2 concentration (µg/m^3)	
	Maximum 1-hour average	Average
Jan-97	55	6
Feb-97	35	10
Mar-97	53	8
Apr-97	78	12
May-97	66	8
Jun-97	90	12
Jul-97	62	8
Aug-97	49	8
Sep-97	53	6
Oct-97	53	10
Nov-97	33	8
Dec-97	70	10
Maximum	**90**	**-**
Average	**-**	**9**
DECC criteria	**246**	**62**

(Source EPA Quarterly Air Quality Monitoring Report (1997))

The monitoring data show that the area experiences NO_2 concentrations below the DECC ambient air quality criteria. The maximum 1hour average NO_2 concentration in 1997 was 90µg/m^3 and the annual average was 9µg/m^3.

There are no known air quality monitoring stations close to the study area that can be used to determine the existing concentrations of oxides of nitrogen, carbon monoxide and particulate matter (PM_{10}). The DECC operate an extensive air quality monitoring network in NSW however their closest monitoring station to the site would be Macarthur (Campbelltown), approximately 20km to the north.

Existing annual average PM_{10} concentrations for the Appin area are estimated to be of the order of 15 µg/m^3 consistent with a relatively clean semi-rural environment. The 24hour average PM_{10} concentrations will be highly variable and, in many parts of NSW, it is common for the DECC's 50 µg/m^3 criteria to be exceeded on several occasions each year due to widespread events such as bushfires or dust storms.

8.3.2 Potential Impacts

The potential air quality impacts of the proposed project are identified as follows:

- Emissions from the flaring units (if utilised)
- Odour from the ventilation gas discharge stacks
- Pollutant emissions from the diesel generator and
- Dust generated during the construction phase.

Flaring Units (if utilised)

The preferred goaf gas management option is the reticulation of the majority of the extracted goaf gas to the EDL Power Stations for reuse as electricity generation. Should BHPBIC utilise flaring units as a contingency measure for the reasons described in **Section 6.3.5**, the emissions from the flaring units have been assessed as part of the air quality impact assessment.

In this assessment, the flaring system is modelled as a point source. Flare unit dimensions are listed in **Table 8.12**.

Plume emissions from flares differ from conventional stacks because of the significant amount of heat released from the stack tip and heat lost due to radiation. In conventional plumes, it is assumed all the available heat is assumed to be available for buoyancy of the plume. The AUSPLUME model used in this assessment does not accurately account for the radiative heat lost from a flare and tends to over-predict the buoyancy of the plume and hence the plume rise from the stack.

In this assessment, the heat lost through the flaring process has been calculated from the flare specifications provided by a manufacturer. Adjustments assuming approximately 20% and 50% heat loss due to flaring have been factored into the diameter of the stack. Details of calculations are provided in **Annex H**. The different stack diameters modelled for the 20% and 50% heat loss are 3.33m and 2.63m respectively.

Table 8.11 lists conservative estimates of emissions for the flaring unit, provided by a manufacturer (Energen), assuming flaring of coal mine methane gas with 90 - 98% methane content.

Table 8.11 – Expected Concentrations of Emissions from Flaring Unit

Pollutant	Emission mg/Nm^3
NOx	150
CO	50

To provide a conservative estimate of the predicted emissions from this flare, it has been assumed that the flare will operate at all hours continuously and that all coalmine gas will be flared.

Ventilation Gas Discharge Stacks

There are limited odour emission data from gas extraction vents associated with underground mining operations. EML Air Pty Ltd were however commissioned by BHPBIC to measure odour emission rates from the Dendrobium underground mine ventilation shaft (Holmes Air Sciences, 2005). The measured odour emission rate was 4,600ou.m^3/s and while this may not be representative of the odour in the gas extraction vents, it provides an indicative estimate for the purposes of this assessment. Ventilation gas discharge stack characteristics and emissions are listed in **Table 8.12**.

Electricity Generator

Emissions from the diesel or duel fuel powered electricity generator, listed in **Table 8.12**, were estimated using the NPI Emission Estimation Technique Manual for Combustion Engines (NPI, 2008). It was assumed that the generator is classed as an uncontrolled stationary diesel engine. Calculations are based on estimated diesel fuel usage of 3500L/week and assume that the generator will operate continuously.

Refer to **Table 8.12** for a description of the characteristics and emissions associated with the flaring units, ventilation gas discharge stacks and diesel generator.

Table 8.12 – Characteristics & Emissions for Modelling of Sources

Characteristic	Ventilation gas discharge stack	Flaring unit	Electricity generator
Assumed stack location (easting and northing in MGA)	290800, 6215900	290800, 6215900	290790, 6215895
Alternate stack location	290680, 6216210	290680, 6216210	290695, 6216210
Height (m)	9	8	3.3
Diameter (m)	0.25	3.63	0.12
Stack cross-section (m^2)	0.05	10.3	0.01
Flow rate coalmine gas (Nl/s) Coalmine	800	800	-
Flow rate total gas (Am^3/s)	-	-	0.67
Temperature (deg C)	25	1050	300
Exit velocity (m/s)	16	9.05	28
Pollutant emissions (g/s)			
PM_{10}	-	-	0.0294
CO	0.005	10.92	0.0923
NO_x	-	32.75	0.4155
Odour emissions ($OU.m^3/s$)			
Odour emission rate	4,600	-	-
OER (Stabilities A,B,C)	55,200	-	-
OER (Stabilities D,E,F)	115,000	-	-

Dust

Dust will be generated during the construction stage of the proposed project. Dust generating activities anticipated during the construction stage of the project are:

- Levelling of the extraction plant site/s
- Trenching works for the surface pipeline reticulation system including under-boring of the Hume Highway and Main Southern Rail Line
- Work pad construction for drilling of the boreholes and
- Drilling of six vertical boreholes, two MRD boreholes and one downhole (to allow gas to be directed to the EDL power station).

The two major dust generating activities are identified as the stripping of topsoil and general construction work by excavators and drill rigs and wind erosion from exposed areas. An estimate of the dust emissions due to these activities has been made and the calculations are provided below in **Table 8.13**.

Table 8.13 – Estimated Dust Emissions During Construction

Activity	Intensity	Emission factor	TSP (kg/y)	TSP (kg/d)
Stripping topsoil and general construction work.	8 h/d	14.0 kg/h	40,880	112
Wind erosion from exposed areas of site	0.3 ha	0.4 kg/ha/h	876	2.4
Total emissions (kg)	**-**	**0**	**41,756**	**114**

The dust emissions presented above are conservative estimates as they assume that an excavator will be working for eight hours per day and emitting at a rate equivalent to bulldozers (14kg/h). Therefore, it is estimated that up to 114kg of dust would be generated per day due to construction activities.

8.3.3 Mitigation and Management Measures

The following mitigation and management measures will ensure that dust emissions are subject to a high level of control:

- Exposed areas will be watered to prevent dust emissions
- Dust from borehole drilling will be suppressed with water sprays
- Stockpiles of topsoil and subsoil will be replaced as soon as practicable. Re-vegetating or stabilising disturbed areas where necessary will prevent or minimise wind-blown dust and
- If necessary, dust-generating activities will be modified during periods of high wind.

8.3.4 Actual Impacts

Odour

Figure 8.3 shows the predicted maximum ground-level odour levels (corrected for nose response times); assuming the contingency extraction plant is utilised and will be located on the property described as Lot 7 DP250231.

The extraction plant location modelled is the closest of the two extraction plant options to residences, therefore odour levels at the most-affected residences would be expected to be less than those shown in **Figure 8.3** if the preferred extraction plant located on the property described as Lot 2 DP576136 is implemented.

For a single rural residence (that is, with population of 2 or less) the relevant odour criterion is 7 odour units at the 99th percentile (DECC, 2006). **Figure 8.3** shows that odour levels at the most affected residence are around 5 odour units at the 99th percentile. This complies with the DECC goal.

It is important to recognise also the uncertainty associated with the odour emissions data used in the modelling. The assumptions used for this assessment could be confirmed with odour emission measurements from the ventilation gas discharge stacks, although considering that gases will only be vented when the underground connection to the EDL Power Station or flaring stacks fail to operate, during maintenance/shutdown periods or in the event that well gas flows exceed the capacity of the extraction plant and gas management system, impacts are expected to be low.

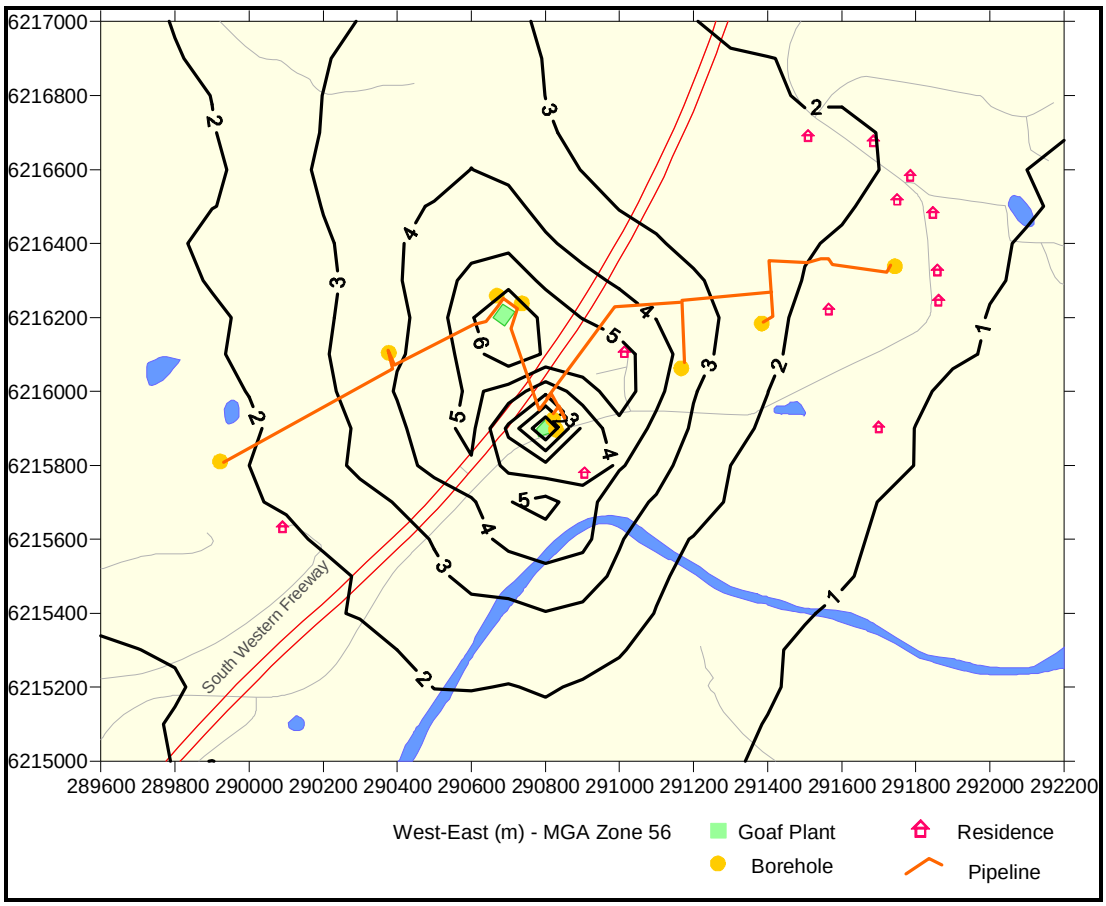


Figure 8.3 – Odour Contours from Vent Stack at 99th Percentile, in Odour Units

Dust

Figure 8.4 shows the predicted maximum 24hour average PM_{10} concentrations due to construction activities, assuming the contingency extraction plant will be located on the property described as Lot 7 DP250231. The DECC criterion is 50µg/m^3, which represents the contribution from all sources of dust, not just the contribution from the modelled sources. Background PM_{10} concentration should be considered when examining the results in **Figure 8.4**.

It can be seen from **Figure 8.4** that the 50µg/m^3 contour is predicted to extend between 200 to 400m in each direction from the centre of site activities.

As discussed in **Section 8.3.1**, average PM_{10} concentrations are estimated to be of the order of 15µg/m^3. The PM_{10} concentrations will vary from day to day however for the purpose of this assessment it has been assumed that the background level is 15µg/m^3 for the days of maximum 24hour average PM_{10} predictions. This means that the allowable contribution from site activity emissions would be 35µg/m^3 before the 50µg/m^3 criterion is reached. The 35µg/m^3 contour extends between 220 and 430m in each direction from the centre of site activities. Approximately eight out of the nine boreholes are within 400m of the nearest residences.

Given the conservative nature of the dust emission estimates and the short-term nature of construction activities, adverse PM_{10} concentrations are unlikely to be observed and the activities would not be a significant dust source.

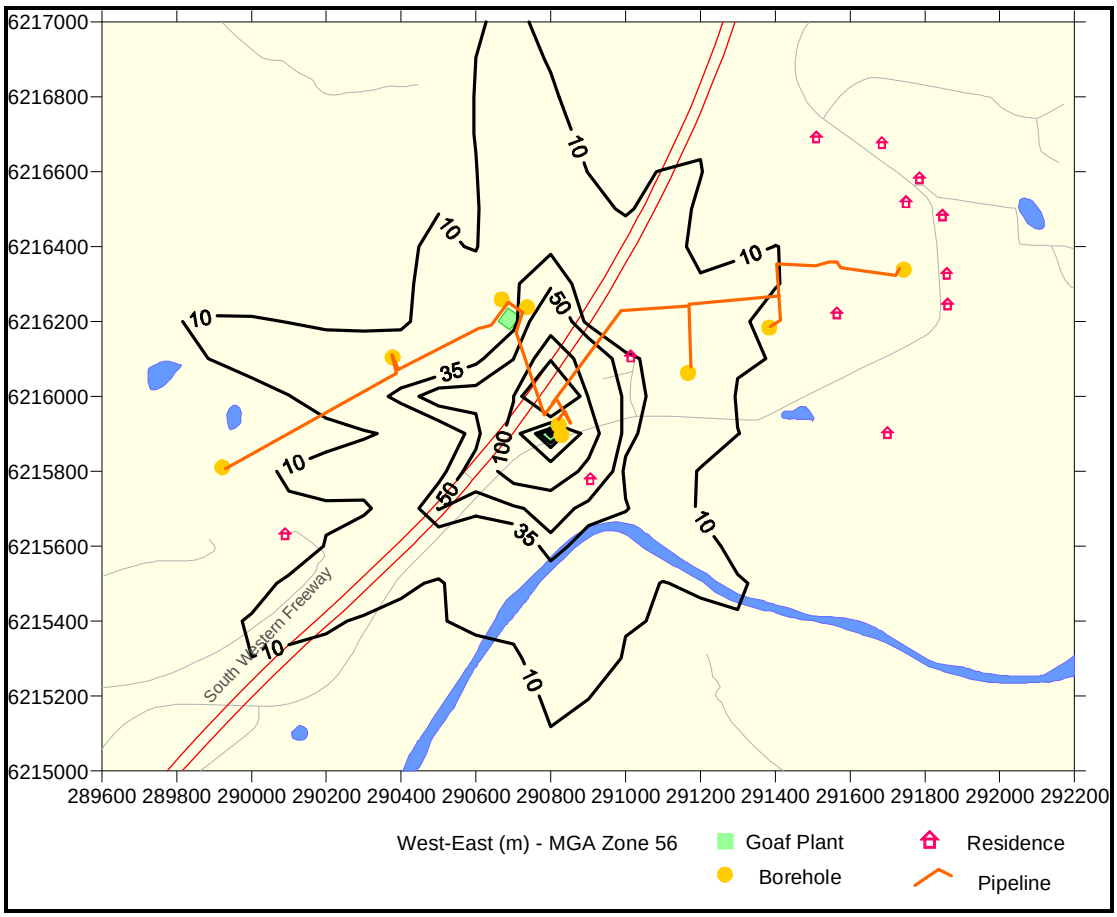
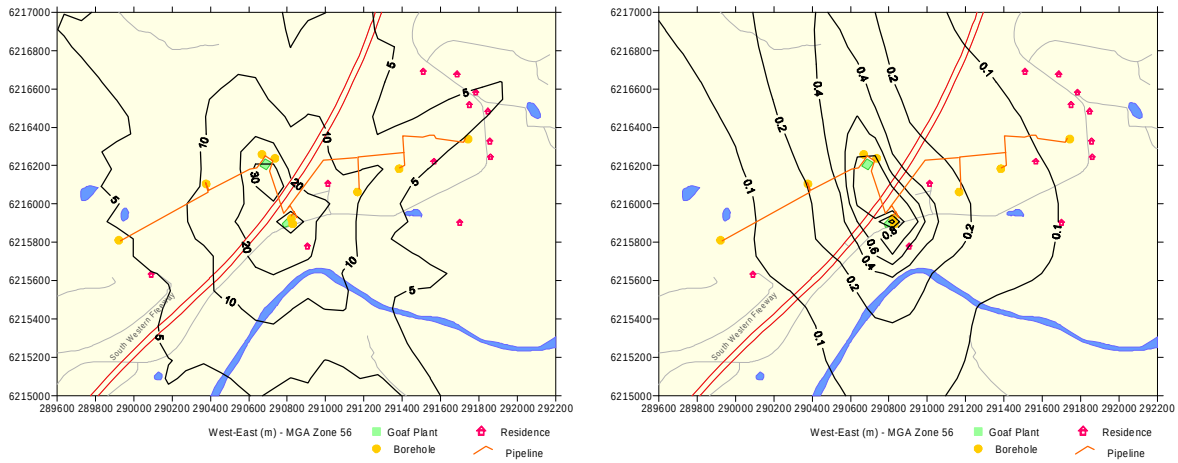


Figure 8.4 – 24 Hour Maximum PM_{10} Contours from Construction Activity, µg/m^3

Oxides of Nitrogen

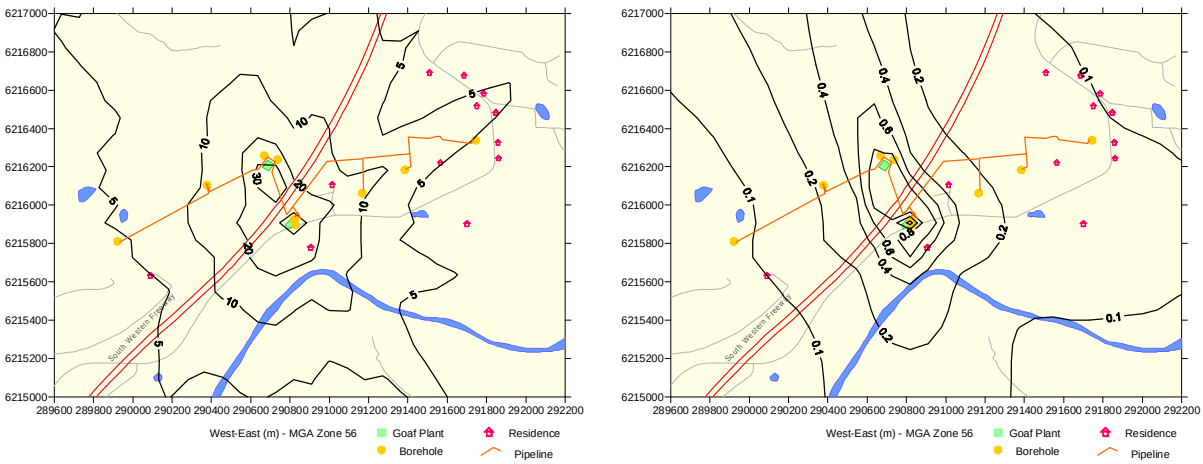
Results from the dispersion modelling for oxides of nitrogen are presented as contour plots in **Figure 8.5** and **Figure 8.6**. The predicted levels are shown as the 1hour maximum and annual averages. The maximum 1-hour average predicted at the most affected residence is approximately 22µg/m^3 for both the 20% and 50% heat loss scenarios, significantly less than the DECC criteria of 246µg/m^3 for nitrogen dioxide. When background levels of around 90µg/m^3 are included (see **Section 8.3.1**), these predicted concentrations are still within the DECC criteria.

The results for the annual average for both the 20% and 50% heat loss scenarios are also shown in **Figure 8.5** and **Figure 8.6**. They show a predicted maximum of approximately 0.6µg/m^3 at the most affected residence, significantly lower than the criteria of 64µg/m^3, even when background levels of 9µg/m^3 are included.



1 hour maximum, µg/m^3 ***Annual average, µg/m^3***

Figure 8.5 – Figure NO2 Contours from Flaring Assuming 20% Heat Loss



1 hour maximum, µg/m^3 ***Annual average, µg/m^3***

Figure 8.6 – NO2 Contours from Diesel Generator & Flare Units, Assuming 50% Heat Loss

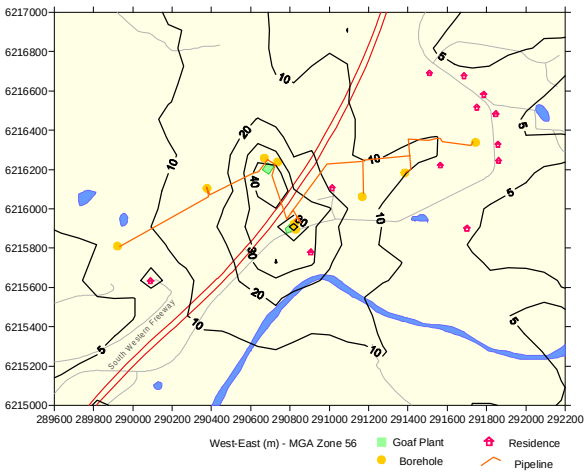
Carbon Monoxide

The dispersion model results are presented in **Figure 8.7** and **Figure 8.8**. The results show predicted carbon monoxide levels for 15minute, 1hour and 8hour averaging times for comparison with the DECC criteria.

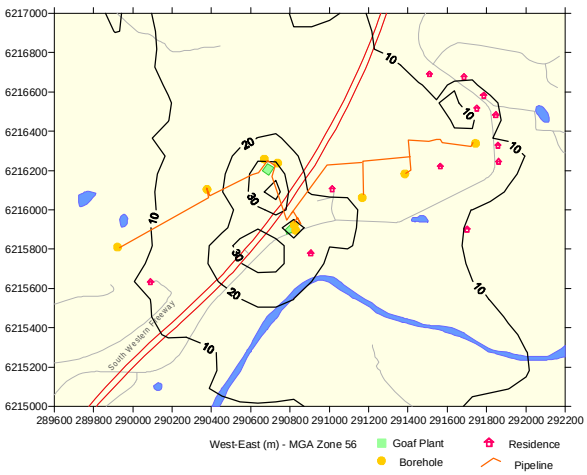
The results show predicted carbon monoxide levels for 15minute, 1hour and 8hour averaging times for comparison with the DECC criteria.

Figure 8.7 presents results assuming the 20% heat loss due to the flare **Figure 8.8** presents the 50% heat loss case.

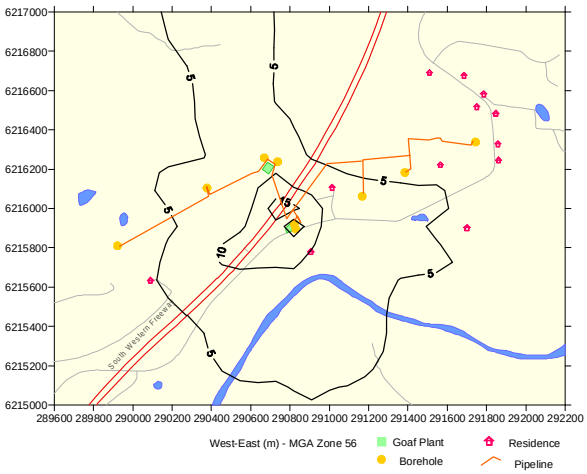
For both scenarios the impact at the residences most affected by the flaring activities were below the DECC criteria of 100mg/m^3. The 15minute ground level concentrations for the 20% and 50% heat loss cases show predicted levels at the most affected residence to be approximately 31µg/m^3 and 30µg/m^3 respectively. These predictions are well below the criteria of 100mg/m^3 (or 100,000µg/m^3). The 1hour and 8hour impacts are also well below the criteria with predictions of approximately 24µg/m^3 and 11µg/m^3 (20% heat loss); 24µg/m^3 and 10µg/m^3 (50% heat loss).



15minute maximum, µg/m^3

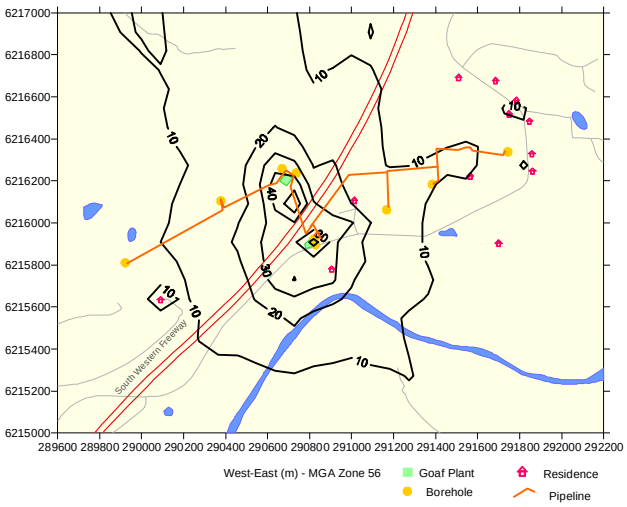


1hour maximum, µg/m3

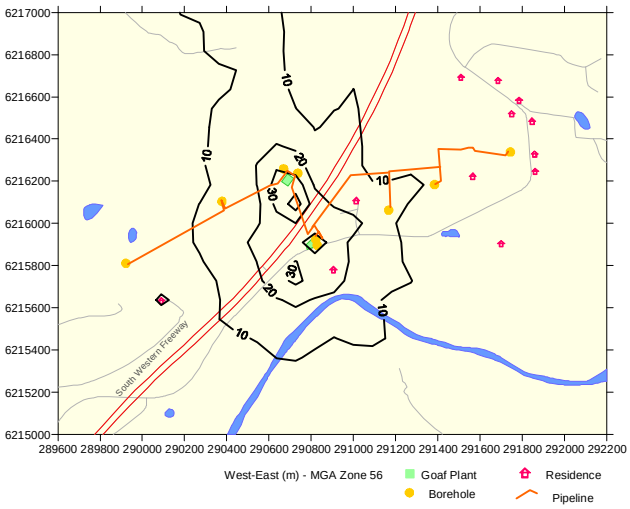


8hour maximum, µg/m3

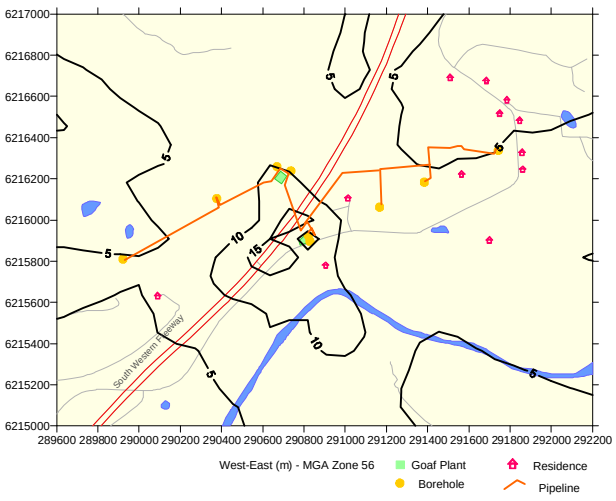
Figure 8.7 – CO Contours from Flaring Units, Assuming 20% Heat Loss



15minute maximum, µg/m^3



1hour maximum, µg/m3



8hour maximum, µg/m3

Figure 8.8 – CO Contours from Flaring Unit, Assuming 50% Heat Loss

8.3.5 Conclusion

The air quality impact assessment concludes:

- Predicted odour levels from vent gasses at nearest residences are within DECC criteria.
- Compliance with dust concentration criteria is predicted during the construction stage of the proposed project.
- Dust mitigation measures will ensure that dust emissions are subject to a high level of control.
- NO_2 and CO concentrations at nearby residences will be below the DECC criteria.
- Emissions at the EDL Power Stations will continue to comply with the existing requirements of their Environment Protection Licences.

There is no reason for air quality impacts to constrain the proposed development as the works proposed in this Major Project application are assessed as having a minor impact.

8.4 Noise

Wilkinson Murray (WM) has been engaged to assess noise impacts to sensitive receivers from the construction and operation of this goaf gas drainage project. This section of the EA summarises the Wilkinson Murray assessment and reports on the recommended noise attenuation measures. The full noise assessment report is in **Appendix G**.

8.4.1 Existing Environment

There are 16 residential properties close enough to the goaf gas drainage project works area that have a potential to be affected by the construction (site implementation) and/or site operational noise. **Table 8.14** identifies these properties and **Figure 8.9** shows the location in relation to the proposed works.

Table 8.14 – Residential Properties Potentially Noise Affected

Receiver #	Distance to Goaf Plant (m)	Distance to Nearest Drilling Site (m)	Distance to Contingency Goaf Plant (m)
1	1200	500	1500
2	1000	500	1400
3	850	215	770
4	610	360	400
5	500	205	215
6	350	125	280
7	900	410	1000
8	875	90	800
9	1000	390	830
10	1100	360	1150
11	1100	200	1050
12	1200	330	1200
13	1200	250	1100
14	1200	290	1150
15	1200	300	1100
16	1300	370	1200

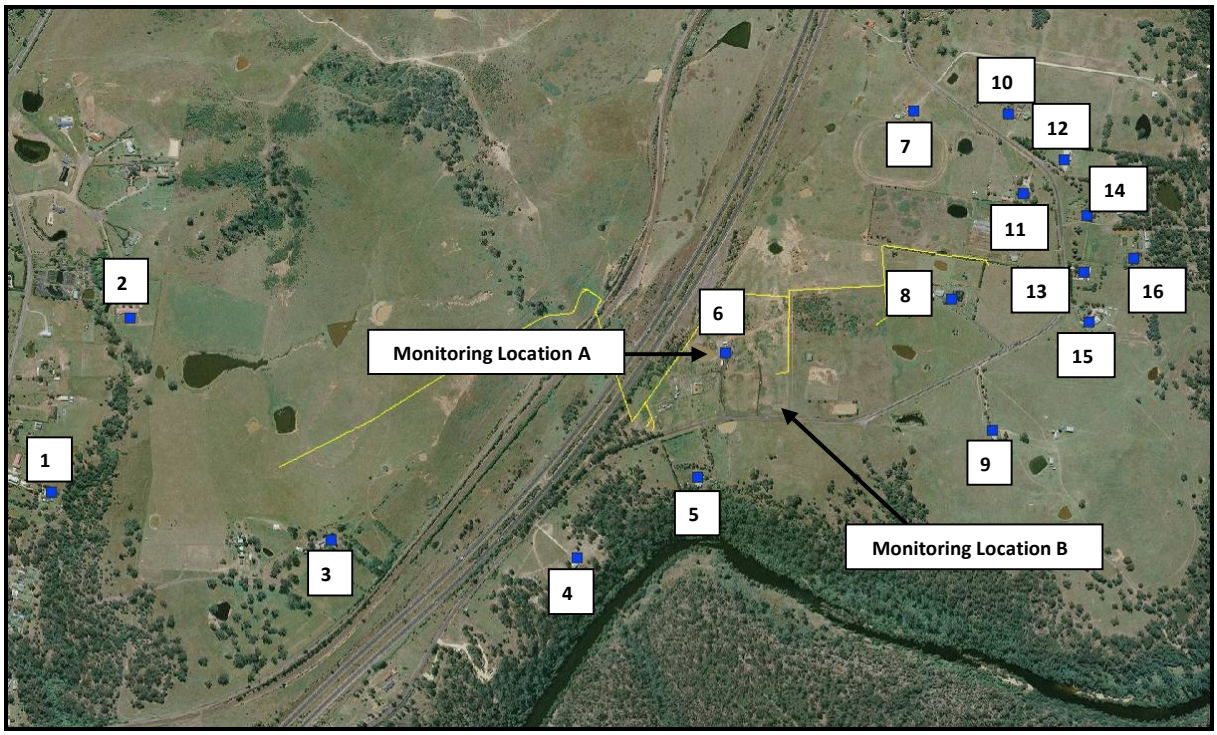


Figure 8.9 – Location of Potentially Noise Affected Properties

WM conducted unattended noise monitoring in the locations shown in **Figure 8.9** between 8 April and 20 April 2009. This allows identification of the existing noise environment that is used to assess impacts from the proposed project.

Whilst onsite conducting attended noise monitoring the WM noise scientists identified the Hume Highway as the primary noise source in the area and that there is no significant industrial noise in the area. The results of the noise monitoring permit definition of the Rating Background Levels (RBL) and the Equivalent Continuous Sound Level (shown as L_{Aeq}) of noise. WM use these measurements to calculate relevant noise criteria for surrounding residential properties, these are shown in tables in the remainder of **Section 8.4**.

8.4.2 Potential Impacts

The goaf gas project will generate different levels of noise from the different work stages. These variables have been accounted for by the noise assessment. The four different noise generating activities are:

1. Constructing and laying of the surface goaf gas pipeline
2. Drilling of vertical wells
3. Drilling of MRD boreholes
4. Operation of the goaf gas drainage equipment.

All of these activities have the potential to create noise impacts on one or more of the 16 surrounding residential properties.

WM undertook measurements of sound from an operational goaf gas drainage plant to assess the extent of the potential noise impacts on the surrounding houses. This demonstrates that the electricity generator is the primary noise generator and that there is notable noise from the vacuum pump. If mains power is able to be utilised at the extraction plants, the noise emission of the

extraction plant will be significantly reduced. Operational noise from the drainage equipment varies depending on the orientation of the site as noise shielding occurs from the various pieces of equipment within the goaf gas drainage compound.

Meteorological conditions affect the ability of sound waves to travel. Thus, some weather conditions can enhance the impact of noise as the sound is of a higher level when it reaches the sensitive receiver. The Noise Assessment predicts impact on the sixteen properties under various meteorological conditions to ensure the highest level of impact is assessed and mitigated.

8.4.2.1 Construction of Goaf Gas Pipeline

BHPBIC will use an excavator and trucks to carryout of this aspect of the project. The operation of this equipment generates noise that has the potential to affect some of the surrounding residential properties. **Table 8.15** provides calculated noise levels at the 16 properties when the equipment will be at the closest locations.

The noise criteria in the **Table 8.15** is the noise level calculated from the RBL of the area, above which the DECC expects impacts to affect amenity.

Table 8.15 – Calculated Noise Impacts from Pipeline Construction

Receiver #	Closest Distance (m)	Predicted Level (dBA)	Criteria (dBA)
1	500	49	50
2	500	49	50
3	210	**56**	55
4	340	52	55
5	205	**59**	50
6	90	**64**	55
7	330	**53**	50
8	80	**65**	50
9	380	**51**	50
10	360	**52**	50
11	180	**58**	50
12	330	**53**	50
13	250	**55**	50
14	290	**54**	50
15	300	**53**	50
16	370	**52**	50

Table 8.15 demonstrates that noise levels from pipeline construction will breach criteria and therefore require appropriate mitigation or management.

8.4.2.2 Drilling of Vertical Wells

Noise levels at the 16 houses have been calculated in relation to the drilling of vertical wells. This takes into account the proposal to drill during the day for two weeks and is based on known drilling sound levels. As the orientation of the drill rig is unknown at this time the highest sound levels are assessed travelling in all directions. When drilling is undertaken sound levels in some directions will be less than shown in **Table 8.16**.

Table 8.16 – Noise from Vertical Well Drilling

Receiver #	Vertical Well Number							Criteria (dBA)
	1	2	3	4	5	6	7	
1	**52**	47	26	24	23	22	20	50
2	**54**	49	26	23	24	22	19	50
3	**59**	49	35	46	44	42	33	55
4	32	40	52	**58**	48	48	33	55
5	30	40	**54**	**65**	**57**	**54**	37	50
6	29	39	**57**	**61**	**67**	52	39	55
7	22	27	38	28	32	36	56	50
8	26	34	39	45	**56**	**63**	**63**	50
9	25	32	46	47	**54**	**58**	47	50
10	22	27	40	26	32	37	**57**	50
11	22	29	41	28	34	41	**63**	50
12	20	28	40	25	31	37	**56**	50
13	22	30	34	30	36	40	**58**	50
14	21	27	38	27	32	39	**58**	50
15	23	30	33	33	39	43	**55**	50
16	21	29	35	29	34	39	**56**	50

The highlighted cells indicate occurrences of noise levels from the work breaching the DECC noise criteria. This indicates that mitigation or management measures are necessary.

8.4.2.3 Drilling of MRD Boreholes

This activity is proposed to continue 24 hours per day, seven days per week until the borehole is complete. It is anticipated that this activity would take six weeks to complete. The noise does have a directional element but as the orientation of the drilling rig is unknown at this time the assessment assumes the highest noise level is emitted in all directions. **Table 8.17** shows calculated noise emissions.

Table 8.17 – Calculated Noise from MRD Drilling

Receiver	Predicted Level (dBA)						Criteria (dBA)		
	MRD1			MRD2					
	Day	Evening	Night	Day	Evening	Night	Day	Evening	Night
1	26	27	28	24	27	29	50	50	41
2	26	27	28	24	26	27	50	50	41
3	34	35	36	47	48	**51**	55	55	43
4	**51**	53	**53**	**57**	**58**	**59**	55	55	43
5	**54**	**56**	**55**	**63**	**64**	**64**	50	50	41
6	**58**	**59**	**59**	**62**	**63**	**62**	55	55	43
7	45	46	**46**	33	35	34	50	50	41
8	**47**	**51**	**50**	**52**	**53**	**52**	50	50	41
9	**47**	49	**49**	**51**	**53**	**52**	50	50	41
10	**47**	48	**48**	35	37	37	50	50	41
11	**48**	49	**49**	36	38	38	50	50	41
12	**49**	**50**	**50**	33	36	35	50	50	41
13	39	41	40	35	36	35	50	50	41
14	41	42	**42**	32	33	33	50	50	41
15	37	40	39	37	38	38	50	50	41
16	42	44	**43**	34	36	35	50	50	41

The highlighted cells are occurrences of non-conformance with noise criteria. This indicates that noise management and mitigation measures will be necessary to protect the amenity of surrounding residents.

8.4.2.4 Operational Noise

The Noise Assessment predicts noise from the operation of the preferred and contingency goaf gas drainage extraction locations and assesses impact on the surrounding properties. **Table 8.18** provides calculated noise levels at the sixteen houses including existing background noise and the operation noise from the preferred goaf gas extraction plant location, without any noise mitigation barriers.

The highlighted cells in **Table 8.18** are occurrences when noise levels from the proposed preferred extraction location are calculated to breach the noise criteria.

Table 8.19 provides calculated noise levels and the relevant noise criteria for the contingency goaf gas extraction plant location, without noise mitigation barriers. The highlighted cells indicate occurrences of calculated non-concurrence with the criteria.

Table 8.18 – Summary of Predicted Receiver Levels without Noise Mitigation Barriers

#	Predicted Level (dBA)												Criteria (dBA)		
	Autumn			Spring			Summer			Winter					
	Day	Evening	Night	Day	Evening	Night	Day	Evening	Night	Day	Evening	Night	Day	Evening	Night
1	15	16	17	15	13	17	15	13	17	14	15	16	45	45	41
2	17	18	19	17	16	19	17	16	19	16	17	18	45	45	41
3	27	28	28	27	26	28	27	26	28	26	27	28	50	50	43
4	39	40	39	39	36	39	39	36	39	36	39	39	50	50	43
5	42	42	**42**	42	40	41	42	40	41	41	42	**42**	45	45	41
6	44	45	**45**	44	43	**44**	44	43	**44**	44	45	**45**	50	50	43
7	30	33	34	29	27	32	29	27	32	31	34	33	45	45	41
8	29	31	31	29	26	30	29	26	30	30	32	31	45	45	41
9	34	35	35	34	30	35	34	30	34	34	35	35	45	45	41
10	25	26	27	23	20	26	24	20	26	26	27	27	45	45	41
11	26	28	28	25	22	27	26	22	27	27	29	28	45	45	41
12	25	27	27	24	21	26	25	21	26	27	27	27	45	45	41
13	24	25	25	24	22	25	24	22	24	25	25	25	45	45	41
14	27	28	28	26	25	27	27	25	27	27	28	28	45	45	41
15	26	27	27	26	24	27	26	24	27	27	28	27	45	45	41
16	23	25	25	23	20	24	23	20	24	24	25	25	45	45	41

Table 8.19 – Summary of Predicted Receiver Levels without Noise Mitigation Barriers

#	Predicted Level (dBA)												Criteria (dBA)		
	Autumn			Spring			Summer			Winter					
	Day	Evening	Night	Day	Evening	Night	Day	Evening	Night	Day	Evening	Night	Day	Evening	Night
1	17	19	21	18	15	21	17	15	22	15	18	19	45	45	41
2	16	18	19	16	14	19	16	14	19	15	17	18	45	45	41
3	33	35	36	33	31	36	33	31	37	32	32	34	50	50	43
4	43	44	**44**	43	43	**44**	43	43	**44**	43	43	**44**	50	50	43
5	**51**	**51**	**51**	**51**	**50**	**51**	**51**	**50**	**50**	**50**	**51**	**51**	45	45	41
6	48	48	**48**	48	47	**48**	48	47	**48**	48	48	**48**	50	50	43
7	23	24	25	22	20	24	22	20	24	24	25	25	45	45	41
8	38	39	39	38	31	39	38	31	39	39	39	39	45	45	41
9	35	38	39	35	31	38	35	31	36	37	39	39	45	45	41
10	25	27	28	24	20	27	24	20	26	26	27	27	45	45	41
11	26	28	28	25	21	28	25	21	27	27	28	28	45	45	41
12	24	27	27	23	20	26	24	20	26	26	27	27	45	45	41
13	27	28	28	26	25	28	27	25	28	28	28	28	45	45	41
14	26	27	28	25	23	27	25	23	27	27	28	27	45	45	41
15	28	29	29	28	26	29	28	26	29	29	29	29	45	45	41
16	26	27	28	26	24	27	26	24	27	27	28	28	45	45	41

The assessment of operational noise criteria demonstrates that the proposal will have noise impacts on sensitive receivers that will require mitigation and management.

8.4.3 Mitigation and Management Measures

The Noise Assessment recommends noise mitigation and management measures to reduce impacts from the four work activities.

8.4.3.1 Pipeline and Vertical Wells

Both these activities are for a short duration and mobile in nature. Due to this, the implementation of noise barriers is not feasible. WM recommend that BHPBIC consider the following noise management and mitigation measures for pipeline construction and drilling of the vertical wells:

- Drilling should be limited to the DECC's recommended standard hours of 7.00am-6.00pm Monday to Friday and 8.00am-1.00pm Saturday, with no audible work on Sunday or Public Holidays.
- Use of the quietest available plant, which is regularly maintained and fitted with appropriate mufflers.
- The plant should, if possible, be oriented so that the loudest side is not facing the nearest receivers.
- Impacted neighbours should be contacted and informed of likely duration of work.

8.4.3.2 MRD Drilling & Drainage Operation

Both of these work aspects have the potential to significantly increase noise levels at some of the surrounding residential properties. The duration of both activities is enough to warrant the implementation of noise barriers to reduce noise impacts.

Noise from the MRD drilling at the preferred and contingency extraction locations will require the erection of a noise barrier. This should be as close as possible to the drilling rig and be at least 1m higher at the preferred location and 2m higher at the contingency location. WM suggest the barriers can consist of earth mounds, shipping containers or masonry and are to be located around the north, east and south sides of both compounds.

Should the preferred extraction plant, located on the property described as Lot 2 DP576136, be powered by mains power and thus not require a diesel generator, the noise emissions from this extraction plant will be greatly reduced. Should this be the case it is expected that noise mitigation barriers at this location will not be required for the operation of this extraction plant.

8.4.4 Actual Impacts

The recommended noise mitigation and management measures will ensure the noise levels at surrounding residential properties will remain within the DECC noise criteria for the following activities:

- Constructing and laying of the surface goaf gas pipeline
- Drilling of vertical wells
- Operation of the goaf gas drainage equipment.

The proposed noise barriers will adequately reduce noise from the MRD borehole drilling at the preferred goaf gas extraction location. However, noise from drilling the MRD borehole at the

contingency goaf gas extraction location will still result in some breaches of noise criteria even after implementation of the noise barriers. **Table 8.20** identifies these breaches:

Table 8.20 – Predicted MRD Drilling Noise Levels after Mitigation

Receiver	Predicted Level (dBA)						Criteria (dBA)		
	MRD1			MRD2					
	Day	Evening	Night	Day	Evening	Night	Day	Evening	Night
1	26	27	28	24	27	29	50	50	41
2	26	27	28	24	26	27	50	50	41
3	32	33	34	44	45	**47**	55	55	43
4	34	36	36	46	47	**48**	55	55	43
5	37	38	38	**53**	**54**	**54**	50	50	41
6	41	42	42	**57**	**58**	**57**	55	55	43
7	36	37	36	33	35	35	50	50	41
8	35	36	36	**49**	**50**	**50**	50	50	41
9	33	35	35	45	48	**47**	50	50	41
10	35	36	35	34	36	35	50	50	41
11	35	36	36	33	35	35	50	50	41
12	34	35	35	32	34	34	50	50	41
13	31	32	32	36	37	36	50	50	41
14	34	35	35	32	33	33	50	50	41
15	31	32	31	39	40	39	50	50	41
16	31	32	31	35	36	36	50	50	41

As noise mitigation has not resulted in sound levels complying with DECC criteria, WM recommends management of these noise levels. This should be via the following actions:

- Use of the quietest available plant, which is regularly maintained and fitted with appropriate mufflers
- Orient the drill rig and equipment so that the quietest side (identified as being up to 9dB quieter than the loudest side) is faced toward the nearest receivers
- Place temporary barriers around the drill rig on three sides. The barriers must extend above the height of the drill rig engine and any pumps by at least 1m and be located as close as possible to these noise sources
- Impacted neighbours should be contacted and informed of likely duration of work, noise mitigation works to be installed, and provided contact details of the Illawarra Coal Operations Manager - Exploration to provide feedback on any noise impacts.

Undertaking these noise mitigation and management measures should ensure that impacts on sensitive noise receivers are acceptable.

8.5 Erosion and Sedimentation

The proposed project will involve some earthworks, which must be managed to ensure soil erosion and sediment escape from the works areas are minimised.

The anticipated earthworks required for the proposed project may include:

- Construction of two extraction plant compounds
- Construction of nine drilling compounds and drilling of eight boreholes and one downhole
- Excavation of 3700m of trench to lay surface pipeline
- Under boring of the Hume Highway and Main Southern Rail Line
- Formalisation of access tracks if required.

8.5.1 Potential Impacts

The potential erosion and sedimentation impacts of the proposed project are identified as follows:

- Increased water flows and velocity over disturbed areas causing erosion and scour and
- Increased sediment flows into farm dams and drainage lines from dirty water runoff.

8.5.2 Mitigation and Management Measures

The contractor/s responsible for construction and drilling works will ensure the works do not result in erosion or sediment escape into natural watercourses or farm dams.

Erosion and sedimentation control measures will be implemented in accordance with the requirements of the "Blue Book" (Soils and Construction, Volume 1, 4th edition March 2004, Landcom). These measures will be developed by the construction contractor and shall be approved by the BHPBIC Project Manager prior to the commencement of works. The following types of controls will apply:

- Regular site drainage maintenance
- Identification of drainage channels and effective management of surface water during construction and operational phases of work
- Disturbed areas will be revegetated and stabilised to minimise erosion and scour
- Reducing the amount and velocity of any water flows over the construction site
- Sediment filters or fences and
- Clean water diversion drains.

A Journey Management Plan will be developed by the contractor and approved by the BHPBIC Project Manager prior to the commencement of drilling works. This plan will guide the appropriate controls required for the mobilisation/demobilisation of the drilling rig from one borehole location to the next, minimising the disturbance due to the formalisation of access tracks.

In addition, any soils left exposed by the construction works would be stabilised prior to commencement of the operational phase (e.g. via hydroseeding). This should take place in a progressive fashion in accordance with the staging of the works. It is intended that this will aid in both erosion and sedimentation control as well as dust control (see **Section 8.3**).

8.5.3 Actual Impacts

Provided that the aforementioned management and mitigation measures are implemented and adhered too, it is considered unlikely that significant impacts on sedimentation and erosion will occur.

There is no reason for erosion and sedimentation to constrain the proposed development as the works proposed in this Major Project application are assessed as having a minor impact.

8.6 Water Resources

8.6.1 Existing Environment

Surface Water

The project site is located in the Upper Nepean River Sub-Catchment of the larger Hawkesbury-Nepean Catchment. The Nepean River flows to the Hawkesbury River, which then discharges to the Tasman Sea at Broken Bay north of Sydney, NSW.

There are a number of small tributary creeks located within the study area, all of which are ephemeral, which flow into the Nepean River. There are also a number of small farm dams located within the project area. At its closet point, the proposed project area is approximately 300m to the North West of the Nepean River.

The proposed project is not located within any riparian zones and thus, will not compromise the integrity of any riparian zones located within the general area. The watercourses within the project area, shown in Figure 5.1 and Annex B plans, primarily consist of highly degraded and disturbed 1st order streams (under the Strahler Stream Order) which are not clearly defined on the ground and thus have negligible riparian vegetation. The general area has been extensively cleared for agricultural purposes.

Flows from these areas consist of overland surface flows, draining into the Nepean River and/or farm dams. Flows are not within clearly defined drainage channels that support riparian vegetation within a designated riparian corridor.

There will be no surface water extracted from the Upper Nepean Catchment as part of the proposed project.

Groundwater

Groundwater flows under the plateau flow under a hydraulic gradient to the Nepean River, being predominantly horizontal and determined by confined flow along discrete layers underlain by fine grained or relatively impermeable strata (GeoTerra, 2006).

Located with the general study area are two BHPBIC groundwater bores (NGW3 and NGW4) and two Department of Water and Energy (DWE) registered bores (GW104154 and GW101437). These bores were drilled between 72m and 165m below the surface; with water obtained from sandstone aquifers with yields ranging from 0.7L/s to 1.3L/s between 116m and 121m below surface (GeoTerra, 2006).

It is understood that DWE data for the general locality indicates that more regionally significant aquifers are intersected between depths of 100m and 110m, although intersections as shallow as 9m may be present as shallow perched aquifers with limited extent (GeoTerra, 2006).

Appin Colliery does not extract or use any groundwater as part of its mining operations. BHPBIC has applied for a Licence under Part 5 of the Water Act 1912 for the incidental extraction of groundwater from the mine. BHPBIC groundwater monitoring bores are licensed under Part 5 of the Water Act 1912.

BHPBIC does not anticipate there will be any groundwater extraction, incidental or authorised under a licence required as part of the proposed goaf gas drainage project.

8.6.2 Water Requirements for the Proposed Project

Surface water from the project area (i.e. the Nepean River and associated creeks or farm dams) will not be extracted as part of the proposed project and it is not anticipated that any significant discharges will be made as a result of the construction or operational phases of the project. A small

amount of water accumulated within the surface pipeline reticulation system as a result of condensation will be required to be released at periodic intervals within the extraction plant compounds. The extremely small volume of condensation water will mean it will be evaporated soon after it is released.

None of the infrastructure to be established as part of the proposed project directly impacts on any of the ephemeral water courses that run through the general project area. There will be no need to either fully or partially obstruct any watercourse, or to re-direct flows. It is not expected that any impacts on surface water flows will occur as a result of the proposal.

The operation of the extraction plant requires water cooling and a small water tank will be located within the extraction plant compound/s. Potable water from supplied by a Sydney Water Authorised user will be brought onsite and used for this cooling process. Approximate cooling water volumes would be less than 2,000L and this will be pumped through a continuous recirculation system between the extraction plant and water tank.

For the drilling of each vertical borehole and under boring of the Hume Highway and Main Southern Rail Line, a single pond lined with an impermeable liner will be excavated within each drilling compound to act as a drilling sump. The approximate dimensions of the pond are 15m length x 5m width x 3m depth and the approximate volume of water used throughout the drilling process is 10,000L per vertical borehole over a drilling period of approximately 2 weeks. Potable water supplied by a Sydney Water Authorised User will be brought onsite for the borehole drilling process.

For the drilling of each MRD borehole, which is a much more intensive drilling process, two ponds of similar dimensions as for the vertical boreholes will be excavated within each drilling compound to act as a drilling sump and each lined with an impermeable liner. The approximate volume of water used throughout the MRD drilling process is therefore 20,000L per MRD borehole over a drilling period of approximately 6 weeks. Potable water supplied by a Sydney Water Authorised User will be brought onsite for the borehole drilling process.

8.6.3 Potential Impacts

The potential impacts to surface water as a result of the proposed project are identified as follows:

- Dirty water runoff from disturbed areas flowing into farm dams and drainage lines affecting water quality.
- Overflow/seepage from drilling sumps flowing into farm dams and drainage lines affecting water quality

The potential impacts to groundwater as a result of the proposed project are identified as follows:

- The water used during the drilling of the boreholes may subsequently be exchanged with groundwater if any aquifers are encountered, thereby leading to the potential for cross contamination.
- In addition, if boreholes were to intersect groundwater, there is potential for drainage from the aquifer to occur, with the potential for interactions between aquifers at different depths.

8.6.4 Mitigation and Management Measures

Construction Phase

It is proposed that the water used for drilling will be sourced from a Sydney Water Authorised User and will be of potable quality. This water will be trucked onsite and stored in the ponds/sumps within each drilling compound. It is anticipated that the use of high quality, potable water for this purpose will minimise the potential for impacts to groundwater and surface water during the construction phase.

All excavated ponds will be lined with an appropriate impermeable liner to prevent water loss. The walls of ponds will be of an appropriate height to provide adequate freeboard to prevent inflow or overflow during rainfall.

If any voids are encountered during the borehole drilling process the drilling will cease and the borehole sealed up immediately to prevent groundwater cross contamination from potential fracturing of the strata from the drilling process. Should any voids be encountered and the potential for groundwater cross contamination arises the small volume and quality of water proposed for use during the borehole drilling process is unlikely to lead to any significant changes to groundwater quality.

Operational Phase

The vertical boreholes will be cased with steel casing and grouted in place from the ground surface of the well to the top of the Bulgo Sandstone section of the strata above the coal seam, an approximate depth of 250m underground (refer **Figure 8.10**), well below that of any regionally significant aquifers that may be present within the project area.

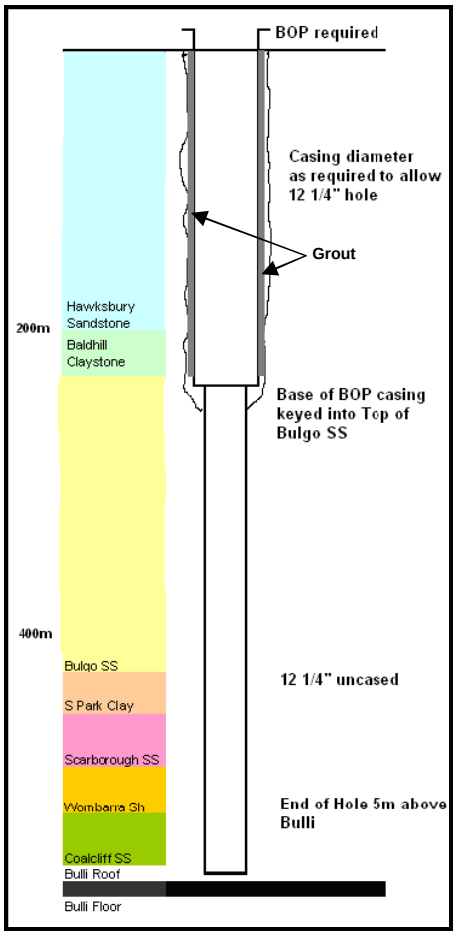


Figure 8.10 – Detail of Typical Vertical Borehole

The MRD boreholes will be cased with welded or threaded steel casing and grouted in place from the ground surface of the borehole to the end of the radial or build section where the horizontal alignment of the borehole starts, an approximate depth of 450m underground (refer **Figure 8.11**), well below that of any regionally significant aquifers that may be present within the project area.

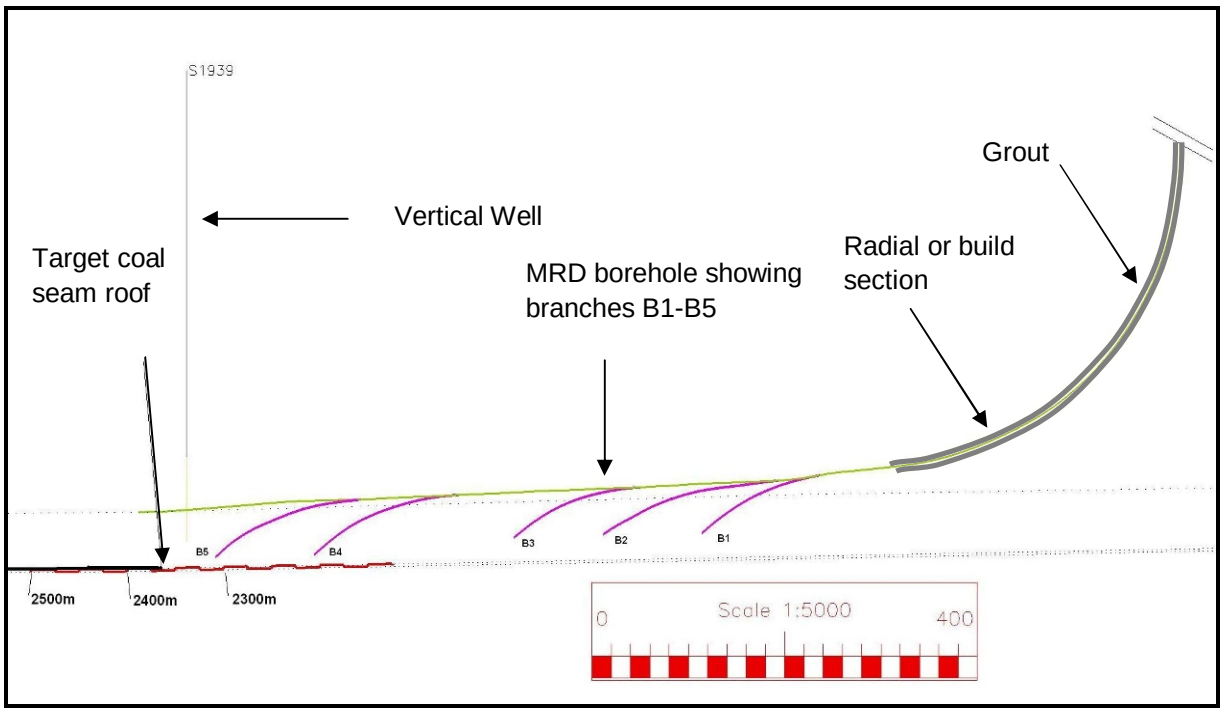


Figure 8.11 – Detail of Typical MRD Borehole

The grout used in both the MRD and vertical boreholes is a cement and water mixture, with a ratio of approximately 1kg of cement to 0.66L of water. The grout mixture will be injected into the voids between the borehole and steel pipeline casing, cementing the steel casing in place and providing an impermeable barrier between the subsurface strata and the borehole.

The casing and grouting of the boreholes will therefore negate the potential for groundwater inflow to and cross contamination of any aquifers via the boreholes during the operational phase of the proposed project.

De-Commissioning Phase

De-commissioning of the boreholes will be undertaken in accordance with *EDG01 Borehole Sealing Requirements on Land* (Summerhayes, 1997). All boreholes will be sealed in accordance with the guidelines upon completion of operations.

The water used in the extraction plant cooling process and borehole drilling will be removed and reused at Appin or West Cliff Collieries.

8.6.5 Actual Impacts

It is considered that, no significant actual (or residual) impacts are likely to result to any water resources if the management and mitigation measures outlined in **Section 8.6.3** are implemented and adhered too.

There is no reason for water resources to constrain the proposed development as the works proposed in this Major Project application are assessed as having a minor impact.

8.7 Flora and Fauna (Biodiversity)

Cardno commissioned Biosis Research to undertake a Flora & Fauna Impact Assessment for the proposed surface works associated with the goaf gas drainage project. This section of the EA summarises this assessment. The full Flora & Fauna Impact Assessment is provided in **Annex D**.

8.7.1 Existing Environment

Flora

The location of the goaf gas drainage project (refer **Figure 1.1**) predominately comprises cleared agricultural lands with scatted trees and a small area of regrowth Cumberland Plain Woodland (CPW) (refer **Figure 8.12**) on the land owned by BHPBIC and proposed for the contingency extraction plant location and Longwall 703 MRD borehole drilling compound. The cleared paddocks (refer **Figure 8.13**) currently support grazing animals such as cattle, goats and ponies.

Figure 8.12 – Regrowth Cumberland Woodland in Poor Condition

Figure 8.13 – Cleared Paddocks

Biosis identify a total of 45 plant species within the goaf gas drainage project area. This is made up of 18 native species and 27 exotic species. The project area also includes noxious weeds. Biosis did not record any threatened plant species within the project area and consider there is no potential habitat for any threatened flora in this area.

Grass is the dominant vegetation within the paddocks but there are also a variety of weeds and exotic plant species. There are a few occurrences of native trees such as Eucalypts within the paddocks and planted trees along fence lines. Biosis assess the current vegetation in the paddocks to be in a disturbed condition due to the history of cattle grazing, weed invasion and clearing. The paddocks have a low natural resilience to these impacts resulting in minimal chance of native vegetation returning.

The location for the proposed contingency extraction plant on the property described as Lot 7 DP250231 supports a relatively young regrowth of CPW, which is an Endangered Ecological Community (EEC), with trees of heights approximately 15m. The ground layer supports mostly exotic grasses and a low number of native understorey species. Biosis assess this native regrowth to be in poor condition due altered state of the environment and low species diversity. However, the vegetation will have some natural resilience due to the canopy cover and native species in the understorey.

Fauna

Biosis consider the CPW habitat in the goaf gas drainage project area to be in poor - moderate condition. This is because there are limited nesting opportunities and the understorey provides poor leaf litter and fallen branches for foraging. Threatened fauna that may visit the project area are nomadic species such as bird and bats.

Biosis did not locate any threatened fauna during their assessment. However, the project area does contain potential habitat for 14 threatened species (refer **Annex D**).

8.7.2 Potential Impacts

Direct impacts to flora and fauna from implementation of the 30m x 40m borehole drilling compound and equipment at the preferred goaf gas extraction location and the route of the proposed surface level 650mm reticulation pipeline will not significantly affect flora and fauna in this area. This is because the vegetation is already highly disturbed due to the long term agricultural land use of the area and provides minimal habitat for native flora or fauna.

These works will only affect 1.2ha of cleared paddocks, which Biosis identify as unnatural landscape. There are greater direct impacts to flora and fauna at the proposed contingency extraction plant and Longwall 703 MRD borehole drilling location on the property described as Lot 7 DP250231. The implementation of the MRD borehole drilling compound and ancillary developments in this location will require the removal of 0.16ha of CPW. This will reduce potential habitat for native flora and fauna.

Potential indirect impacts on flora and fauna associated with all the proposed goaf gas drainage works are:

- Soil erosion resulting in pollution of watercourses and a reduction in the habitat quality for flora and fauna
- Greater human activity in the area resulting in further disturbance to the natural environment.

8.7.3 Mitigation and Management Measures

Biosis recommend the following actions to mitigate potential impacts on flora and fauna:

- Adjust the location of sections of the surface goaf gas pipeline to avoid native trees and significant habitat features such as trees with hollows.
- Trees with hollows should be retained and protected, with no drilling within the critical root zone (extending to 2m beyond the drip line) of the trees.
- Where possible, locate proposed boreholes, pipelines and access tracks within existing cleared areas.
- Implement sediment and erosion control measures at all sites.
- Remove chemicals from site directly after use and dispose of appropriately.
- Wash-down machinery and vehicles prior to accessing site to avoid the transmission of weed seed or disease into intact areas of native vegetation.
- Rehabilitate the contingency goaf gas extraction plant and Longwall 703 MRD borehole drilling compound location with local native species characteristic of CPW after the cessation of goaf gas drainage project to replace any cleared vegetation.

8.7.4 Actual Impacts

Biosis' Flora & Fauna Impact Assessment regarding the proposed goaf gas drainage works development indicates that impacts will be minor due to the majority of the works being within areas of significantly disturbed vegetation. As discussed in **Section 8.7.2** there will be actual impacts on flora and fauna from the clearing of 0.16ha of CPW due to the implementation of the Longwall 703 MRD borehole drilling compound within the property described as Lot 7 DP250231. BHPBIC will rehabilitate this area with local native species characteristic of CPW after hew cessation of the proposed project to replace the cleared vegetation.

After assessment of all the actual impacts the Flora & Fauna Impact Assessment concludes:

- The proposal may remove or modify a small area of potential foraging habitat for 14 threatened or migratory species listed on the TSC Act and/or the EPBC Act, and two species preliminary listed under Schedule 2 of the TSC Act.
- Impact Assessments following the Guidelines for Threatened Species Assessment under Part 3A of the EP&A Act (DEC & DPI 2005) and Significant Impact Guidelines under the EPBC Act (DEH 2006) were carried out for threatened biota occurring or with potential habitat in the Study Area. The impact assessments found the impacts of the proposal are likely to be minor.

There is no reason for flora and fauna to constrain the proposed development as the works proposed in this Major Project application are assessed as having a minor impact.

8.8 Cultural Heritage

Cardno commissioned Biosis Research to undertake an Archaeological and Cultural Heritage Impact Assessment for the proposed surface works associated with the goaf gas drainage project. This section of the EA summarises this assessment. The full Archaeological and Cultural Heritage Impact Assessment (ACHIA) is provided in **Annex E**.

8.8.1 Existing Environment

The ACHIA report advises:

- Cultural heritage legislation protecting Aboriginal and historical heritage places applies in New South Wales. These places are an important part of our heritage. They are evidence of more than 40,000 years of occupation of New South Wales by Aboriginal people, and of the more recent period of post-contact settlement.
- Heritage places can provide us with important information about past lifestyles and cultural change. Preserving and enhancing these important and non-renewable resources is encouraged.

As this goaf gas drainage project requires excavation works it is possible that the development may affect Aboriginal cultural heritage. The assessment of the potential for this to occur commences with a review of the work location as different land areas, vegetation and topography alter the possibility of Aboriginal heritage being present.

The location for the goaf gas drainage project (refer **Figure 1.1**) predominately comprises open undulating plains that are cleared of vegetation due to a history of agricultural uses from approximately 1811. This results in extensive ground disturbance that often destroys archaeological or Aboriginal artefacts. The project area is situated on the transitional zone of the Woronora Plateau and the Cumberland Plain, known as the Cumberland Lowlands, where the open undulating plains meet the rugged sandstone plateau.

Large patches of remnant vegetation follow parts of the Nepean River where the topography is unsuitable for farming purposes. These areas have a greater potential of containing items, areas or evidence of Aboriginal cultural heritage as the land is less disturbed, the vegetation may have provided shelter and the river may have provided hunting opportunities for Aboriginal inhabitants. Any of these activities may have resulted in the Aboriginal's leaving evidence of their presence. Such items could now be defined as Aboriginal artefacts.

In order to provide additional cultural knowledge for this assessment Aboriginal representatives from the Tharawal Local Aboriginal Land Council and Cubbitch Barta Native Title Claimants Aboriginal Corporation assisted Biosis Research.

8.8.2 Potential Impacts

Any development that disturbs the ground or removes trees has the potential to damage or destroy Aboriginal cultural heritage. Additionally the potential for impact goes further this is due to the different values that can result in a location, item or area being considered of cultural value. The ACHIA report identifies the following values as being relevant in assessing potential cultural heritage:

- Social
- Historic
- Scientific
- Aesthetic
- Cultural landscape.

Due to this wide range of values, the actual development of land has the potential for impact on Aboriginal cultural heritage as a geographic location may be of cultural value to Aboriginal people or a specific tribe or group.

The potential impacts from the goaf gas drainage project may include:

- Destruction, damage or relocation of an artefact during boring/excavation/trenching works or due to vehicle or plant movement
- Felling of a scarred tree during any permitted vegetation removal
- Location of modern developments within an area of Aboriginal cultural significance
- Damage to a shelter due to vibrations from drilling, excavation or vehicle movement.

The ACHIA report advises that 17 Aboriginal site are registered on the DECC Aboriginal Heritage Information Management System (AHIMS) within the close proximity to the project works area.

Table 8.21 provides a description of the 17 AHIMS sites within the proposed project area.

Table 8.21 – AHIMS Sites Registered within the Proposed Project Area

AHIMS Site No.	Site Name	Site Type
52-2-1213	Unit e rubbish dump; Didicoolum	Axe Grinding Grooves
52-2-1214	Unit d ground axe paddock; Didicoolum	Open Campsite
52-2-0014	No Name	Shelter with Art
52-2-1921	Brooks Point 8	Shelter with Art
52-2-1922	Nepean River 2	Shelter with Art
52-2-2094	Nepean River 5 (Duplicate)	Shelter with Deposit
52-2-2095	Nepean River 6	Shelter with Deposit
52-2-2096	Nepean River 7	Scarred Tree
52-2-2097	Nepean River 5	Shelter with Deposit
52-2-2098	Nepean River 4	Shelter with Midden
52-2-2099	Brooks Point 9	Shelter with Art and Deposit
-	Mountbatten 2	Open Campsite
52-2-3674	Mountbatten 1	Open Campsite
-	Harris Creek 3 (HC 3)	Isolated Artefact
-	Moreton Park Road 4 (MPR4)	Open Camp Site
-	AA7-07	Shelter with Potential Archaeological Deposit

The ACHIA report confirms:

- Of the 17 sites recorded near the Study Area, the predominant site types are Open Camp Site (26%). The remaining site types are Shelter with Art (19%), Shelter with Deposit (19%), Shelter with Midden (6%), Shelter with Art and Deposit (6%), Shelter with Potential Archaeological Deposit (6%), Axe Grinding Grooves (6%), Scarred Tree (6%), and Isolated Artefact (6%).

In addition to the sites listed on AHIMS, Biosis Research identified three new Aboriginal sites consisting of two isolated artefacts and one open camp site within the works area during the survey for this project. These are very close to, or within, areas that will be directly affected by the above ground gas drainage pipeline and comprised open stone artefact scatters or isolated artefact occurrences. There is also one site on AHIMS that is in a location that will be directly affected by the pipeline.

Therefore there are 20 Aboriginal cultural heritage sites situated within the Study Area. Four of these sites; Mountbatten 1 (52-2-3674), Moreton Park Road IA-1 (52-2-3671), Moreton Park Road IA-2 (52-2-3672) and Moreton Park Road OCS-1 (52-2-3673) may be impacted by the installation of the surface pipeline reticulation system.

Biosis Research assessed the archaeological significance of the four sites potentially affected by the surface pipeline reticulation system and **Table 8.22** presents the results.

Table 8.22 – Archaeological Significance Assessment

Site Name	Discussion of contributing Features and Aspects	Archaeological Significance
Mountbatten 1 **(52-2-3674)**	*General*: This site contains three stone artefacts occurrence in an open context, giving only limited value under the general criteria. *Representativeness:* The site has a limited number of artefacts and hence low representative value. *Rarity:* Isolated stone artefact occurrences are not rare. *Research Potential:* Isolated artefacts have limited research potential beyond their basic recording. *Aesthetic:* Located on the upper slopes of a ridge with a vista of the surrounding region, the site has some aesthetic value.	**Low**
Moreton Park Road IA-1 **(52-2-3671)**	*General*: This site contains an isolated artefact occurrence in an open context, giving only limited value under the general criteria. *Representativeness:* The site has a limited number of artefacts and hence low representative value. *Rarity:* Isolated stone artefact occurrences are not rare. *Research Potential:* Isolated artefacts have limited research potential beyond their basic recording. *Aesthetic:* Located on the lower slopes of an undulating plain it has little aesthetic value.	**Low**
Moreton Park Road IA-2 **(52-2-3672)**	*General*: This site contains an isolated artefact occurrence in an open context, giving only limited value under the general criteria. *Representativeness:* The site has a limited number of artefacts and hence low representative value. *Rarity:* Isolated stone artefact occurrences are not rare. *Research Potential:* Isolated artefacts have limited research potential beyond their basic recording. *Aesthetic:* Located on the lower slopes of an undulating plain it has little aesthetic value.	**Low**
Moreton Park Road OCS-1 **(52-2-3673)**	*General*: This site contains two stone artefacts occurrence in an open context, giving only limited value under the general criteria. *Representativeness:* The site has a limited number of artefacts and hence low representative value. *Rarity:* Isolated stone artefact occurrences are not rare. *Research Potential:* Isolated artefacts have limited research potential beyond their basic recording. *Aesthetic:* Located on the upper slopes of a ridge with a vista of the surrounding region, the site has some aesthetic value.	**Low**

8.8.3 Mitigation and Management Measures

To ensure this project does not have any significant impacts on Aboriginal cultural heritage BHPBIC will implement relevant mitigation measures. In determining these measures, it is important to judge the archaeological significance of the heritage item or area because items of high significance may require very specific mitigation measures and items of low significance may not require any protection.

The ACHIA reports identifies that all four sites that are within the area that may be directly affected by the surface pipeline reticulation system are of low archaeological significance. Notwithstanding this Biosis Research propose the following mitigation and management measures:

- Sites Mountbatten 1 (52-2-3674), Moreton Park Road IA-1 (52-2-3671), Moreton Park Road IA-2 (52-2-3672) and Moreton Park Road OCS-1 (52-2-3673) to be registered as Aboriginal sites with NSW DECC. The sites should be listed on AHIMS.
- Where practicable, the proposed project should avoid impact to Mountbatten 1 (52-2-3674), Moreton Park Road IA-1 (52-2-3671), Moreton Park Road IA-2 (52-2-3672) and Moreton Park Road OCS-1 (52-2-3673).
- If the archaeological sites can be avoided, they should be fenced prior to construction using protective barriers, and all contractors should be notified of the importance of avoiding archaeological sites prior to undertaking of ground disturbance activities.
- If the archaeological sites cannot be avoided then an Aboriginal Cultural Heritage Management Plan (ACHMP) should be developed and implemented to facilitate the management, salvage and relocation of these sites. The ACHMP will also apply to any additional site uncovered during project construction.
- In the case of skeletal remains the following process should be implemented:
  - The find will be reported to police and state coroner
  - BHP Billiton Illawarra Coal will be notified of the find
  - Aboriginal stakeholders will be notified of the find
  - NSW DECC will be notified of the find
  - If the skeletal remains are of Aboriginal ancestral origin an appropriate management strategy will be developed in consultation with the Aboriginal stakeholders
  - The find will be recorded in accordance with the National Parks and Wildlife Act 1974 (NSW) and the NSW NPWS Aboriginal Cultural Heritage Standards and Guidelines Kit
  - The ACHMP will be amended to include the newly discovered Aboriginal ancestral remains in the management regime established by the plan.

An ACHMP has been developed. This outlines the management of Mountbatten 1 (52-2-3674), Moreton Park Road IA-1 (52-2-3671), Moreton Park Road IA-2 (52-2-3672) and Moreton Park Road OCS-1 (52-2-3673), and any other Aboriginal cultural material uncovered during construction for the proposed project. The ACHMP also describes Aboriginal community consultation and involvement of registered stakeholder groups.

The ACHMP has been included and implemented as part of this EA and is provided in **Annex F**.

8.8.4 Actual Impacts

The actual impacts to the Aboriginal heritage sites will be minimal. The ACHMP will ensure that all impacts to the Aboriginal heritage sites are minimised and managed accordingly.

There will be no impacts to non-Aboriginal heritage sites as a result of the proposed project as there were no new or previously registered historical archaeological sites within the proposed project study area.

There is no reason for Aboriginal and cultural heritage to constrain the proposed development as the works proposed in this Major Project application are assessed as having a minor impact.

8.9 Risks and Hazards

8.9.1 Potential Impacts

Interception of Existing Utilities Infrastructure

There is potential for services and utilities such as electricity, telecommunications and gas to be intercepted by the boreholes and reticulation pipelines, and the under-boring works underneath the Hume Highway and Main Southern Rail Line resulting in damage to infrastructure. It is understood that the area is not serviced by potable water, sewage or stormwater infrastructure. The risk of this impact occurring is predicted to be minimal provided appropriate management measures and consultation with infrastructure owners is undertaken.

Accidental Spills

There is potential for accidental spills to occur in relation to re-fuelling or servicing of any plant or equipment used, particularly with respect to re-fuelling of the extraction plant/s (if mains power is not available), which will occur on a weekly basis.

An accidental spill kit will be kept on site at all times and staff will be trained in its use. In the event of any accidental spill on site, works shall cease immediately and the Site Supervisor will notify the BHPBIC Project Manager.

However, the risk of this impact occurring is predicted to be minimal as safe practices and management measures will be implemented.

Fire and Explosion

One of the key risks associated with the proposal is the risk of fire or explosion in relation to the goaf gas. As discussed in **Section 6.1**, where concentrations of methane gas of 5% or more are exposed to air, there is the potential for combustion. Therefore, the flow rate and concentration of methane gas drained from the goaf areas will need to be monitored and management interventions may be required in the event that the operational parameters of the extraction plant are exceeded. In addition, there is a risk that methane emitted to the atmosphere via the ventilation discharge stacks may be ignited by lightning. The small volumes of gas emitted to the atmosphere via this method and the sporadic, undeterminable location of potential lightning strikes lend this risk to be considered minor.

It is considered that the risk of fire and explosion is minor provided that the management and mitigation measures provided in **Section 8.9.2** are implemented.

8.9.2 Mitigation and Management Measures

- Prior to commencing works, a survey of all below-ground infrastructure will be undertaken. The survey will seek to confirm that the locations selected for drilling of boreholes and trenching works do not coincide with any existing infrastructure.
- BHPBIC has also been in consultation with the telecommunications agencies with respect to the under-boring of the Hume Highway and Main Southern Rail Line and avoiding the communication services that exist within the area.
- The layout of the boreholes have taken into consideration the location of any underground services and any subsurface works carried out as part of the proposed project including the under-boring of the Highway and Rail Line will not coincide with any existing infrastructure.
- Any re-fuelling of drilling rigs, extraction plants and associated machinery will take place within a suitably lined, bunded area located within the extraction plant or drilling compound and away from any locations draining directly to any watercourses. An accidental spill kit will be kept on site at all times and staff will be trained in its use. In the event of any accidental

spills on site, works shall cease immediately and the Site Supervisor will notify the BHPBIC Project Manager.

- Any oil, fuels or other chemicals kept on site during the construction phase will be stored in a secure, bunded area.
- Regular maintenance and servicing of plant and equipment will be undertaken to ensure that the risk of accidental leaks is minimised.
- Installation of lighting masts within the extraction plant compounds and ventilation gas discharge stacks.
- Flame arrestors, should be fitted to the ventilation stack and to the inlet side of the extraction plant/s, situated between the fan and wellhead.
- Suitable fire extinguishers will be available during the construction phase of the proposed project and will be located onsite within the extraction plant compounds. These will be regularly maintained and tested.
- Personal Protective Equipment (PPE) will be required to be worn by all employees during the construction and operational phases of the proposed project.
- The proposed project will be conducted in accordance with BHPBICs Health Safety Environment and Community (HSEC) policies.

8.9.3 Actual Impacts

BHPBIC recognizes that the safety of employees, contractors and the community is of the utmost importance and has an overriding commitment to health, safety, environmental responsibility and sustainable development. The safety of employees, contractors and the communities in which Illawarra Coal operates is an integral part of its business. BHPBIC manages safety risks across all sites through risk-based HSEC Management Standards.

Therefore with the implementation of the abovementioned mitigation and management measures the actual risks and hazards associated with the proposed project will be minimal. There is no reason for risks and hazards to constrain the proposed development as the works proposed in this Major Project application are assessed as having a minor impact.

8.10 Waste

8.10.1 Potential Impacts

The proposed project will generate small amounts of waste in the form of:

- Excavated material from the drilling of boreholes and under-bore of the Hume Highway and Main Southern Rail Line
- Excess construction materials
- Sewage from temporary portable toilets located within the drilling compound(s), and
- General waste generated by construction workers.

All of these waste streams will require removal and appropriate disposal off site. The excavated material from the trenching works will be used to backfill and cover the surface pipeline reticulation system.

8.10.2 Mitigation and Management Measures

A Waste Management Plan will be prepared by the contractor, to form part of the Construction Environmental Management Plan, for both the initial construction and the de-commissioning works. The Plan should be developed in accordance with BHPBIC's Sustainable Development Policy, standard operating procedures and industry best practice.

Non-mineral wastes of the type likely to be generated as a result of this proposed project, should be removed offsite and recycled where possible or otherwise disposed of at a suitable, licensed waste disposal facility.

The excavated material or spoil from the drilling of boreholes and under-bore of the Highway and Rail Line is proposed to be trucked to the West Cliff Emplacement Area at the West Cliff Mine, for reuse as capping material for the rehabilitated stages of the Emplacement Area and/or used on site for site establishment or rehabilitation purposes.

8.10.3 Actual Impacts

With the implementation of the abovementioned mitigation and management measures the actual impacts associated with waste generated from the proposed project will be minimal. There is no reason for waste impacts to constrain the proposed development as the works proposed in this Major Project application are assessed as having a minor impact.

8.11 Visual Amenity

8.11.1 Existing Environment

The proposed project area is located approximately 2km North East of the township of Douglas Park.

Assessment of the proposed project area's existing visual condition and potential impact the proposed project will have on this is conducted by examining the following characteristics:

- Visual character
- Visual catchment (where the proposed extraction plant sites are visible from)
- Visual sensitivity (impacts on surrounding locations).

Visual Character

Topography, land use and vegetation surrounding the project area influence its visual character. The proposed project area has the following visual character:

- The topography of the project area varies from gently undulating to hilly with ground levels generally rising from the south west to the north east. The project area is defined by the Nepean River Gorge to the south and the Hume Highway and Main Southern Rail Line which crosses the project area in a south west to north east direction.
- The topography of the preferred extraction plant location on the property described as Lot 2 DP576136 is characterised by cleared steep hills rising generally from the south west to the north east, with the actual site proposed to be located within a gully heavily overgrown with blackberries on the side of a steep hill, which falls towards the south east towards the Main Southern Rail Line.
- The topography of the contingency extraction plant location on the property described as Lot 7 DP250231 is characterised by a generally flat grade and fairly dense vegetation. The

surface level of this site is significantly lower than that of the preferred extraction plant location mentioned above, the Hume Highway and Main Southern Rail Line.

§ The land surrounding the project area has been previously cleared for mixed agricultural purposes and primarily consists of small rural residential blocks. There are a number of residential dwellings within and surrounding the project area (refer Figure 6.1 and Annex B). There is some dense remnant vegetation following the Nepean River Gorge and along the alignment of the Hume Highway and Moreton Park Road within the project area and smaller sporadic patches on the surrounding properties.

Figure 8.14 shows the site characteristics of the proposed project area looking towards the Nepean River to the South East.

Figure 8.15 shows the view from the north east at the preferred extraction plant location on the property described as Lot 2 DP576136.

Figure 8.16 shows the general character of the preferred extraction plant location.

Figure 8.17 shows the view from the preferred extraction plant location looking to North East to the Main Southern Rail Line.

Figure 8.18 shows the general character of the contingency extraction plant location on the property described as Lot 7 DP250231.

Figure 8.19 shows the general character of the contingency extraction plant location of the site looking towards Moreton Park Road.

Figure 8.14 – Site Characteristics of the Proposed Project Area

Figure 8.15 – View from the North East Looking Down Towards the preferred Extraction Plant Location

Figure 8.16 – View from the Preferred Extraction Plant Location Looking North East to the Main Southern Rail Line

Figure 8.17 – Existing Vegetation Character of the Preferred Extraction Plant Location

Figure 8.18 – General Character of the Contingency Extraction Plant Location

Figure 8.19 – View from the Contingency Extraction Plant Location Looking South West to Moreton Park Road

Visual Catchment

The overall visual catchment of the proposed project area encompasses an expansive area of agricultural and rural residential land uses. There are a number of obvious ridge lines around the site proposed for the preferred extraction plant on Lot 2 DP576136 which will serve to obstruct the view from the North West. Towards the contingency extraction plant location on the property described as Lot 7 DP250231, the visual catchment is dominated by the existing Hume Highway, and patches of fairly dense vegetation obstructing most views of the site.

From the South East of the preferred extraction plant location on Lot 2 DP576136, the main public vantage points are from the Hume Highway and Main Southern Rail Line as traffic passes immediately past the site (as shown in **Figure 8.20**) and along a section of Moreton Park Road (as shown in **Figure 8.21**).

Figure 8.20 – View Looking North West from the Hume Highway to the Proposed Preferred Extraction Plant Location

Figure 8.21 – View Looking North West from Moreton Park Road to the Preferred Extraction Plant Location

For the proposed contingency extraction plant located on the property described as Lot 7 DP250231, the main public vantage point is from Moreton Park Road for traffic travelling in both directions. Existing dense vegetation consisting primarily of tall trees partially block the view towards the site. **Figures 8.22 and 8.23** illustrate the view for West and East bound traffic travelling along Moreton Park Road respectively.

Figure 8.22 – View West Bound Traffic along Moreton Park Road Looking Towards the Contingency Extraction Plant Location

Figure 8.23 – View from East Bound Traffic along Moreton Park Road Looking Towards the Contingency Extraction Plant Location

Visual Sensitivity

Visual sensitivity can be described by the distance to the site/s, the frequency of the view and the composition of the view. These are described below:

- Distance to Site
  - Within the foreground zone (0 to 0.5km from the two extraction plant sites), the preferred extraction plant location is visible for south and north bound vehicles on Hume Highway and Main Southern Rail Line (refer **Figure 8.20**). The contingency extraction plant location is not within a direct visual corridor for north bound traffic on Hume Highway. The view for south bound traffic towards this location is blocked by the dense vegetation consisting of tall trees along Hume Highway and within the site itself and also the height difference of ~10m AHD of the site below the Highway.
  - Within the middle ground zone (0.5 to 6.5km), the preferred extraction plant location is slightly visible from limited locations along Moreton Park Road, but the view is largely blocked by ridgelines and vegetation along the Hume Highway road corridor (refer **Figure 8.21**). The contingency extraction plant location is not visible from any location within the middle ground zone due to the dense vegetation surrounding the site (refer **Figures 8.22** and **8.23**).
  - Within the background zone (6.5 to 16km), both sites are not visible from any directions as both sites are obstructed by existing vegetation and/or the undulating topography of the area
- The frequency of the view to the both extraction plant locations is limited for the motorists along the Hume Highway and Moreton Park Road, trains on the Main Southern Rail Line, and the residents of the property described as Lot 1 DP838568. The high speeds at which motorists travel along the Hume Highway (110 km/hr), Moreton Park Road (80 km/hr) and the speed of the trains along the Main Southern Rail Line; coupled with infrequent train movements, represent a low frequency of the view to these locations. However, for the residents of Lot 1 DP838568, the

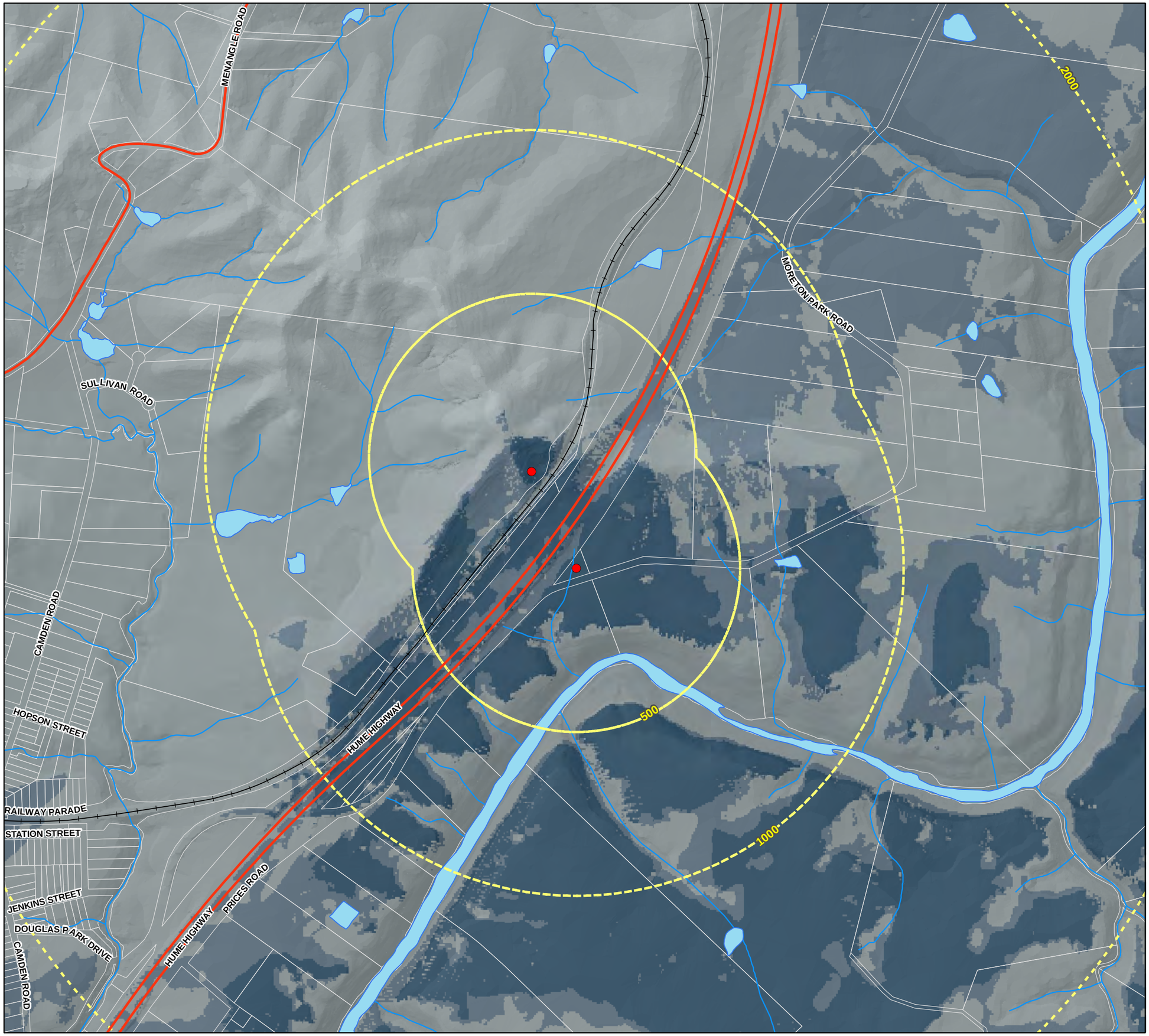
frequency of the view to both extraction plant locations, which is partially blocked by the topography and existing vegetation, is for the duration of the project.

§ The composition of the existing view comprises primarily of a rural landscape. The Hume Highway and Main Southern Rail Line form a large visual component of the view. Due to the depth of the gorge, the Nepean River is not a visually prominent component of the view for the project area. The project area is situated amongst the many rural residential allotments in the composition, many of which have associated sheds and ancillary machinery and/or farm equipment readily visible from Moreton Park Road. Both extraction plant locations are not considered to be visually prominent sites within this setting.

8.11.2 Potential Impacts

Figure 8.24 presents a viewshed analysis showing the visibility of both extraction plant locations in relation to their surrounds. This figure only takes into account the topography of the area and not the obstruction that existing vegetation provides in terms of views.

Table 8.23 assesses the visual impact of the proposed project in relation to character, catchment and sensitivity. Further impact assessments follow **Table 8.23**.



bhpbilliton
ILLAWARRA COAL

Viewshed Analysis

APPIN AREA 7 GOAF
GAS DRAINAGE PROJECT

Legend

- Proposed Extraction Plant Location/s
- Major Roads
- Railway
- Watercourses
- Waterbodies
- Cadastre
- 500m Buffer Rings of Extraction Plants

Viewshed Analysis

- High : 2
- Low : 0

Figure 8.24

N
W E
S

Scale 1:10,000 (at A3)

Metres
0 125 250 500

Cardno Forbes Rigby

Map Produced by Cardno Forbes Rigby Pty Ltd
Date: 27 May 2009
Coordinate System:
Zone 56 MGA/GDA 94
GIS MAP REF: 109033-02_2802_Viewshed.mxd 04

Data sourced from Department of Lands (LPI) unless otherwise stated

Table 8.23 – Visual Impact Assessment

Criteria	Potential Visual Impacts, Justification & Mitigation Measures	Photographic Evidence
Visual Character		
Topography	The goaf gas drainage equipment has the potential to visually affect topography by introducing new vertical elements, in the form of the gas flaring units (if utilised), into the landscape. If such an impact does occur, the affect on the surrounding topography would be minor. This is because the flaring units are approximately 10m in height and narrow in diameter. Additionally, the minor impacts are justified by: • The topography of Lot 2 DP576136 and its surrounds means that views to the proposed extraction plant from key vantage points will be blocked by surrounding hills. • The viewshed analysis shows the preferred extraction plant on Lot 2 DP576136 is only visible from a limited section of the Hume Highway and Main Southern Rail Line. • The proposed development will not alter the topography of the site as there are no significant earthworks proposed. • The topography around the contingency extraction plant on Lot 7 DP250231 is characterised by flat grades. The proposed contingency extraction plant would not alter this topography. As there is unlikely to be any visual impact to the topography of the area from the proposed developments there are no mitigation measures required.	 *Image showing the approximate location of the proposed extraction plant on Lot 2 DP576136.*
Land Use	The proposal has potential for visual impacts as a new land use is proposed for the locality. If not managed the goaf gas equipment could be a visual feature in the area because it is out of character with the existing land use. Neither the preferred or contingency extraction plant locations are considered to have a visual impact in relation to land use. This is because: • Lot 2 DP576136 is cleared and sustains limited grazing activities. Lot 7 DP250231 is vacant land, currently vegetated with regrowth CPW. • The proposed development does not involve significant land clearing and would not significantly affect the current land use of either site. The development will not alter the existing rural/agricultural character of the locality. The proposed development may require the clearing of 0.16ha of CPW on Lot 7 DP250231. • The small scale of the proposed development is not visually prominent. From all directions, both sites will still be retained as a rural land, dominated by open grassland and patches of vegetation. As visual impacts associated with land use will be no greater than minor mitigation measures are unnecessary.	 *Internal view from the South East to the preferred extraction plant location on Lot 2 DP576136.*
Visual Catchment		
	Any new development has potential to affect the appearance within its visual catchment. The impact is governed by the scale, height & location of the development in addition to existing developments, topography and screening. The proposed goaf gas drainage equipment will not have a significant impact on the visual catchment in which it is situated because: • The existing visual catchment of Lot 2 DP576136 is characterised by expansive areas of rural land, framed by the Hume Highway and Main Southern Rail Line to the East. • From the West, there are no public vantage points to the preferred extraction plant on Lot 2 DP576136 and thus the visual catchment will remain unchanged. • The key public vantage point to the preferred extraction plant location on Lot 2 DP576136 is from Hume Highway and Main Southern Rail Line. The preferred extraction plant will be visible for both North and South bound traffic along both these transport routes. • The location of the preferred extraction plant on Lot 2 DP576136 does not immediately adjoin any residential dwellings. The preferred extraction plant would not block the view of any users in the surrounding area. • For the contingency extraction plant located on Lot 7 DP250231, the small scale of the development and its location, partially surrounding by exsiting vegetation, would not affect the character of the existing visual catchment, with existing rural residential dwelling and associated buildings and sheds dominating the catchment. As the proposed development will not have a significant impact on the visual catchment no mitigation measures are necessary.	
Visual Sensitivity		
Distance to Site, Frequency of View, Composition of	If a development site is prominent, close and frequently seen it may be a visually sensitive location. A proposed development in such a position can have a significant visual impact on the locality. The visual sensitivity of the proposed locations for the preferred and contingency extraction plants is assessed by using the following pubic vantage points. This indicates that these locations are not visually sensitive, thus the proposed developments will only have minor visual impacts.	

Criteria	Potential Visual Impacts, Justification & Mitigation Measures	Photographic Evidence
View	• From the **Hume Highway and Main Southern Rail Line**, the current view for South and North bound traffic will be slightly modified as a result of the proposed extraction plant: - The distance to Lot 2 DP576136 is approximately 50m from the Main Southern Rail Line and 150m from the Hume Highway. The preferred plant will be located at approximately 10m above the RL of the Rail Line. The plant does not intrude the view of the Rail Line and Highway and will not affect the safety of users of these transport routes. - The contingency plant located on Lot 7 DP250231 is located approximately 10m below the RL of the Hume Highway. The view to the plant will be blocked by the existing tall trees along the Highway and difference in height, resulting in visibility of the contingency extraction plant being low from both the Rail Line and Highway. - The frequency of the view to both sites is low. - The composition of the view will be characterised by the Highway and Rail Line for either users of these transport routes. The preferred extraction plant and contingency extraction plant (if utilised) would not significantly affect the composition of the view. • From **Menangle Road and Camden Road**, both the preferred and contingency extraction plants are not visible from these locations. • From **Moreton Park Road**: - The visibility to both the preferred and contingency extraction plants site is high, but views partially blocked by vegetation. - The frequency of the view is medium to low as motorists would concentrate on the road when driving. - The composition of the view is characterised by a rural road, framed by the residential dwellings and associated buildings and sheds and existing trees along Moreton Park Road. The preferred and contingency extraction plants will not significantly affect the view and safety for motorists using Moreton Park Road. As the proposed developments will not affect a visually sensitive location there are no need for mitigation measures.	 *View along Moreton Park Road. The view is framed by existing street trees. These trees would partially block the view towards the contingency extraction plant on Lot 7 DP250231.*

Reflection & Colour

The proposed development has the potential to be visually intrusive due to the introduction of colours that are unusual in a agricultural setting or reflectivity of sunlight from equipment. The only aspects of the proposal that may reflect light are the flare units if they are utilised. Other proposed equipment is often painted mute or dark colours.

There is likely to be minimal visual impact from reflection or colour due to this project. The flare stacks are not a tall feature in the locality thus reducing their prominence and possibility of being seen due to a reflection. Additionally, the flare stacks will dull over time due to exposure to the elements; this will further reduce the chances of light reflecting.

Visual impacts from both reflectivity and colour will be reduced due to the location of the extraction plant compounds as these are partially obscured by existing vegetation and topography and located some distance away from houses.

Vegetation Clearing

BHPBIC propose to remove some of the trees on the property described as Lot 7 DP250231 for the purposes of the Longwall 703 MRD borehole drilling compound and the contingency extraction plant should this be utilised and this may remove some of the potential screening on the North East side of the property. This should not significantly affect visual impact mitigation as the facility is set back from the nearest visual receiver. The majority of trees that provide screening of this location are not on this property and removal of these is not proposed. Thus, this will continue to partially screen the Longwall 703 MRD borehole drilling compound to views from the South, West and North.

Night Lighting

The fluorescent lights at both MRD borehole drilling compounds has the potential to cause a visual impact during the night as these boreholes are proposed to be drilled 24 hours per day and the surrounding area does not contain any significant light sources, apart from the residential dwellings that are located within the project area.

The night lighting from the MRD borehole drilling compounds, located on the properties described as Lot 2 DP576136 and Lot 7 DP250231 should be a minimal impact on the surrounding area due to the location away from vantage points, limited and short duration view corridors to the compounds and screening from vegetation. These lights will be focused within the drilling compounds and not directed outside of these small specific areas. Nigh time MRD borehole drilling works is temporary and is expected to occur for duration of 12 weeks. All other borehole drilling and construction activities will be carried out during daylight hours.

The design of the flare units, should they be utilised, ensure the flame is completely contained within the stack. This results in the flame from the flaring units not being visible from outside the extraction compound during the day or night.

To further reduce impacts all lights will be turned off when not required for operational purposes.

Bulk & Height

The bulk and height of a development has potential to create a visual impact as it is out of scale with its surroundings resulting in visual prominence or a feeling of overbearing. The goaf gas drainage equipment such as the extraction plant/s, drill rigs and wellheads are not of a significant height to be prominent in a bushland setting, as trees and topography within the vicinity of extraction plant and borehole drilling compounds are greater in height. The equipment does not have significant bulk because it is all transportable.

Noise Barrier

A noise barrier is necessary at both the preferred and contingency extraction locations. This must be at least 1m higher than the MRD drilling rig at the preferred location and at least 2m higher than

the MRD drilling rig at the contingency location. This barrier may consist of a masonry wall, earth mound or shipping containers. Each option will have a visual impact on the surrounding area.

8.11.3 Mitigation Measures

This assessment indicates that the proposed goaf gas drainage equipment will have minimal visual impacts primarily due to the location away from visually sensitive receivers, screening from surrounding vegetation and small size of equipment.

The proposed clearing of 0.16 ha of Cumberland Plain Woodland at the contingency extraction location is unlikely to reduce the mitigation of visual impacts from existing vegetation. This is because the location is on lower land than the Hume Highway and has many mature trees growing around the north, west and south sides of the compound. These trees will not be affected by the proposed goaf gas drainage works.

The noise barrier will be as small as possible to meet the noise reduction objectives and also reduce the visibility of this development. The requirement for a noise barrier to be 1m or 2m taller than the drilling rig is only necessary during the 6 week MRD borehole drilling process. During the operation of the goaf gas extraction process a noise barrier just higher than the electricity generator and vacuum pump is necessary. As the noise barrier for ongoing operations will be lower, it will have less visual impact. This barrier will be removed once the extraction location is no longer required.

8.11.4 Actual Impacts

This visual assessment concludes there will be low actual impacts from the proposed goaf gas drainage development as the equipment is small in size, benefits from existing screening, is not in an area of scenic beauty and will only be in place for a temporary period.

The night time drilling works for the MRD boreholes will be partially visible at night time due to the lights from the drilling compounds. However, as these lights will be focused within the drilling compounds, partially obstructed by vegetation and surrounding topography and will only be for a temporary period of approximately 12 weeks, the visual impacts are expected to be minimal.

The noise barriers will be visible but only in place for a temporary period. The reduction in noise and protection of public and private residential amenity due to the barriers is justification for the short term visual impact.

There is no reason for visual impacts to constrain the proposed development as the works proposed in this Major Project application are assessed as having a minor impact.

8.12 Site Rehabilitation

The surface infrastructure associated with the proposed project, consisting of the trailer-mounted extraction plant/s, ventilation stacks, flaring units (if required) and surface pipelines, are temporary in nature will be removed and/or decommissioned after operations cease. All wells and boreholes will be sealed and reinstated in accordance with the appropriate guidelines upon completion of operations.

De-commissioning of the pipeline underneath the Hume Highway and Main Southern Rail Line will be the responsibility of BHPBIC. Upon de-commissioning of this section of the surface pipeline reticulation system, BHPBIC will fill in the pipeline and seal off both ends and will rehabilitate any disturbed areas within the road corridor to pre-project land use condition.

De-commissioning of wells and boreholes will be undertaken in accordance with *EDG01 Borehole Sealing Requirements on Land* prepared by the Department of Mineral Resources NSW (1997).

EDG01 states that boreholes "*drilled from the surface or from underground-it shall, upon completion, be completely backfilled with material of an approved type unless otherwise directed by the Chief Inspector*". The relevant requirements of EDG01 are listed below:

Borehole Filling Requirements

- All boreholes shall be filled in from the total depth to the surface with approved cement mixtures, in such manner that no excess is deposited on the surface which may interfere with any land use activities.
- If a hole is left open temporarily for any reason a suitable casing cap or bridge must be placed over the top of the hole for the period involved.
- Approved cement mixtures shall be designed to support the maximum allowable length of grout and provide an effective seal within the hole.
- Approved cement mixtures shall not be deposited in more than 200m of vertical depth in any borehole at any one time. Setting and weight testing shall be satisfactory completed and recorded before any further cement mixtures can be deposited in the borehole. When directed by an officer of the Department representative samples of the concrete mixture shall be kept for strength determinations.

Borehole Sealing Procedures

- All boreholes must be sealed by pumping the cement mixture from either the base of the hole or the bottom of the previously cemented section of the hole. The cement maybe preceded and/or followed by plugs. The position of the plugs in the borehole shall be determined before further grouting. In the event that a number of plugs are used within a borehole, the plugs must be placed so as not to leave a significant unfilled section between the plug and the underlying previously cemented section.
- When grouting surface casing the cement mixture should be allowed to extrude from the annulus between the casing and the borehole wall or another larger diameter casing string.
- All boreholes should be depth tested between all grouting and plug operations to determine if the level of the grout in the borehole is higher than shown in the calculations. All depth testing for this purpose shall be recorded.
- No cement mixture excess shall be deposited on the surface. In order to produce an effective seal all casing strings that are not cemented into place according to these guidelines must be removed prior to or during the sealing of the hole. Where non-grouted casing cannot be removed, the casing must be perforated and grout must be pumped under pressure to fill the annulus behind the unsealed casing. In this situation it may be necessary to place a suitable bridge or plug near the base of the affected casing in order to facilitate the injection of grout behind the casing.

Site Rehabilitation Requirements

- Clean-up work area, do not leave plastic, wire, nails, etc on site, remove all pegs, stakes, measuring strings, wires, equipment and materials unless approval has been given by the landowner.
- Reseed any areas of activity where vegetation has been damaged due to construction and operational activities. The contingency goaf gas extraction plant and Longwall 703 MRD borehole drilling compound located on the property described as Lot 7 DP250231 will be revegetated with local native species characteristic of CPW after the cessation of goaf gas drainage project to replace any cleared vegetation.
- Stripped topsoil will be stockpiled onsite within the extraction plant compounds. Upon rehabilitation the stockpiled topsoil will be reinstated and the site/s reprofiled to match existing contours before revegetation takes place.

- Sedimentation fences will be maintained for a period of approximately three months after site decommissioning has occurred. After this time, the sedimentation fences will be removed offsite by BHPBIC.
- Weed control will occur to effectively manage the potential for weed growth on each site.
- All surface impacts will be rehabilitated to the pre-project land use condition at the completion of the project or to the respective landowner's specific requirements.
- Surface casing must be removed below a level such that it will not have an impact on future uses of the land e.g. ploughing depth.

The above mentioned site rehabilitation requirements, which will be carried out by BHPBIC upon completion of the proposed goaf gas extraction project, should address the rehabilitation requirements raised in the DGRs and therefore not constrain the approval of the proposed project.

9 Secondary Environmental Impacts

This section identifies and assesses secondary environmental impacts.

9.1 Traffic

9.1.1 Existing Environment

Existing transport infrastructure within the proposed project area consists of the Hume Highway and the Main Southern Rail Line. Moreton Park Road and Camden Road are the main local roads servicing the project area and it is anticipated that normal traffic volumes along these local roads are low.

9.1.2 Potential Impacts

The key potential impacts on traffic relate to construction of the surface pipeline reticulation system, implementation of the goaf gas drainage equipment onsite.

Construction of Pipeline Reticulation System

As part of this proposal, a small section of the surface pipeline reticulation system requires the pipeline to cross underneath both the Main Southern Rail Line and Hume Highway (refer **Figure 5.1** and **Annex B**).

Trenching works for the remainder of the pipeline reticulation system is proposed to be carried out on private property in agreement with the landowners and should therefore not affect traffic along local roads, the Highway or Rail Line.

Borehole Drilling and Extraction Plant Construction

Site access to the various properties for the proposed project will be via either Moreton Park Road or Camden Road. All construction and operational associated traffic will use these two local roads. Site implementation associated traffic will consist of:

- Drill rigs
- Trailer mounted excavator for trenching works
- Trailer mounted extraction plant/s
- Employees personal vehicles
- Trucks supplying construction materials and water for the borehole drilling and under-boring process
- Trucks supplying ventilation discharge stacks and flare units (if required)
- Trucks to remove the spoil from the borehole drilling and under-boring process.

Construction traffic will access the relevant sites via either Moreton Park Road or Camden Road. The potential impact of this traffic on these two local roads may be increased traffic volumes and travel times along these roads.

The borehole drilling and under-boring process will generate spoil. BHPBIC propose to remove this from site and reuse it as capping material for the rehabilitated stages of the West Cliff Emplacement Area, located at the West Cliff Colliery or for site rehabilitation purposes as part of the proposed project.

During normal operations BHPBIC will store this spoil at the borehole drilling compounds until there is enough to fill a 20 tonne truck. The excavator onsite will lift the soil into the truck then this will use public roads to access West Cliff Colliery.

Approximate quantities of spoil produced from each borehole may be in the order of four tonnes per day over a period of two weeks for each vertical borehole and six weeks for each MRD borehole.

BHPBIC anticipate that approximately one 20 tonne truck per week will be necessary to remove the spoil from the borehole drilling and under-boring process. The addition of one truck per week on the local roads surrounding the project area will not have a noticeable impact on traffic congestion.

The actual borehole drilling and construction works is proposed to be carried out on private property in agreement with the landowners and should therefore not affect traffic along local roads, the Highway or Rail Line.

9.1.3 Mitigation and Management Measures

Pipeline Reticulation System

- Under-boring will be undertaken at a depth of approximately 10m below that of the Highway in order to install the pipeline underneath the Hume Highway and Main Southern Rail Line, thereby negating any interruption to traffic or rail services.
- The surface reticulation pipeline has been designed to follow property fence lines wherever possible, thereby minimising disruption of access to properties, dams and farm buildings. In addition, the pipeline will be placed in a trench approximately 1.4m below the surface and backfilled to permit access over the pipeline easement.

Construction Traffic

- During the construction phase, warning signs will be erected along Moreton Park Road and Camden Road at the access points to each property.
- A Journey Management Plan will be developed by the contractor and approved by the BHPBIC Project Manager prior to the commencement of any drilling works. This plan will guide the appropriate controls required for the moving of the drill rigs from one borehole location to the next.
- A Traffic Management Plan may be prepared by the contractor and approved by the BHPBIC Project Manager prior to the commencement of any construction works. This plan will guide the appropriate controls required for the day to day movements of employee's vehicles and associated implementation traffic if required.
- BHPBIC has consulted with and obtained written agreements from all landowners. In addition, residents will be advised prior to the commencement of works and advised of any related disruptions to local traffic.

9.1.4 Actual Impacts

Given the relatively short duration of works and the minor amounts of traffic that the proposed project is likely to generate, it is anticipated that any impacts on traffic and access will be minimal.

The actual impacts that may occur relate to the minor short-term increases in traffic volumes and hence travel times for local traffic utilising Moreton Park Road and Camden Road but as these impacts are expected to be minimal they should not constrain the approval of the proposed project.

9.2 Cumulative Impacts

Cumulative impacts relate to compounding effects and interactions arising from developments proposed or under implementation within the locality or at a similar time that together impact on the natural or built environment. Cumulative impacts could have significant affect if any of the environmental impacts from the proposed project (identified in **Table 8.1**) combine with the same environmental impact from another new or existing development. This could result in the adopted mitigation or management measures not sufficiently mitigating or managing the resulting impact.

The assessment of cumulative impacts ensures consideration of environmental impacts from the proposed project is not isolated from surrounding developments. As BHPBIC have no other proposed developments within the project area, it is considered that there are no cumulative impacts associated with the proposed project.

9.3 Overview of Mitigation and Management Measures

Sections 8 and **9** identify and assess environmental impacts from the proposed project. Existing and proposed controls or mitigation and management measures are discussed as necessary in relation to the specific impacts. **Table 9.1** lists the existing and/or proposed mitigation and management measures that this EA identifies as required to minimise the environmental impacts from the proposed development.

Table 9.1 – Overview of Mitigation Measures

Environmental Impact	Mitigation and Management Measure
GHG Emissions	The proposed project seeks to abate GHG emissions whilst safely removing goaf gas from longwall mining. No additional GHG mitigation measures are necessary.
Air Quality	The following measures will reduce dust escape from works areas: • Watering of exposed areas and spraying of excavations • Removal or replacement of stockpiled soil without undue delay • Reduction of dust generating activities during high wind.
Noise	The following measures will minimise noise impacts from the proposed project: • Use of the quietest available plant, which is regularly maintained and fitted with appropriate mufflers. • Orient the drill rig and equipment so that the quietest side (identified as being up to 9dB quieter than the loudest side) is faced toward the nearest receivers. • Place temporary barriers around the drill rig on three sides. The barriers must extend above the height of the drill rig engine and any pumps by at least 1m and be located as close as possible to these noise sources. • Impacted neighbours should be contacted and informed of likely duration of work, noise mitigation works to be installed, and provided contact details of the Illawarra Coal Operations Manager-Exploration to provide feedback on any noise impacts.
Erosion & Sedimentation	The work sites will be well maintained and include appropriate surface water control measures to direct and reduce flow direction & speeds. The sites will include sediment filters or fences and will direct clean water around the work area.

Water Resources	The drilling process will use water of potable quality to minimise any chance of pollution of ground water. This will be stored in lined ponds onsite prior to use. The borehole will be sealed immediately if any voids are encountered during the drilling process. The proposed wells and boreholes will be encased and grouted to prevent cross contamination of aquifers.
Flora and Fauna (Biodiversity)	The proposed works will be located in cleared areas and to avoid native trees and significant habitat where possible. Works will also include protection of trees with hollows. Vehicles will be washed-down before accessing site and chemicals removed once no longer required. Any clearing of Cumberland Plain Woodland from the contingency extraction plant site and MRD borehole location will be rehabilitated with CPW species.
Cultural Heritage	Locations containing cultural heritage will be avoided when possible and will be protected when this is not possible. Processes in the Aboriginal Cultural Heritage Management Plan will be followed.
Risks and Hazards	BHPBIC will ensure location of underground services prior to commencement of drilling. Re-fuelling will take place in a suitably bunded location and any oils, fuels and chemicals will be stored in a safe environment. The plant will be suitably maintained and fitted with safety equipment as necessary. Fire extinguishers and suitable PPE will be available and used when necessary.
Waste	Waste will be reused, recycled or disposed appropriately.
Visual Amenity	Due to the location and small size of the equipment mitigation measures are unnecessary.
Site Rehabilitation	Boreholes and wells will be back filled and appropriately sealed. All work areas will be rehabilitated with appropriate pasture or native plant species following completion of works.
Traffic	The pipeline under the Main Southern Rail Line and Hume Highway will be implemented using under boring techniques to mitigate any impacts on rail or road users. During site implementation warning signs will be placed near the site access and BHPBIC traffic managed as appropriate.

As the potential environmental impacts are minor, and all of the impacts are mitigated by the mitigation and management measures outlined in **Table 9.1** above, the proposed project will operate in compliance with the relevant legislation outlined in **Section 3**. Thus, additional environmental controls under the authority of this Part 3A Application in relation to the proposed project are not considered necessary.

10 Construction Management

This section describes the procedures BHPBIC will employ to ensure safety at work and minimise environmental impacts.

A number of contracting firms will construct different aspects of the proposed project. However, BHPBIC will maintain responsibility for the environmental management of the proposed project and is certified to the ISO 14001 standard.

10.1 Environmental Management Plan

The contractor/s appointed to undertake construction works will prepare Health, Safety and Environmental documentation that will include details of the environmental controls for the worksite. Compliance with the following requirements will be a minimum:

- All employees associated with the proposed project will be briefed on environmental controls prior to the commencement of work.
- Mitigation measures for control of erosion and water pollution in accordance with the soil and construction handbook (Soils and Construction, Volume 1, 4th edition March 2004, LANDCOM).
- Plant will be inspected on arrival to site and prior to use to ensure it is complies with its safety specifications.
- Daily inspection of plant to ensure it remains safe for use.
- Inductions of all workers to the Project site.

10.2 Construction Safety

All work carried out for BHPBIC mining activities must be covered by an Authority to Work (ATW) permit that is issued by the Mine Site Safety Personnel. The Contractor/s will be required to complete a risk assessment in relation to activities involved in the construction of the proposed project. Once approved by BHPBIC the risk assessment will form part of the ATW that controls all safety management aspects of the development.

Workplace safety is of utmost importance to BHPBIC and relevant measures are in place to increase safety. These include:

- Site induction including safety awareness and hazard specific training
- Mandatory wearing of the following Personal Protective Equipment (PPE):
- Steel toe-capped footwear
- Hard hat
- High visibility vest or coat
- Hand protection
- Eye protection
- Hearing protection (wherever applicable).

In addition to compliance with site safety regulations, protective equipment and attendance at site inductions; the contractor/s will be responsible for the safety of their employees and any sub-contractor employees.

10.3 Equipment Inspection

All motorised plant in use during construction may be subject to inspection by the Mine Electrical and Mechanical Engineers. The construction work will meet Coal Mine Safety equipment requirements. Equipment that does not meet relevant standards will be removed from site.

10.4 Pollution Control Measures

The development will ensure that appropriate measures are in place to ensure control of stormwater and silt runoff during construction. Such measures will include silt fencing and clean water diversion drains if required.

An Environmental Management Plan (EMP) will be prepared and implemented before work commences. Compliance with all such protection measures outlined in the EMP will be mandatory.

11 Statement of Commitments

This section sets out commitments that BHPBIC will abide by upon approval of this Part 3A application.

Preceding chapters have described environmental impacts and mitigation measures in relation to the proposed goaf gas drainage. The following commitments aim to ensure ongoing protection of the environment, employees and equipment.

Subject to approval of the project, BHPBIC will commit to the following controls as detailed in **Table 11.1** below.

Table 11.1 – Statement of Commitments

Objective	Commitment
Greenhouse Gas Emissions	
• Minimise impacts to the environment associated with GHG emissions.	• Subject to attaining RTA/ARTC approval and/or any unforseen construction delays to the under-bore beneath the road and rail corridor, BHPBIC will maximise the reticulation of goaf gas to EDL for electricity generation to minimise the emission of Greenhouse Gas emissions from the extraction of goaf gas associated with Longwall 703. (Note: this is the preferred option). • BHPBIC will implement a temporary flaring system (subject to a flaring system being available) to minimise the emission of Greenhouse Gas emissions from the extraction of goaf gas associated with Longwall 703 after three months of commissioning the secondary extraction plant. Flaring will occur until the road and rail corridor under-bore can be completed and connected to the EDL reticulation system. (Note: this is not the preferred option and is a contingency measure only). • BHPBIC will maximise the reticulation of goaf gas to EDL to minimise the emission of Greenhouse Gas emissions from the works associated with Longwall 704. • If unplanned and prolonged goaf gas venting occurs, BHPBIC will investigate the implementation of a flaring capability to minimise GHG emissions.
Working Hours - Construction	
• Minimise impacts on the local area from construction and site implementation operations.	• BHPBIC will carry out vertical well drilling and Hume Highway under-boring six days per week during daylight hours. • BHPBIC will drill the MRD boreholes 24 hours per day, seven days per week until complete (expect six week process for each well). • BHPBIC will conduct construction of the goaf gas reticulation pipeline six days per week during daylight hours. • BHPBIC will carry out extraction plant implementation activities six days per week during daylight hours.
Working Hours - Operation	
• Minimise impacts on the local area from operation of the extraction plant.	• The extraction plant(s) will operate 24 hours per day, seven days per week until goaf gas is depleted.
Noise	
• Minimise noise impacts from the goaf gas drainage project activities on sensitive receivers.	• BHPBIC will endeavour to use quietest available MRD drilling plant, which is regularly maintained and fitted with appropriate mufflers. • Orient the drill rig and equipment so that the quietest side is faced toward the nearest receivers where it is possible to do so. • Place temporary noise barriers around the MRD drill rig. • Place temporary noise barriers around the extraction plant. • Affected neighbours will be contacted and informed of likely duration of

Objective	Commitment
	work, noise mitigation works to be installed, and provided contact details of the Illawarra Coal Operations Manager- Exploration to provide feedback on any noise impacts.
Public Consultation	
• Keep local residents informed of BHPBIC operations. • Provide a public opportunity to comment on ongoing operations at Appin Colliery.	• BHPBIC will continue to operate the Appin community office during construction of this project to allow for any public comments or enquiries. • BHPBIC will continue to operate the 24-hour telephone line to provide an alternative method for public information. • BHPBIC will continue to support the Appin Area Community Working Group and associated liaison activities to ensure the local community have an opportunity to raise any questions regarding the goaf gas drainage project.
Water	
To minimise impacts on: • Quality • Supply • Groundwater	• Stormwater runoff, soil and erosion control measures will be managed in accordance with guidelines detailed in the Landcom Publication, "Soils and Construction" Volume 1, 4th Edition, dated March 2004. • Water used for drilling operations will be from a Sydney Water Authorised user. • All excavated ponds will contain an appropriate impermeable liner to prevent water loss. The walls of ponds will be of an appropriate height to provide adequate freeboard to prevent inflow or overflow during rainfall. • The vertical boreholes will be cased with steel and grouted in place from the ground surface of the well to the top of the Bulgo Sandstone section of the strata above the coal seam, (approximately 250m underground) this is well below any regionally significant aquifers that may be present within the project area. • The MRD boreholes will be cased with welded or threaded steel and grouted in place from the ground surface of the borehole to the end of the radial or build section where the horizontal alignment of the borehole starts, an approximate depth of 450m underground, well below that of any regionally significant aquifers that may be present within the project area. • The water used in the extraction plant cooling process and borehole drilling will be removed and reused at Appin and/or West Cliff Collieries.
Flora and Fauna	
BHPBIC will minimise impacts on native vegetation and animals by managing: • Weeds • Cumberland Plains Woodland (CPW)	• Machinery and heavy vehicles will be washed-down prior to accessing private properties to avoid the transmission of weed seed or disease into intact areas of native vegetation. • Rehabilitation of the land that was at the contingency goaf gas extraction location with local native species characteristic of CPW after the cessation of goaf gas drainage project to replace any cleared habitat.
Rehabilitation	
• To reduce long term affects from the proposed developments on the natural environment. • To ensure public and/or private safety following completion of borehole use.	• Any disturbed land will be rehabilitated to ensure the environment is returned back to the pre-development condition or to meet landowner specific requirements. • De-commissioning of the boreholes will be undertaken in accordance with *EDG01 Borehole Sealing Requirements on Land* (Summerhayes, 1997). All boreholes will be sealed in accordance with these guidelines upon completion of operations.
Waste	
BHPBIC will minimise impacts on the environment associated with	• BHPBIC will minimise waste where possible through careful planning of

Objective	Commitment
waste generation and disposal.	the extraction locations prior to implementation. • Drilling waste will be reused where possible: o At West Cliff Coal Wash Emplacement for site capping or rehabilitation o Onsite for construction and rehabilitation purposes o Onsite for construction of the noise barrier. • Appropriate capture and transfer of waste to suitable reuse, recycling or disposal location.
Air Quality	
• Reduce impacts from dust on surrounding properties.	• Construction activities will be managed in order to minimise the generation of dust.
Heritage	
• BHPBIC will minimise impacts on Aboriginal cultural heritage	• Aboriginal cultural sites will be avoided and temporally fenced during construction where possible. • Aboriginal cultural sites that may be impacted during construction will be managed in accordance with the Aboriginal Cultural Heritage Management Plan and in consultation with registered Aboriginal Stakeholders.
Traffic	
• Reduce the potential for traffic associated with this proposed project to create congestion. • Protect road safety.	• During the construction phase, warning signs will be erected along Moreton Park Road and Camden Road at the access points to each property. • A Journey Management Plan will be developed by the contractor and approved by the BHPBIC Project Manager prior to the commencement of any drilling works. This plan will guide appropriate controls for movement of drill rigs. • If necessary, a Traffic Management Plan will be prepared by the contractor and approved by the BHPBIC Project Manager prior to the commencement of any construction works. This plan will control movements of employee's vehicles and associated implementation traffic. • BHPBIC has consulted with and obtained written agreements from all landowners. In addition, residents will be advised prior to the commencement of works and advised of any related disruptions to local traffic.
Construction Management	
• Minimise impact on environment from construction work. • Ensure employee safety during construction.	• The successful contractor/s will prepare a safe working method statement for approval by BHPBIC prior to work commencing. • The Contractor will maintain equipment to a safe standard and ensure secure storage. • The Contractor will prepare an Environmental Management Plan for BHPBIC approval prior to the commencement of works. • All works conducted in accordance with relevant construction legislation and best practice.

12 Conclusion

This section outlines the conclusions of this Environmental Assessment and association with other major projects.

This Environmental Assessment (EA) forms part of a Major Project Application under Part 3A of the Environmental Planning & Assessment Act 1979 for drilling and surface equipment associated with the drainage of goaf gas from proposed BHPBIC longwall mining activities located approximately 5km north-west of Appin, in NSW.

BHPBIC propose to continue longwall mining at the Appin Colliery within Consolidated Coal Lease 767. This mining process requires drainage of methane gas, referred to as goaf gas, from the mining area via boreholes to the surface.

BHPBIC propose to manage the extracted goaf gas via the following three options in order of preference:

1. Capture and reuse for alternative energy generation at the EDL Power Stations located at Appin West Mine Pit Top and Appin No.2 Shaft, and/or
2. Onsite flaring, and
3. Onsite venting.

BHPBIC's preference is to reticulate the extracted goaf gas to the EDL Power Stations for reuse as electricity generation. As this may not be possible due to landowner constraints the use of flaring and, as a last resort, natural ventilation has been assessed in this EA.

The borehole drilling works over Longwall 703 described in this EA as the Longwall 703 Drilling Program may already have a separate approval granted under the Mining Act 1992.

Upon approval of this Part 3A application, the boreholes associated with the Longwall 703 Exploration Program will be converted to goaf gas drainage wells for the purpose of the Appin Area 7 Goaf Gas Drainage Project.

The approval of this application allows BHPBIC to meet customer requirements and continue mining in accordance with SMP approval for Longwalls 701 to 704 within Appin Area 7 granted by the DPI on 1 November 2006. This has important 'multiplier' affects as staff will have continued employment, federal and state governments will continue to receive benefits and spending of associated wages will continue in the Illawarra and Macarthur Regions.

The assessment of key and secondary environmental impacts identifies that the project has no significant impacts. This assessment is based on the following areas of potential concern:

- Greenhouse gas (GHG) emissions
- Air quality
- Noise
- Erosion & sediment control
- Water resources
- Flora and fauna
- Aboriginal cultural and European heritage
- Risks & hazards
- Waste management
- Visual

- Site rehabilitation
- Traffic
- Cumulative impacts.

The works to drain goaf gas have minimal environmental impacts due to the location away from sensitive receivers and the ability to site the developments avoiding known areas of significant vegetation or cultural heritage.

An ACHMP has been developed. This outlines the management of Mountbatten 1 (52-2-3674), Moreton Park Road IA-1 (52-2-3671), Moreton Park Road IA-2 (52-2-3672) and Moreton Park Road OCS-1 (52-2-3673), and any other Aboriginal cultural material uncovered during construction for the proposed project.

The ACHMP will ensure that all impacts to the Aboriginal heritage sites are minimised and managed accordingly.

The majority of the equipment for drainage will be temporary, resulting in the removal of any impacts in the long term. BHPBIC will rehabilitate all disturbed sites to their pre-existing state.

The development proposed in this application has been assessed in accordance with the Director-General's Requirements and objects of the EP&A Act 1979. The project is compliant with both and provides economic and social benefits to the State Government and continued employment provision. These project justifications and the minimal environmental impacts result in the project being suitable and acceptable.

12.1 Association with other major project

This Part 3A application seeks DoP approval to the goaf gas drainage project but understands that BHPBIC is currently preparing a separate Major Project Application known as the 'Bulli Seam Project' for the continuation of mining operations at West Cliff and Appin Collieries. A determination of the Bulli Seam Major Project is not expected until early 2010, and it is suggested that any requirements of this approval be ultimately incorporated into the Bulli Seam Project approval.

In order to facilitate safe and efficient mining of Appin Area 7 approved Longwalls 703 to 704 prior to approval of the Bulli Seam Major Project, BHPBIC are seeking approval of the works described in this EA.

In order to ensure the safe and efficient mining of Appin Area 7 Longwalls 703 to 704, BHPBIC wish to conduct the works described in this EA immediately. Due to this, BHPBIC are seeking the approval for these works prior to the submission of the Bulli Seam Project Environmental Assessment.

BHPBIC recognise that the approval of this Part 3A application for the goaf gas drainage of Appin Area 7 Longwalls 703 to 704 shall cease to have force and effect subsequent to the granting of any project approval under Part 3A of the EP&A Act 1979 for the Bulli Seam Project.

13 References

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Meyer, T. (2006) Surface Goaf Hole Drainage Trials at Illawarra Coal, in Aziz, N. (ed), *Coal 2006: Coal Operators' Conference*, University of Wollongong and the Australasian Institute of Mining and Metallurgy, 2006, pp: 200-209.

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NSW State Government (1992) *Mining Act 1992.*

NSW State Government (1995) *Threatened Species Conservation Act 1995.*

NSW State Government (1997) *Protection of the Environment Operations Act 1992.*

NSW State Government (1997) *Sydney Regional Environmental Plan No. 20 Hawkesbury – Nepean River.*

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Summerhayes, G. (1997) *EDF01 Borehole Sealing Requirements on Land: Coal Exploration.* Prepared by Mineral Resources New South Wales Environmental Management Guidelines for Industry. NSW Department of Mineral Resources, 1 December 1997.

Wollondilly Shire Council (1991) *Wollondilly Local Environmental Plan 1991.*

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Annex A

A. Director General's Requirements

NSW GOVERNMENT
Department of Planning

Major Project Assessment
Industry & Mining
Phone: (02) 9228 6339
Fax: (02) 9228 6466
Email: alison.thomas@planning.nsw.gov.au
Room 305
23-33 Bridge Street
GPO Box 39
SYDNEY NSW 2001

Dr Bruce Blunden
Manager – Environmental Approvals
BHP Billiton Illawarra Coal Holdings Pty Ltd
PO Box 514
UNANDERRA NSW 2526

Our ref: S03/01563

Dear Dr Blunden

Director-General's Requirements
Appin Gas Drainage Project
Project Application Number: 08_0256

The Department has received your application for the Appin Gas Drainage Project.

I have attached a copy of the Director-General's requirements for the project. These requirements have been prepared in consultation with the relevant agencies, and are based on the information you have provided to date. I have also attached a copy of the agencies' comments for your information.

Please also note that under section 75F(3) of the EP&A Act, the Director-General may alter these requirements at any time.

If your proposal is likely to have a significant impact on matters of National Environmental Significance, it will require an approval under the Commonwealth *Environment Protection Biodiversity Conservation Act 1999* (EPBC Act). This approval is in addition to any approvals required under NSW legislation. It is your responsibility to contact the Department of Environment, Water, Heritage and the Arts in Canberra (6274 1111 or http://www.environment.gov.au) to determine if the proposal requires an approval under the EPBC Act. The Commonwealth Government has accredited the NSW environmental assessment process, so if it is determined that an approval is required under the EPBC Act, please contact the Department immediately as supplementary Director-General's requirements may need to be issued.

I would appreciate it if you would contact the Department at least two weeks before you propose to submit your Environmental Assessment (EA) for the project. This will enable the Department to determine the:

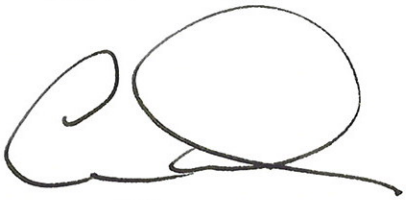
- applicable fee (see Division 1A, Part 15 of the *Environmental Planning and Assessment Regulation 2000*); and
- number of copies (hard-copy and CD-ROM) of the EA that will be required for exhibition purposes.

Once it receives the Environmental Assessment, the Department will review it in consultation with relevant agencies to determine if it adequately addresses the Director-General's requirements, and may require you to revise it prior to public exhibition.

The Department is required to make all the relevant information associated with the project publicly available on its website. Consequently, I would appreciate it if you would ensure that all the documents you subsequently submit to the Department are in a suitable format for the web, and arrange for an electronic version of the EA to be hosted on a suitable website.

If you have any enquiries, please contact Alison Thomas on 9228 6339 or alison.thomas@planning.nsw.gov.au.

Yours sincerely



2.2.09

Chris Wilson
Executive Director
Major Project Assessment
As delegate for the Director-General

Director-General's Requirements

Section 75F of the *Environmental Planning and Assessment Act 1979*

Application number	08_0256
Project	The Appin Gas Drainage Project
Location	About 6 km north-west of Appin
Proponent	BHP Billiton Illawarra Coal Holdings Pty Ltd
Date of Issue	2 February 2009
General Requirements	The Environmental Assessment of the project must include: • an executive summary; • a detailed description of the project, including the: – need for the project; – alternatives considered; – various components of the project; – the likely inter-relationship between the proposed project and existing or approved mining operations in the region; – likely staging of the project; and – plans of any proposed building works; • a risk assessment of the potential environmental impacts of the project, identifying the key issues for further assessment, and taking into consideration the issues raised during consultation; • a detailed assessment of the key issues specified below, and any other significant issues identified in the general overview of environmental impacts of the project (see above), which includes: - a description of the existing environment, using sufficient baseline data; - an assessment of the potential impacts of all stages of the project, taking into consideration any relevant policies, guidelines, and statutory provisions (see below); and - a description of the measures that would be implemented to avoid, minimise, mitigate, rehabilitate/remediate, monitor and/or offset the potential impacts of the project, including detailed contingency plans for managing any significant risks to the environment; • a statement of commitments, outlining all the proposed environmental management and monitoring measures; • a conclusion justifying the project on economic, social and environmental grounds, taking into consideration whether the project is consistent with the objects of the *Environmental Planning & Assessment Act 1979*; and • a signed statement from the author of the Environmental Assessment, certifying that the information contained within the document is neither false nor misleading.
Key Issues	• **Greenhouse Gas** – a full greenhouse gas assessment (including an assessment of the amounts of methane likely to be either a) vented or b) flared, the feasible alternatives for the utilisation of the methane produced by the project, a quantitative analysis of the greenhouse emissions associated with the project, and a qualitative assessment of the impacts of these emissions on the environment); • **Air Quality**; • **Noise;** • **Water Resources** – including details on water supply for the project and statutory water licensing requirements for the protection of any watercourses, riparian corridors and wetlands on the site; • **Erosion and Sediment Control** – including the proposed erosion and sediment controls during construction and stormwater and spill management during operation; • **Biodiversity** – including potential impacts to any threatened species, populations or ecological communities and the minimisation of any vegetation clearing;

	• **Aboriginal and Non-Aboriginal Heritage**; • **Risks and Hazards**; • **Waste**; • **Visual**; and • **Rehabilitation** – including a detailed description of the measures that would be implemented to rehabilitate the site upon completion of extraction.
References	The Environmental Assessment must take into account relevant State and Commonwealth Government technical and policy guidelines. While not exhaustive, the following attachment contains a list of some of the guidelines, policies and plans that may be relevant to the environmental assessment of this project.
Consultation	During the preparation of the Environmental Assessment, you should consult with relevant local, State or Commonwealth Government authorities, service providers, community groups or affected landowners. In particular you should consult with the: • Department of Environment and Climate Change; • Department of Primary Industries; • Department of Water and Energy; • Mine Subsidence Board • Road and Traffic Authority; and • Wollondilly Shire Council. The consultation process and the issues raised during this process must be described in the Environmental Assessment.
Deemed refusal period	60 days

Policies, Guidelines & Plans

Aspect	Policy /Methodology
Greenhouse Gas	
	National Greenhouse Accounts (NGA) Factors (AGO)
Air Quality	
	Approved Methods for the Modelling and Assessment of Air Pollutants in NSW (DEC)
	Approved Methods for the Sampling and Analysis of Air Pollutants in NSW (DEC)
Noise	
	NSW Industrial Noise Policy (DECC)
	Environmental Noise Control Manual (DECC)
Water Resources	
Surface Water	National Water Quality Management Strategy: Australian Guidelines for Fresh and Marine Water Quality (ANZECC/ARMCANZ)
	National Water Quality Management Strategy: Australian Guidelines for Water Quality Monitoring and Reporting (ANZECC/ARMCANZ)
	Approved Methods for the Sampling and Analysis of Water Pollutants in NSW (DEC)
	Managing Urban Stormwater: Soils & Construction (Landcom)
Groundwater	National Water Quality Management Strategy Guidelines for Groundwater Protection in Australia (ARMCANZ/ANZECC)
	NSW State Groundwater Policy Framework Document (DLWC)
	NSW State Groundwater Quality Protection Policy (DLWC)
	NSW State Groundwater Quantity Management Policy (DLWC) Draft
	Draft Guidelines for the Assessment & Management of Groundwater Contamination (DECC)
Biodiversity	
	Draft Guidelines for Threatened Species Assessment under Part 3A of the *Environmental Planning and Assessment Act 1979* (DEC)
	NSW Groundwater Dependent Ecosystem Policy (DLWC)
	State Environmental Planning Policy No. 44 – Koala Habitat Protection
Heritage	
Aboriginal	Draft Guidelines for Aboriginal Cultural Heritage Impact Assessment and Community Consultation (DEC)
	Aboriginal Cultural Heritage Standards and Guidelines Kit (NSW EPA)
Non- Aboriginal	NSW Heritage Manual (NSW Heritage Office & DUAP)
Risks and Hazards	
	State Environmental Planning Policy No. 33 – Hazardous and Offensive Development
	Applying SEPP 33 – Hazardous and Offensive Development Application Guidelines (DUAP)
	Hazardous Industry Planning Advisory Paper No. 6 – Guidelines for Hazard Analysis
	Locational Guidelines – Development in the vicinity of operating coal seam methane wells (DIPNR)
	Planning for Bushfire Protection (NSW RFS)

Annex B

B. Goaf Gas Layout Plans

290000 291000 292000

6217000

6216000

Lot 21 DP811782
Lot 52 DP740992
Lot 1 DP121322
Lot 4 DP804133
Lot 1 DP802151
LONGWALL 705
LONGWALL 704
LONGWALL 703
LONGWALL 702
Lot 7 DP249218
Lot 1 DP661402
Lot 51 DP864824
Lot 52 DP864824
Lot 3 DP231728
Lot 4 DP231728
Lot 1 DP231728
Lot 1 DP568196
Lot 201 DP869647
Lot 202 DP869647
Lot 3 DP249218
Lot 61 DP879419
Lot 5 DP237935
Lot 62 DP879419
Lot 4 DP838568
Lot 1 DP601444
Lot 2 DP601444
Lot 3 DP237935
Lot 2 DP237935
Lot 1 DP237935
Lot 3 DP838568
Lot 2 DP838568
Lot 1 DP838568
Lot 2 DP576136
Lot 1 DP576136
GOAF PLANT
GOAF PLANT
Lot 1 DP915066
Lot 6 DP250231
Lot 17 DP8738
Lot 19 DP8738

bhpbilliton
Carbon Steel Materials
Illawarra Coal Holdings Pty Ltd
Asset Development
Gas & Ventilation

Lot 4 Pipes Removed
Lot 21 Downcast Borehole Removed
Lot 3 Well Relocated
MRD Well Trajectories Shown

0 50 100 200
Metres

Appin Area 7
AREA 7 GOAF DRAINAGE PROJECT
703 & 704 WELLS & PIPELINES

Date: FEB, 2009
Author: Mick Loney
Signed Off:

NTS
Horizontal Datum
MGA - Zone 56

GV-A7-03
Version 3

291000

6216000

GOAF PLANT

Lot 1
DP802151

Lot 2
DP576136

Lot
Lot 1
DP915066

Lot 6
DP250231

Lot 1
DP838568

Lot 7
DP250231

GOAF PLANT

6216000

291000

bhpbilliton

Carbon Steel Materials
Illawarra Coal Holdings Pty Ltd
Asset Development
Gas & Ventilation

Lot 4 Pipes Removed
Lot 21 Downcast Borehole Removed
Lot 3 Well Relocated

0 50 100 200 Metres

Appin Area 7

AREA 7 GOAF DRAINAGE PROJECT

703 & 704 GOAF PLANT LOCNS

Date: FEB, 2009
Author: Mick Loney
Signed Off:

NTS
Horizontal Datum
MGA - Zone 56

GV-A7-02
Version 2

292000

6216000

Lot 4
DP838568

LONGWALL 703

Lot 1
DP601444

Lot 2
DP601444

Lot 5
DP237935

Lot 62
DP879419

Lot 3
DP237935

Lot 3
DP838568

Lot 2
DP838568

Lot 2
DP237935

Lot 1
DP237935

LONGWALL 702

Lot 17

6216000

292000

bhpbilliton

Carbon Steel Materials

Illawarra Coal Holdings Pty Ltd
Asset Development
Gas & Ventilation

Lot 4 Pipes Removed

Appin Area 7

AREA 7 GOAF DRAINAGE PROJECT

DETAIL VIEW - LOT3

Date: FEB, 2009
Author: Mick Loney
Signed Off:

NTS
Horizontal Datum
MGA - Zone 56

GV-A7-02f
Version 3

0 50 100 200
Metres

Annex C

C. Greenhouse Gas Assessment

Cardno Forbes Rigby

Shaping the Future

Appin Colliery Area 7

Goaf Gas Drainage Project

Greenhouse Gas Assessment

Project Number 109033-02-Report 002 Rev 1

Prepared for BHP Billiton Illawarra Coal

20 May 2009

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Document Control

Version	Date	Author		Reviewer	
Report 002 R1	20 May 2009	Mathew Carden	MDC	Peter Chudleigh	PCC

Executive Summary

BHP Billiton Illawarra Coal (BHPBIC) has Subsidence Management Plan (SMP) approval to mine Longwalls 701 to 704 at Appin Colliery Area 7, within the Southern Coalfield of NSW. BHPBIC has completed mining Longwall 702 and mining of Longwall 703 is expected to commence in November 2009.

Appin Colliery mines coal from the Bulli Seam, which contains relatively high methane gas (CH_4) content. Therefore, measures to drain the gas from the coal seam and from the goaf areas of the mine are used to minimise the quantity of gas that reports to the Mine Ventilation Air (MVA). High concentrations of methane in the MVA can cause significant underground safety risks, delays in development and longwall mining, and direct emissions of methane to the atmosphere via the upcast ventilation shafts.

BHPBIC propose to drain goaf gas from Longwalls 703 to 704 within Appin Area 7 by:

1. Implementing a procedure to safely drain the goaf gas;
2. Safely capturing, reticulating and managing the goaf gas;
3. Minimising impacts on cultural heritage, and the natural and urban environment; and
4. Minimising Greenhouse Gas (GHG) emissions.

Extracted goaf gas will be piped to the Energy Developments Limited (EDL) Power Station at Appin Colliery for electricity generation, with a small amount of venting to the atmosphere in the event of plant breakdown or operational issues. If significant operational issues arise causing ongoing venting, Illawarra Coal will consider the implementation of on-site flaring as a contingency measure. The proposed project will minimise GHG emissions through the conversion of methane gas to carbon dioxide, which has a lower Global Warming Potential (GWP). The project will also offset emissions associated with coal fired power generation through the use of the extracted goaf gas for energy generation at EDL.

Cardno Forbes Rigby (Cardno) was engaged by BHPBIC to prepare a GHG Assessment (GGA) for the proposed project. The scope of this GGA has been defined by the Director Generals Requirements (DGRs) for the project, which require a full greenhouse gas assessment, including an assessment of:

- The amounts of methane likely to be either a) vented; or, b) flared;
- The feasible alternatives for the utilisation of the methane produced by the project;
- A quantitative analysis of the greenhouse emissions associated with the project; and
- A qualitative assessment of the impacts of these emissions on the environment.

The methodology and approach used in this assessment aims to address the above listed requirements.

All greenhouse gas emission calculations were undertaken in accord with the methodology outlined in the *National Greenhouse Accounts (NGA) Factors* (2008) and industry best practice. To evaluate the change in emissions due to the project, all emission sources were categorised into either Scope 1, 2 or 3 type emissions, in accord with the NGA Factors (2008). The various Scope emission sources for the project are summarised in the following table.

We note that no Scope 2 emissions (electricity consumption) are associated with the proposed project as it is anticipated that all energy requirements will be supplied by onsite diesel generators, which have been included in Scope 1 emissions.

GHG Emission Sources

Scope 1 Emissions	Scope 2 Emissions	Scope 3 Emissions
• Diesel combustion during construction and installation works; • Drilling of MRD boreholes and vertical wells; • Diesel combustion during transportation of plant and materials; • Fuel combustion during employee travel associated with construction / installation works; • Diesel combustion resulting from ongoing power supply to the goaf extraction plant and flaring units; • Production of CO_2 and N_2O during onsite flaring of the extracted gas; and • Emission of CO_2 and CH_4 during from onsite venting of extracted gas directly to the atmosphere.	N/A	• Production of CO_2 and N_2O during combustion of extracted gas at EDL's Appin Colliery Power Station; and • Indirect extraction emissions associated with all Scope 1 fuel combustion emissions listed in column 1 (these emissions occur during the extraction and transportation of fuels used for energy).

This GGA quantifies the likely reduction in GHG emissions associated with the project by estimating baseline emissions (defined as those that would occur without the project) and post-project emissions (defined as those that would occur with the project), and comparing the two to determine the likely net reduction in GHG emissions that will result from the project being approved and implemented.

Baseline emissions were taken as the total emissions that would occur from Appin Mine due to the mining of Longwalls 703 to 704 without any utilisation of extracted goaf gas. Baseline emissions were estimated using the NGA Factors (2008) methodology for estimating fugitive emissions from underground coal mines (gassy mines), which is the industry accepted and agency preferred method for estimating fugitive mining emissions. This methodology accounts for release of methane and carbon dioxide during the mining process due to the fracturing of coal seams, overburden and underburden strata (NGA, 2008).

Post-project emissions were taken as the total emissions that would occur from Appin Mine if the proposed goaf gas drainage project was implemented, factoring the likely amounts of goaf gas to be used for energy generation, flared onsite, or vented directly to the atmosphere. Post-project emissions also included emissions that would occur during setup and installation works, and fuel consumption during operation of the extraction plants and flaring units.

BHPBIC are in consultation with Integral Energy and propose to connect the preferred extraction plant located on the property described as Lot 2 DP576136, to the existing 11kVA mains located on the adjacent property described as Lot 1 DP576136. This GGA has taken a conservative approach in assessing GHG emissions associated with proposed project and has therefore assumed the worst case scenario in that the preferred extraction plant and contingency extraction plant (if utilised) will be powered by a diesel generator.

Should the preferred extraction plant be able to be powered by electricity and not diesel, the actual GHG emissions associated with the operation of the extraction plant will be significantly lower due to this; however, the GHG emissions determined by this GGA has assumed the use of diesel fuel for operation of the extraction plant/s.

This GGA determined that the project will significantly reduce and offset GHG emissions by converting methane to CO_2, and generating electricity at the EDL Power Station. Methane is a GHG with a GWP of 21, which means that 1 tonne of methane gas emissions is equivalent to 21 tonnes of Carbon Dioxide (CO_2) emissions. Therefore, any conversion of methane to CO_2 by combustion will

result in a reduction in Carbon Dioxide equivalent ($CO_{2\text{-}e}$) GHG emissions. The goaf gas drainage project will reduce GHG emissions in this way. The estimated baseline, post-project, and net reduction in emissions likely to occur as a result of the project is provided in the following table.

Net Reduction in Emissions at Appin Mine Resulting from the Project

Operation	Total Emissions at Appin Mine (kt CO_2-e over the life of the project)	Equivalent Annual Emission (kt CO_2-e/yr)
Baseline Fugitive Emissions due to Mining of Longwalls 703 to 704	2028	1193
Post-Project Emissions	1694	996
Net Reduction in Emissions due to Goaf Gas Drainage Project	334	197

This assessment shows that the Project will result in a net reduction in GHG emissions of approximately 334,000 t CO_2-e (i.e. an annual equivalent of approximately 197,000 t CO_2-e based on a project timeframe of 1.7 years). In addition to this direct net reduction in emissions, the project will also offset emissions associated with coal fired power generation by utilising extracted methane gas for energy generation at the EDL Power Station. It is estimated that each MWh of electricity generated using extracted goaf gas will represent an emission offset of 0.89 t CO_2-e, and the total emission offset throughout the life of the goaf gas extraction project will be in the order of 44,000 – 89,000 t CO_2-e.

The DGRs issued for the project requested identification of feasible alternatives for the utilisation of goaf gas. The project proposes to convey as much of the extracted goaf gas as possible to the EDL Power Station at Appin Colliery for energy generation. If operational issues cause significant venting of the goaf gas then Illawarra Coal will consider the installation and operation of an on-site flare to abate GHG emissions.

Notwithstanding the above, the alternatives for the utilisation of goaf gas determined by this assessment include increased flare capacity, installation of VAMP plants at other upcast ventilation shaft sites, and an increased power generation capacity at the existing EDL Power Stations. This assessment concludes that none of these alternatives are feasible or reasonable in this instance and the project represents the most environmentally and economically feasible alternative for the management of the extracted goaf gas.

This GGA recommends that the goaf gas extraction project aim to maximise the amount of gas utilised in the following order of priority:

1. Reuse for energy generation at the EDL Power Station; and
2. Onsite flaring if ongoing venting occurs; or
3. Venting to atmosphere.

It is recommended that BHPBIC aim to minimise the amount of goaf gas vented directly to the atmosphere, and the consumption of diesel and petrol fuel wherever possible during the construction and operation phase of the project.

Mathew Carden
Environmental Engineer

Peter Chudleigh
Project Manager

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1 Introduction

1.1 Purpose of this Report

BHP Billiton Illawarra Coal Pty. Ltd. (BHPBIC) is seeking Part 3A approval for surface works and activities related to the drainage of goaf gas from coal mining at Appin Area 7 Longwalls 703 to 704. BHPBIC has Subsidence Management Plan (SMP) approval to mine Longwalls 701 to 704 granted by the Department of Primary Industries in November 2006. These Longwalls will extract coal from the Bulli Coal Seam at an approximate depth of 500m within an area approximately 6km north-west of the township of Appin in NSW.

BHPBIC have commissioned Cardno Forbes Rigby (Cardno) to prepare a Greenhouse Gas Assessment (GGA) for the proposed goaf gas drainage project. This GGA has been prepared in accord with the Director-General Requirements (DGRs) for the project, which were issued to BHPBIC by the NSW Department of Planning (DoP) on the 2 February 2009.

1.2 Scope of Study

The scope of this GGA has been defined by the DGRs for the project, which require a full greenhouse gas assessment, including an assessment of:

- The amounts of methane likely to be either a) vented; or, b) flared;
- The feasible alternatives for the utilisation of the methane produced by the project;
- A quantitative analysis of the greenhouse emissions associated with the project; and
- A qualitative assessment of the impacts of these emissions on the environment.

The methodology and approach used in this assessment is aimed at addressing the above listed requirements.

1.3 Existing Operations and Project Context

BHPBIC has SMP approval to mine Longwalls 701 to 704 in Appin Mine's Area 7 and is now seeking SMP approval to mine Longwalls 705 to 710 to the north of the abovementioned longwalls within this mining domain.

The mining of coal within the coal seams underground releases gases, which have been trapped within the coal seam pores by the chemical process of adsorption and/or absorption, produced by the coalification process. These gases consist primarily of methane which is a Greenhouse Gas that has a Global Warming Potential (GWP) of 21.

BHPBIC use in-seam drilling to drain methane contained within the Bulli Coal Seam prior to mining. Seam gas from the strata underlying the longwall is drained by cross measure boreholes. The in-seam and cross measure gas drainage produces high purity methane gas. These measures are known as pre-mine drainage. Post mining drainage is used to minimise the gas content within in the Mine Ventilation Air (MVA) and this is known as goaf gas drainage i.e. the gas is removed from the goaf area within the mine after the coal has been extracted.

If unmanaged, goaf gas can enter the mine ventilation system and cause safety and operational issues, including the risk of an uncontrolled underground explosion. The MVA is emitted to the atmosphere at upcast ventilation shafts. MVA from Appin Mine has a methane concentration in the order of 0.8 %. In order to limit the potential for gas build up in the mine ventilation system and

mitigate safety and operational risks, and also to reduce GHG emissions, BHPBIC propose a gas extraction system to draw the goaf gas to the surface, and a gas utilisation system to reduce GHG emissions. BHPBIC require surface equipment to drain this goaf gas. This equipment constitutes development of land that is ancillary to coal mining thereby requires development approval under the Environmental Planning & Assessment Act 1979.

1.4 Report Outline

This layout of this report is as follows:

Section 1 Introduction.

Section 2 Description of the Project, which provides a description of the various construction and installation works, as well as the operation of the project including the likely amounts of methane that will be extracted.

Section 3 Greenhouse Gas Assessment, which describes the methodology and source data used in the assessment, and presents the results of the study.

Section 4 Impact Assessment, which provides a qualitative assessment of the impacts of greenhouse gas emissions on the environment and a description of abatement measures employed by IC to minimise greenhouse gas emissions.

Section 5 Assessment of Feasible Alternatives for Goaf Gas Utilisation.

Section 6 Conclusions and Recommendations.

2 Description of the Project

2.1 Project Overview

This report forms the GGA for activities directly related to the proposed goaf gas drainage project for Appin Colliery Area 7 Longwalls 703 to 704.

The objectives of the goaf gas drainage project are to:

1. Implement a procedure to safely drain the goaf gas;
2. Safely capture, reticulate and manage the goaf gas;
3. Minimise impacts on cultural heritage and the natural and urban environment; and
4. Minimise Greenhouse Gas (GHG) emissions.

Every coal mine with high coal seam gas concentrations has to put in place procedures for controlling the gas concentrations in their ventilation systems. BHPBIC propose to drain gas from the goaf areas of Longwalls 703 and 704 by drilling vertical and steered boreholes, between the extracted coal seam and the surface ground level. The goaf gas will be drawn up the boreholes by extraction plants located on the surface to ensure underground gas concentrations remain well below 1.25 % in the MVA.

The extraction plants use a vacuum pump to draw the goaf gas to, and up, the wells thus minimising gas in the goaf from entering the mine ventilation system. The proposed extraction plants will be in a centralised location so that gas may be drawn from multiple wells/boreholes that are connected by a surface pipeline reticulation system.

BHPBIC has obtained written approval from the landowners prior to the location and implementation of the extraction plants, wellheads and pipelines. These facilities are temporary in nature and only require a small area that is located in an open paddock to avoid or minimise environmental impacts. The surface facilities will be fenced to control access to these sites.

One primary and one contingency extraction plant are proposed to be used for the goaf gas drainage of Longwalls 703 to 704 (refer **Annex A** for plans showing location of extraction plants and associated surface facilities). The extraction plants will be mobile, semi-trailer mounted and powered by a diesel generator.

2.2 Project Timeframe

Mining of Longwalls 703 to 704 is scheduled to commence in November 2009 and it is estimated to be complete by approximately August 2011. This estimate is based on a mining progression rate of 50 m per week, over the total approximate length of both longwalls of 4239 m, with allowance for a four week period between longwalls to relocate mining equipment. The anticipated schedule of mining is provided in **Table 2.1**.

Table 2.1 – Anticipated Project Timeframe

Activity / Operation	Approximate Start Date	Approximate Finish Date
Installation of goaf gas drainage infrastructure	Date of Approval	November 2009
Mining of Longwall 703	November 2009	August 2010
Relocate underground mining equipment	August 2010	September 2010
Mining of Longwall 704	September 2010	July 2011

From the above table it is assumed that the duration of the goaf gas drainage project is likely to be 1.7 years or 89 weeks.

2.3 Installation and Operation of Goaf Gas Drainage System

2.3.1 Borehole and Surface Pipelines

BHPBIC will implement two types of boreholes for this project:

1. Medium Radius Drilled (MRD) wells – a 250 mm borehole, which starts vertically from the surface and is steered to near horizontal for some distance above the goaf (refer **Figure 2.1**). The MRD hole may have a number of branches to improve gas flow; and
2. Vertical wells – a 250 mm borehole drilled vertically from surface level to the goaf (refer **Figure 2.1**).

The location and type of boreholes used for the proposed goaf gas drainage of Longwalls 703 to 704 is presented in **Annex A**.

The vertical wells are drilled from the surface using a mobile drilling rig to a depth of approximately 10 m above the Bulli Coal Seam roof, approximately 500 m underground. A temporary fence would surround the rig and associated equipment during drilling. Associated equipment includes a rod trailer, ponds or sumps, compressors, storage shed and portable toilet. The compound would be approximately 30 m x 40 m in area.

Medium radius drilled (MRD) wells have emerged over the past two years as a viable addition or alternative to underground based in-seam drilling in coal mines and vertical well hydro-fracture for coal seam methane exploitation. The basic MRD well consists of an inclined, medium radius borehole collared at the surface to tangentially extend horizontally above the target coal seam at a approximate height of 50 m (refer **Figure 2.1 and Annex A**).

On the surface, the two borehole types appear identical. Each borehole has a well head, which is where the borehole breaks the ground surface (refer to **Figure 2.2**), and is attached to the surface pipeline reticulation system. The following equipment is proposed for installation at each wellhead:

- Shut off valve;
- Non–return valve;
- Flame trap;
- Gas monitoring fittings;
- Flow monitoring fittings;
- Polyethylene piping to carry the gas away to the extraction plants; and
- Fencing to prevent unauthorised access.

2.3.2 Extraction Plant

The proposed extraction plant will be located in a centralised location remote from the individual well heads. The preferred location for the extraction plant is on the western side of the Hume Highway on the property described as Lot 2 DP 576136, with an underbore connection beneath the Hume Highway and Main Southern Rail Line connecting the gas drainage network for Longwall 703 to that of Longwall 704 (refer **Annex A**). This would allow the use of only one extraction plant and the extracted goaf gas from Longwalls 703 and 704 to be conveyed to the Energy Developments Limited (EDL) Power Station at Appin Colliery via a downhole on Lot 1 DP 576136 to the existing underground gas drainage pipe range. However, if approval is not granted to underbore the Hume Highway and Main Southern Rail Line, a second back up or contingency extraction plant location on the eastern side of the Hume Highway would be required, and would be located on the property described as Lot 6 DP 250231 if required (refer **Annex A**).

BHPBIC are in consultation with Integral Energy and propose to connect the preferred extraction plant located on the property described as Lot 2 DP576136, to the existing 11kVA mains located on the adjacent property described as Lot 1 DP576136. This GGA has taken a conservative approach in assessing GHG emissions associated with proposed project and has therefore assumed the worst case scenario in that the preferred extraction plant and contingency extraction plant (if utilised) will be powered by a diesel generator.

Should the preferred extraction plant be able to be powered by electricity and not diesel, the actual GHG emissions associated with the operation of the extraction plant will be significantly lower due to this; however, the GHG emissions determined by this GGA has assumed the use of diesel fuel for operation of the extraction plant/s.

The extraction plant will draw gas from multiple wells that are connected by a surface pipeline reticulation system. A separate diesel powered electricity generator is necessary to power the plant and provides approximately 175kVA of power. Experience indicates that this will require filling once a week by a mobile diesel tanker.

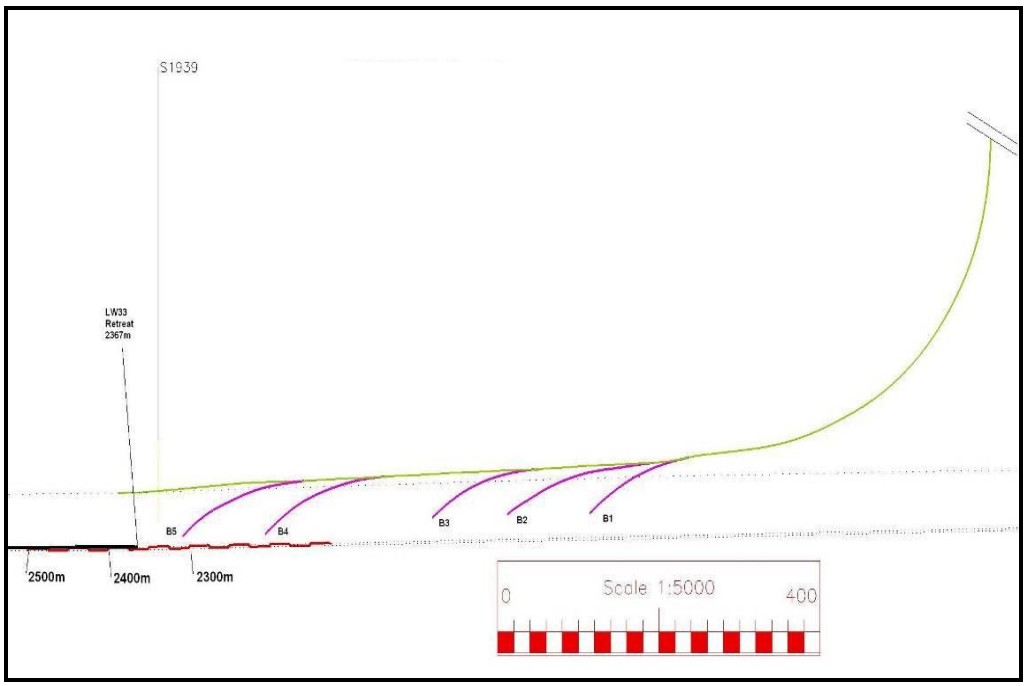

Figure 2.1 – Section Showing Vertical Well and MRD Borehole and Branches

Figure 2.2 – Typical Wellhead

BHPBIC has obtained written approval from all the landowners for the implementation of the extraction plant, well heads and surface pipelines proposed for their land. The proposed infrastructure is temporary in nature and only requires a small area that will be located in an open paddock and sited to avoid or minimise environmental impacts. All surface impacts will be rehabilitated to the pre-project land use at the completion of the project or to landowner's specific requirements.

The facility does not require permanent staff because monitoring and safety systems allow remote operation of the extraction plant via radio communications.

Well flows are variable but BHPBIC expect each well would produce up to 800 L/s of goaf gas for a period of approximately 4 to 12 weeks. Expected average flow over the life of a well would be around 400 L/s. The nominal capacity of the extraction plant is 800 L/s.

Figure 2.3 shows a drawing of a typical goaf gas extraction plant layout, which consists of:

- Mobile goaf gas extraction plant
- Discharge gas pipe work to discharge point;
- Remote vent stack; and
- Flare units.

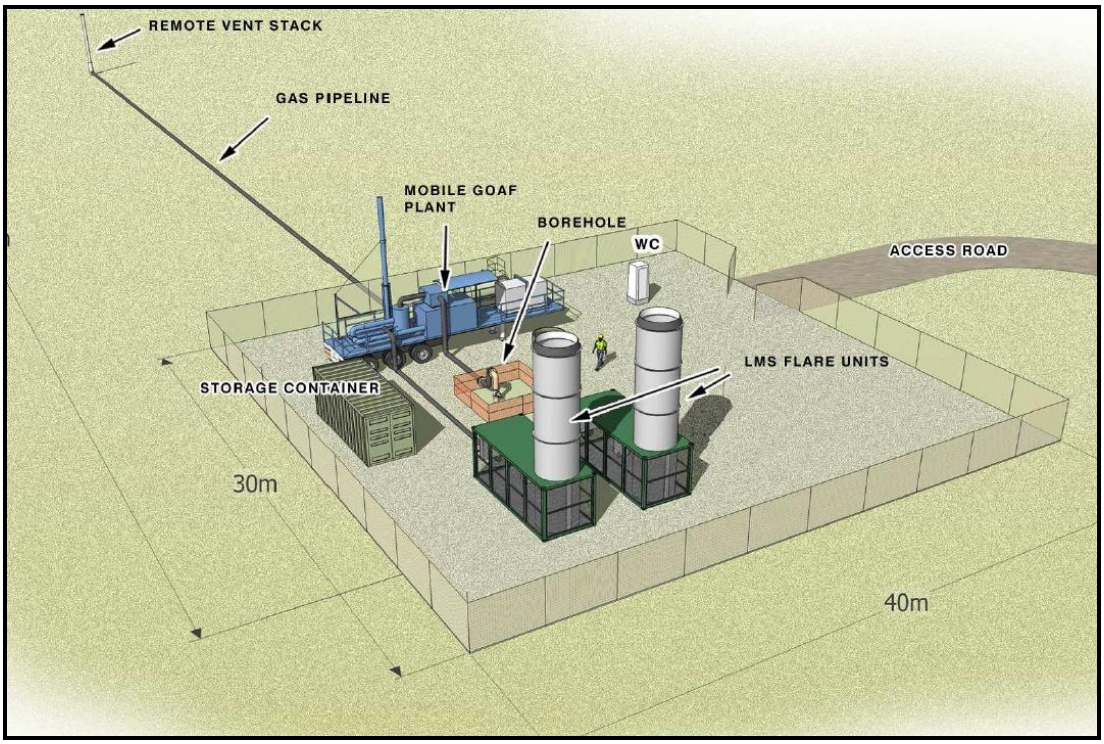

Figure 2.3 – Typical Extraction Plant Layout (*Source: Maurice Hayler & Associates Architects)*

2.3.3 Location of Drainage Infrastructure

The proposed location of the drainage infrastructure and extraction plants is shown on the concept drainage layout for Appin Area 7 Longwalls 703 to 704, which is provided in **Annex A**.

The wellheads are located at the top of the boreholes and the proposed surface reticulation pipeline will be located in a trench just below the surface ground level where possible. The proposed pipelines are located on private property, and BHPBIC have obtained written approval from relevant property owners for this infrastructure.

The location of wellheads responds to the longwall design and the goaf areas. As it is vital for the borehole to access the goaf area there is only limited opportunity to alter the location of the wells. Selection for the location of the proposed pipelines is the shortest distance between surface wells to permit the interconnection whilst minimising disruption to the property owner and impact to the environment. The majority of the surface pipelines follow existing boundary fence lines and range in diameter from 250 mm at the wellhead up to 600 mm for the main trunk pipeline to the extraction plant.

2.4 Processing of Extracted Gas

2.4.1 Overview

Extracted gas from the goaf area of the mine will be processed via a combination of the following three methods (in order of preference):

1. Electricity Generation – gas will be piped to the EDL Power Station at Appin Colliery and used for electricity generation; and/or

2. Onsite Flaring – gas will be flared onsite at the extraction plant using a mobile flaring unit if ongoing venting occurs; or
3. Onsite Venting – gas will be vented onsite at the extraction plant using a ventilation stack.

The majority of the extracted gas will be reticulated to the EDL Power Station for electricity generation. In the event that flow rates exceed the capacity of the extraction plant, power station and reticulation system, a small amount of venting to the atmosphere will occur to maintain safety. If ongoing venting occurs, BHPBIC will consider the installation of on-site flares co-located with the extraction plant to abate GHG emissions.

A description of each of the processes listed above is provided in the following sections, along with the likely distribution and quantity of gas flow to each process.

2.4.1 Electricity Generation

BHPBIC currently supply methane gas to the EDL Gas Fired Power Stations located at Appin West Mine Pit Top and Appin No. 2 Shaft. The EDL operated power stations consist of a series of gas engines that generate electricity. EDL supply electricity to BHPBIC's mining activities and to the NSW grid thus reducing demand on coal fired power stations.

The proposed goaf gas drainage system will be connected to the existing underground gas drainage system servicing Appin Colliery, which contains a connection to EDL via the underground workings. A downhole on the western side of the Hume Highway on the property described as Lot 1 DP 576136 will be constructed to connect into the existing underground drainage system within the workings (refer **Annex A**). This will allow the goaf gas drawn from Longwalls 703 and 704 to combine with other methane gas in the existing drainage system en-route to the Appin West Power Station.

BHPBIC are seeking approval to underbore the Hume Highway and Main Southern Rail Line to provide a connection between the two drainage networks for Longwalls 703 and 704, on either side of the Hume Highway. This approval would facilitate the conveyance of the goaf gas drawn from Longwall 703 (in addition to Longwall 704) to the EDL Power Station using only one extraction plant.

The EDL Power Stations have sufficient capacity to utilise this additional goaf gas as it is supplemented by external natural gas sources where mine/goaf gas is not readily available. The goaf gas from this specific project will therefore displace the externally sourced natural gas required to make up sufficient volumes, thus reducing EDL's and the Project's GHG emissions.

This electricity generation process burns methane to minimise greenhouse gas emissions and uses the heat generated to create electricity. As EDL supply some of this electricity to BHPBIC for their mining operations, this reduces BHPBIC's net use of electricity drawn from the grid as well as minimising GHG emissions.

Methane in both the EDL Gas Fired Power Stations (and any flare units) is oxidised to carbon dioxide according to **Equation 1**.

Equation 1: Methane Oxidation

$$CH_4 + 2O_2 \rightarrow CO_2 + 2H_2O + \text{heat}$$

$$1 \text{ mole } CH_4 \rightarrow 1 \text{ mole } CO_2$$

$$1 \text{ tonne } CH_4 \rightarrow 2.75 \text{ tonne } CO_2$$

(21 t $CO_{2\text{-e}}$) (2.75 t $CO_{2\text{-e}}$)

Carbon dioxide (CO_2) is 21 times less potent a GHG than methane (CH_4). This is based on methane's Global Warming Potential (GWP) of 21 and carbon dioxides GWP of 1. Both utilisation by

EDL and flaring of the goaf gas effectively reduces GHG emissions by 18.25 tonnes of carbon dioxide equivalent units (t CO_2-e) per tonne of methane converted to carbon dioxide.

The gas engines used in the EDL Power Station maximise methane conversion whilst maintaining NOx and other air pollutant levels below the limits prescribed in their Environment Protection Licences. The supply of the goaf gas from this project to the EDL Power Station will not result in any additional NOx or other air pollutant emissions above their consented licence limits as the goaf gas from this project will displace the required amounts of natural gas sourced externally.

2.4.2 Flaring

Flaring the goaf gas from the extraction plant may occur onsite via a mobile flaring unit situated within the extraction plant compound. The procedure known as flaring operates by surface level equipment burning the goaf gas as it is extracted from the goaf. The flaring of goaf gas is desirable as the combustion of methane produces carbon dioxide and water, therefore lowering the GWP of the discharged gas and overall GHG emissions (see Equation 1 and associated explanation).

Purpose built enclosed gas combustion units burn the gas cleanly and in a controlled manner. The flame is not visible as the combustion is completely enclosed and controlled within the stack (refer **Figure 2.4** on the following page).

Any flare unit will be co-located with the goaf gas extraction unit. A flaring unit may be located within the contingency extraction plant location at Lot 7 DP250231 (refer **Annex A**), if the underbore connection is not approved or implemented.

The capacity of the proposed flaring system will be in the order of 800 L/s, which meets the expected maximum flow rate of the extraction plant. In the event that flow rates exceed 800 L/s, or flaring unit breakdown and/or maintenance occurs, a small amount of venting to the atmosphere via the discharge ventilation stack will occur to maintain safety.

2.4.3 Onsite Venting at Extraction Plant

Emergency venting of goaf gas from the extraction plant will occur via a discharge stack, to be located remote from the extraction plant compound (refer **Figure 2.3**). The discharge of goaf gas to the atmosphere is the least desirable application for the gas because the goaf gas has a high concentration of methane, which has a higher GWP than carbon dioxide (NGA, 2008).

Discharge occurs via a vertical discharge stack situated at least 100 m from the extraction plant for safety reasons (refer **Figure 2.5**). Irrespective of the goaf gas management option selected, a vertical gas discharge stack will be required for emergency venting upon failure/shut down of gas surface management equipment or in the event that gas flow exceeds the capacity of the utilisation or flaring system.

Figure 2.4 – Enclosed Goaf Gas Flaring Units

Figure 2.5 – Vertical Goaf Gas Discharge Stack

2.5 Extracted Gas Flow Properties

2.5.1 Raw Coal Extraction Volumes

The mass of Run of Mine (ROM) coal to be extracted from Longwalls 703 to 704 is estimated to be approximately 6.6 Mt. This will be mined over a period of approximately 1.7 years. This estimate is based on an assumed ROM coal density of 1.5 t/m^3, and a mining progression rate of 50 m per week. A breakdown of the amount of ROM coal estimated to be mined per financial year from Longwalls 703 and 704 is provided in **Table 2.2**.

Table 2.2 – ROM Coal Extraction Quantities from Longwalls 703-704 per FY

Quantity	FY2010	FY2011	FY2012	TOTAL
ROM Coal Volume (m3)	1,720,589	2,605,871	107,091	4,433,550
ROM Coal Mass (t)	2,580,883	3,908,806	160,636	6,650,325

2.5.2 Coal Seam Gas Content and Composition

Coal seam gas from the Bulli Seam comprises primarily of methane (>85 %), carbon dioxide (~8 %), and a number of other gases including oxygen, nitrogen, hydrogen, ethane, propane, argon, and butane. A typical breakdown of coal seam gas composition is provided in **Table 2.3**. The energy content of the goaf gas is approximately 35 MJ/m^3 (Heggies, 2008).

Table 2.3 – Typical Composition Coal Seam Gas from the Bulli Coal Seam (Heggies, 2008)

Gas	O_2	Ar	CH_4	CO	CO_2	H_2	C_2H_6	Propane	n-butane	i-butane
%	0.03	3.06	86.80	0.00	7.75	0.19	1.72	0.56	0.12	0.16
%	0.03	2.99	86.91	0.00	7.76	0.19	1.73	0.54	0.12	0.16

Estimates of cumulative Specific Gas Emissions (SGE) for previously mined Appin Longwalls 402 to 405 showed that SGE were in the range of 35 to 40 m^3/t ROM coal mined (Self, 2004). This value is representative of the volume of gas that is liberated from the Bulli Seam and surrounding strata per tonne of ROM coal mined at Appin Colliery. Based on this SGE, it is estimated that the total volume of gas that will be liberated by the mining of Longwalls 703 to 704 is within the range of approximately 230 to 265 million m^3.

Approximately 5 to 10 % of SGE leave via the goaf wells, approximately 25 to 30 % is captured in floor holes drilled into the underlying strata (if used), and the remaining 60 to 65 % is diluted in the Mine Ventilation Air (MVA) system (Heggies, 2008).

It is noted however, that baseline emissions used in this assessment were estimated using the National Greenhouse Accounts methodology (NGA, 2008) for calculating fugitive emissions from underground coal mining. The use of the NGA Factors methodology was specifically requested in the DGR's issued for this project, and is described in more detail in **Annex B**.

2.5.3 Extracted Gas Flow Distribution

As described in **Section 2.4**, coal seam gas extracted via the proposed extraction system will be either piped to EDL for energy generation, flared onsite, or vented to the atmosphere, with the vast majority of extracted gas being either used for electricity generation at the EDL Power Station or flared onsite.

BHPBIC's preferred management strategy for this project is to convey extracted goaf gas from both longwalls to the EDL Power Station at Appin for use in energy generation. However, this will only be achievable if approval is granted to underbore the Hume Highway and Main Southern Rail Line to connect the drainage network from Longwall 703 to that of Longwall 704. If the Hume Highway and Main Southern Rail Line underbore is not approved, only extracted gas from Longwall 704 will be piped to EDL, with the extracted gas from Longwall 703 proposed to be flared onsite. This is because the connection to the existing underground EDL drainage network is only available via the downhole above the workings on the western side of the Hume Highway. In either case, it is likely that a small amount of gas will be vented onsite in the event of plant breakdown, or the extracted gas flow rate exceeding system capacity to accept the gas.

A breakdown of the likely distribution of gas for each of these scenarios is provided in **Table 2.4**. The GHG emission outcome for both scenarios is the same.

Table 2.4 – Likely Distribution of Gas Flow Streams

Extraction Phase / Operational Scenario	Percentage of Extracted Gas		
	Electricity Generation	Onsite Flaring	Onsite Venting
MRD & Vertical Boreholes, <u>with</u> Approval to Underbore Hume Highway and Main Southern Rail Line	99%	0%	1%
MRD & Vertical Boreholes, <u>without</u> Approval to Underbore Hume Highway and Main Southern Rail Line	52%	47%	1%

2.5.4 Estimated Extraction Volumes

The volume of gas that will be extracted has been estimated based on the anticipated extraction flow rate and duration of 800 L/s and 1.7 years, respectively.

It is anticipated that the average gas flow rate per borehole will be approximately 400 L/s. However, it is likely that the extraction plant will extract gas from a number of boreholes (simultaneously) at any one time. Therefore, it is assumed that the extraction plant will be operating at maximum capacity of 800 L/s over the duration of the drainage phase, which is estimated to be approximately 1.7 years or 89 weeks. This equates to a total gas extraction volume via the goaf gas drainage system of approximately 43 million m^3.

Table 2.4 above shows the likely distribution/management of the extracted gas, which will vary depending on whether or not approval is granted to underbore the Hume Highway and Main Southern Rail Line.

3 Greenhouse Gas Assessment

3.1 Introduction

This Greenhouse Gas (GHG) assessment has been undertaken using methodology outlined in the *National Greenhouse Accounts (NGA) Factors* (2008) and using emissions factors tabulated in that document and industry best practice.

The NGA Factors (2008) workbook was produced by the Department of Climate Change, and replaces the AGO Factors & Methods Workbook (2006). All methodologies are underpinned by frameworks outlined in documents produced by the Intergovernmental Panel on Climate Change (IPCC) and the United Nations Framework Convention on Climate Change (UNFCCC) with due regard to the Kyoto Protocol.

Policies devised by the IPCC and UNFCCC are accepted as the internationally-spanning frameworks designed for intergovernmental efforts to tackle the challenges posed by climate change.

A description of methodology and calculations used in this GHG assessment is provided in **Annex B**.

3.2 Greenhouse Gas Assessment Definitions

Consistent with the protocols of IPCC, UNFCCC, and NGA Factors (2008), three scopes of GHG emissions have been defined for this project. These include Scope 1, Scope 2, and Scope 3 emissions, each of which is defined below:

- **Scope 1** – Scope 1 emissions include direct emissions from sources within the boundary of an organisation such as fuel combustion and manufacturing processes.

- **Scope 2** – Scope 2 emissions include indirect emissions from the consumption of purchased electricity, steam or heat produced by another organisation. Scope 2 emissions result from the combustion of fuel to generate electricity, steam, or heat and do not include emissions associated with the production of fuel. Scopes 1 and 2 are carefully defined to ensure that two or more organisations do not report the same emissions in the same scope.

- **Scope 3** – Scope 3 emissions include all other indirect emissions that are a consequence of an organisation's activities but are not from sources owned or controlled by the organisation. Examples of Scope 3 emissions include indirect emissions associated with the extraction/production of fuels used onsite fuel extraction and line loss associated with the consumed electricity, transport of product outside the organisation, and emissions associated with end use of product.

The *Greenhouse Gas Protocol 2004* (WBCSD & WRI) considers reporting of Scope 3 emissions to be optional in the GHG inventory calculation of a project, as they are produced by third party organisations and form part of the GHG inventories of those third parties. Also, reporting Scope 3 emissions can result in double-counting of emissions and can potentially make comparisons between organisations and projects problematic, and yield emission values higher than the true value.

Notwithstanding the above, we have included Scope 3 emissions in this study from as many sources as practical, and from sources where data were available as a review of previous Part 3A applications determined in NSW show a strong desire from DoP for this information to be included in GHG assessments for proposed developments.

There are several different types of greenhouse gases (e.g. carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), etc.) and each type of greenhouse gas has a different Global Warming Potential (GWP).

To allow a quantitative comparison between the emissions of different types of gases, the IPCC has defined a universally comparable unit referred to as the GWP, which are provided in Appendix 1 of NGA Factors (2008). The GWP is the equivalent of non-carbon dioxide gas emissions given in tonnes of carbon dioxide equivalent (CO_2-e). Emissions from non-carbon dioxide gases are converted to t CO_2-e by multiplying the emission of each non-carbon dioxide gas by its GWP (e.g. 1 t CH_4 = 21 t CO_2-e).

3.3 Greenhouse Gas Emissions Sources

This assessment considers emissions associated with both the development and ongoing operation phases of the project. Scope 1 emissions have been defined as point source emissions that occur as result of coal seam gas liberation during the mining of Longwalls 703 to 704, or operator controlled activities directly associated with the proposed goaf gas drainage project (including setup or installation works and ongoing power supply to the extraction equipment). Scope 1 emissions will include direct point source emissions resulting from:

- Diesel combustion in machinery engines and generators during construction and installation of the proposed goaf gas drainage infrastructure;
- Drilling of boreholes (drill rig diesel combustion);
- Diesel combustion during transportation of construction material, extraction plant, flaring units, and associated equipment (incl. pipeline network);
- Fuel combustion during employee travel associated with construction / installation works;
- Diesel combustion from onsite generators used to supply power to the goaf extraction plant and flaring units during the operational phase of the project;
- Production of CO_2 and N_2O during onsite flaring of the extracted gas; and
- Emission of CO_2 and CH_4 during onsite venting of extracted gas directly to the atmosphere.

We note that emissions resulting from the combustion of extracted gas at the EDL Power Stations servicing Appin Mine are considered as occurring outside the organisation under the jurisdiction of a third party and as such these have been considered as Scope 3 emissions in this assessment (refer below).

There are no Scope 2 emissions associated with the project as this assessment assumes that all energy requirements during the construction and operational phases of the project will be supplied by onsite diesel generators, which have been included in Scope 1 emissions.

Scope 3 emissions in this assessment include:

- Direct point source emissions resulting from the production of CO_2 and N_2O during combustion of the extracted gas at EDL's Power Stations; and
- Indirect extraction emissions associated with all Scope 1 fuel combustion emissions listed above (these emissions occur during the extraction and transportation of fuels used for energy).

3.4 Greenhouse Gas Inventory

The various Scope 1, 2, and 3 GHG emissions associated with the project and included in this GGA are summarised in **Table 3.1**.

Table 3.1 – Scope 1, 2, & 3 Emissions from Appin Area 7 Goaf Gas Drainage Project

Scope 1 Emissions	Scope 2 Emissions	Scope 3 Emissions
• Diesel combustion during construction and installation works; • Drilling of MRD boreholes and vertical wells; • Diesel combustion during transportation of plant and materials; • Fuel combustion during employee travel associated with construction / installation works; • Diesel combustion resulting from ongoing power supply to the goaf extraction plant and flaring units; • Production of CO_2 and N_2O during onsite flaring of the extracted gas; and • Emission of CO_2 and CH_4 during from onsite venting of extracted gas directly to the atmosphere.	N/A	• Production of CO_2 and N_2O during combustion of extracted gas at EDL's Appin Colliery Power Station; and • Indirect extraction emissions associated with all Scope 1 fuel combustion emissions listed in column 1 (these emissions occur during the extraction and transportation of fuels used for energy).

3.5 Methodology

The methodology used in this GHG assessment is described in **Annex B**. The assessment protocols, methodologies, and greenhouse gas estimates were derived primarily from the *NGA Factors (2008)*, with due consideration given to the following reference documents:

- *Tracking to the Kyoto Target, Australia's Greenhouse Emissions Trends, 1990 to 2008-2012 and 2020*, Department of Climate Change, Australia;
- *State and Territory Greenhouse Gas Inventories 2005*, Australian Greenhouse Office, Department of the Environment and Water Resources, Australia;
- *NSW Greenhouse Plan*, November 2005, New South Wales Greenhouse Office, Australia;
- *Greenhouse Gas Protocol 2004*, The World Business Council for Sustainable Development (WBCSD) and World Resources Institute (WRI);
- *Projected Changes in Climatological Forcing For Coastal Erosion in NSW*, A Project Undertaken for the NSW Department of Environment and Climate Change, McInnes et al., CSIRO 2007; and
- *Economic Impact of Climate Change Policy: The Role of Technology and Economic Instruments*, ABARE, July 2006.

Goaf gas quantification and volume to mass conversion was undertaken using the ideal gas law.

Baseline emissions were estimated using the NGA Factors (2008) methodology for estimating fugitive emissions from underground coal mines (gassy mines), which is the industry accepted and agency preferred method. This methodology accounts for release of methane and carbon dioxide during the mining process due to the fracturing of coal seams, overburden and underburden strata (NGA, 2008).

A detailed explanation of the methodology used is provided in **Annex B**.

3.5.1 Source Data and Assumptions

Source data used in this GGA was obtained from Illawarra Coal in the first instance, sound reference data in the second instance, or estimated based on reasonable assumptions where such data was not available. Source data used is provided in **Table 3.2**.

Table 3.2 – Source Data Used in this Assessment

Parameter	Data Used	Source
Number of Vertical Boreholes	7	BHPBIC conceptual gas drainage layout (refer **Annex A**)
Average Vertical Borehole Depth	500 m	Average Depth of Coal Seam
Total Length of MRD Boreholes	3615 m	Estimated based on BHPBIC conceptual gas drainage layout (refer **Annex A**)
Length of Extraction Surface Pipe Network	3445 m	BHPBIC conceptual gas drainage layout (refer **Annex A**)
Extraction Plant Power Supply	175 kVA generator consuming 3500 L/week of diesel	Heggies, 2008
Extraction Plant Flow	800 L/s	Assumed maximum capacity of extraction plant
Operational Duration of Extraction Plant	89 weeks	Based on mining rate of 50 m per week, combined length of both longwalls of 4239 m and a equipment changeover time of 4 weeks
Seam Gas Composition	Refer **Table 2.3**	Heggies, 2008
Extracted Gas Flow Distribution	Refer **Table 2.4**	BHPBIC

The following assumptions have been made in estimating GHG emissions from the project:

- Goaf gas emissions follow the ideal gas law (i.e. used for volume to mass conversions);
- Goaf gas emissions consist of 70 % seam gas, and 30 % MVA;
- ROM coal density assumed to be 1.5 t/m^3, with an average seam depth of 3 metres;
- Flaring units are delivered from Melbourne by truck;
- Fuel consumption of an excavator is 120 L/day for earthworks and pipeline installation;
- Earthworks duration of 4 days will be required for site levelling during construction activities;
- 6 workers will be travelling to and from the site each day during construction works, with an average return trip distance of 60 km (equivalent return distance from Wollongong);
- Construction / installation of infrastructure will occur over 15 weeks;
- Drill rig fuel consumption during drilling of vertical wells is 2 L/m;
- MRD drill rig fuel consumption is 4 L/m; and

- Pipeline lengths to be transported to the site in 6 m lengths, at 40 lengths per trip, with an average return distance of 60 km (equivalent return distance from Wollongong).

It is noted that some of the GHG emissions associated with the project are difficult to estimate because there is no sound methodology for estimating them, or it is difficult to define an accurate quantity. In all such instances, this GGA has taken a conservative approach by over estimating GHG emissions and quantities rather than underestimating. This rule has been applied generally across all GHG emission estimates. For example, in estimating the operational power consumption it was assumed that all electricity will be supplied to the project via onsite diesel generators with no connection to the grid. This is conservative as power supplied via a diesel generator results in a higher per kWh emission then electrical energy supplied via the grid.

3.6 Results

3.6.1 Baseline Emissions

Baseline emissions for the mining of Longwalls 703 and 704 were estimated using the NGA Factors (2008) methodology for estimating fugitive emissions from underground coal mining, using the emissions factor for gassy underground coal mines. This methodology accounts for release of methane and carbon dioxide during the mining process due to the fracturing of coal seams, overburden and underburden strata (NGA, 2008).

Baseline emission estimates represent the emissions that are likely to occur due to the mining of Longwalls 703 and 704 without the implementation of the goaf gas extraction and utilisation project (i.e. all gas would be vented directly to the atmosphere via the MVA). The estimated baseline emissions are provided in **Table 3.3**.

Table 3.3 – Baseline Emissions

Operation	Total Emission (kt CO_2-e)	Equivalent Annual Emission (kt CO_2-e/yr)
Baseline Fugitive Emissions from Appin Mine due to Mining of Longwalls 703 to 704	2028	1193

3.6.2 Project Emissions

Emissions associated with the project have been categorised into Scope 1 and Scope 3 emissions. As described in **Section 3.2** there are no Scope 2 emissions associated with the project as it has been conservatively assumed that all power supply requirements will be met using onsite diesel generators. Scope 3 emissions arise due to the extraction and transportation of fuels used for energy, and combustion of extracted gas at the EDL Power Station, which is under the jurisdiction of a third party.

Project emissions associated with both the construction and operational phase of the project are summarised in **Table 3.4**. A detailed breakdown showing calculations and emissions for each source is provided in **Annex C**.

As described in **Section 2.5.3**, BHPBIC's preferred extracted goaf gas flow distribution will be to direct all extracted gas to EDL for electricity generation (refer refer **Table 2.4**, scenario 1 - with Approval to Underbore Hume Highway and Main Southern Rail Line). Therefore, we have based our assessment on this preferred option. We note however, that regardless of which flow distribution scenario is implemented, the same quantity of methane will be converted to carbon dioxide in accord with **Equation 1** (page 8 of this report) by onsite flaring. Therefore the total post-project emissions presented in this assessment are representative of both possible flow distribution scenarios.

Table 3.4 – Project Emissions

Operation	Scope 1 Emissions (kt CO_2-e)	Scope 3 Emissions (kt CO_2-e)	Total Emissions (kt CO_2-e)	Equivalent Annual Emission (kt CO_2-e/yr)
Project Emissions (Construction / Setup / Installation Works)				
Diesel Combustion During Construction / Setup / Installation Works	0.078	0.006	0.084	0.049
Petrol Fuel Combustion from Employee Travel	0.0062	0.0005	0.0067	0.0039
Project Emissions (Operational)				
Emissions from EDL Combustion and Onsite Venting	4.0	58.0	62.0	36.5
Extraction Plant and Flaring Unit Power Supply (Diesel Combustion)*	0.899	0.1	0.9	0.5
Total Project Emissions	4.9	58.1	63.0	37.1

*BHPBIC are in consultation with Integral Energy and propose to connect the preferred extraction plant located on the property described as Lot 2 DP576136, to the existing 11kVA mains located on the adjacent property described as Lot 1 DP576136. This GGA has taken a conservative approach in assessing GHG emissions associated with proposed project and has therefore assumed the worst case scenario in that the preferred extraction plant and contingency extraction plant (if utilised) will be powered by a diesel generator.

Should the preferred extraction plant be able to be powered by electricity and not diesel, the actual GHG emissions associated with the operation of the extraction plant will be significantly lower due to this; however, the GHG emissions determined by this GGA has assumed the use of diesel fuel for operation of the extraction plant/s.

The emission total for all Scope 1 and Scope 3 emissions is 0.09 kt CO_2-e for the construction / installation phase of the project and 62.9 kt CO_2-e for the ongoing operational phase of the project. It is noted that emissions that occur during the construction / installation phase of the project are insignificant in comparison with the operational emissions, making up only 0.14 % of total project emissions.

The total post-project emissions, including those that will occur via the Appin Mine MVA, are provided in **Table 3.5**.

Table 3.5 – Total Post-Project Emissions from Appin Mine

Operation	Scope 1 Emissions (kt CO_2-e)	Scope 3 Emissions (kt CO_2-e)	Total Emissions (kt CO_2-e)	Equivalent Annual Emission (kt CO_2-e/yr)
Total Project Emissions (Goaf Gas Drainage and Utilisation Project)	4.9	58.1	63.0	37.1
Post Project Fugitive Emissions (Appin Mine MVA)	1631	N/A	1631	959
Total Post-project Emissions at Appin Mine	1636	58.1	1694	996

Table 3.5 shows that the total post-project emissions at Appin Mine are 1694 kt CO_2-e. Of this total, 96.3 % is made up of Appin Mine MVA emissions, and the remaining 3.7 % is associated with the proposed goaf gas drainage and utilisation project.

3.6.3 Reduction in Emissions from Appin Mine Resulting from the Project

The project will result in an overall net reduction in GHG emissions at Appin Mine of 334,000 t CO_2-e over the 1.7 year project duration, which is equivalent to an annual average of 196,000 t CO_2-e/yr. This is due to the destruction of methane and conversion to CO_2 that takes place during combustion for power generation at EDL and/or onsite flaring. Without the proposed project, this methane would be emitted to the atmosphere in the Appin MVA via upcast ventilation shafts. The estimated net reduction in emissions predicted to occur at Appin Mine as a result of the project is provided in **Table 3.6**.

Table 3.6 – Appin Mine GHG Emission Reductions Resulting from the Project

Operation	Total GHG Emissions (kt CO_2-e)	Equivalent Annual GHG Emission (kt CO_2-e/yr)
Baseline Emissions	2028	1193
Total Post-Project Emissions	1694	996
Net Reduction in Appin Mine Emissions due to Goaf Gas Extraction and Utilisation Project	334	196

3.6.4 Emission Offsets from Power Generation using Extracted Gas

The use of extracted goaf gas for electricity generation at the EDL Power Station will result in a GHG emission offset, because the electricity generated using extracted goaf gas will displace power that would otherwise have been generated using a coal fired power station. Assuming that each megawatt hour (MWh) of electricity generated using extracted goaf gas from the proposed project will directly substitute for electricity generated at a coal fired power station, it is estimated that the proposed project will result in an offset of 0.89 t CO_2-e per MWh of power generated. This calculation uses the NGA Factors (2008) methodology for estimating emissions from electricity generation using a coal fired power station.

The minimum volume of extracted goaf gas that will be conveyed to the EDL Power Station has been conservatively estimated to be approximately 16 million m^3 (which excludes extracted gas from Longwall 703 as a worst case scenario), and the average energy content of extracted coal seam gas is 35 MJ/m^3 (Heggies, 2008). Therefore, the total amount of stored energy in the extracted goaf gas that will be conveyed to EDL is approximately 560 million MJ (equivalent to approximately 155,000 MWh). While it is noted that the EDL power generation process is not 100 % efficient, and therefore not all of this energy will be converted to usable electrical energy, the amount of electricity generated from the extracted gas will still be in the order of 50,000 - 100,000 MWh. This equates to a GHG emission offset of approximately 44 - 89 kt CO_2-e, which is significant in relation to the overall project emissions.

While the GHG emission offset resulting from electricity generation has not been quantified in **Table 3.6** above, it still represents a significant project benefit and should be considered in appraising the environmental benefits of the project.

3.7 State, National, and Global Emissions Comparisons

The total New South Wales (NSW) GHG emissions in 2005 were reported to be approximately 158.2 Mt CO_2-e and are likely to be a similar quantity in 2009/2010. When compared to this figure, the annual equivalent baseline emissions that would occur without implementation of this project represent approximately 0.75 % of the 2005 NSW emission total. With the implementation of the proposed goaf gas drainage project, the estimated post-project annual equivalent emissions are reduced to approximately 0.6 % of the 2005 NSW total GHG emissions. This represents a reduction of approximately 0.15 % from baseline emissions due to the proposed goaf gas drainage project.

The total Australian GHG emissions in 2005 were estimated to be 559.1 Mt CO_2-e and increasing to over 560 Mt CO2-e in the current period. When compared with national emission totals, the baseline and post-project annual equivalent emissions represent approximately 0.21 % and 0.18 % of the 2005 national emission total, respectively. This represents a reduction in annual GHG emissions of approximately 0.03 % of the 2005 national emissions total.

The world total greenhouse gas emissions are predicted to increase to 41,825 Mt CO_2-e in 2010. When compared to this total, the annual reduction in GHG emissions associated with the project represents approximately 0.00047 % of the annual global emissions total.

4 Impact Assessment

Climatic change involves complex interactions between climatic, biophysical, social, economic, institutional and technological processes. There is a general consensus among the scientific community that the world is warming due to the release of emissions of carbon dioxide and other GHGs from human activities including industrial processes, fossil fuel combustion and changes in land use, such as deforestation (Pew Center on Global Climate Change 2007). The Fourth Assessment Report of the Intergovernmental Panel on Climate Change published in 2007 stated that most of the observed increases in globally averaged temperatures since the mid-20th century is very likely due to the observed increase in (human produced) greenhouse gas concentrations (IPCC 2007).

4.1 Global and National Climate

Global temperatures have increased since the earliest reliable data measurements began in the late 1800's (AGO 2007). During the past 100 years, average global surface temperatures have increased by 0.7°C and evidence suggests that 11 of the past 12 years were the warmest since 1860 (AGO 2007).

Scientists believe that the Earth's average temperature will rise by 1.1 to 6.4 °C from 1990 to 2100 if nations around the world do not act to control greenhouse emissions (AGO 2007).

Australia is vulnerable to changes in temperature and precipitation and Australia's vulnerability to climate change is intensified by already being a generally dry continent and experiencing high natural climate variability from year to year (Commonwealth Minister for Environment and Heritage Dr David Kemp 2003).

A few degrees of global warming will lead to more heat waves and fewer frosts. In Australia, the projected average warming of 0.4 to 2.0 °C by the year 2030 would lead to a 10 to 50 per cent increase in days over 35 °C at many places and a 10 to 80 per cent decrease in frosts experienced (AGO 2007).

4.2 Global and National Sea Level

Sea levels in Australia are naturally variable, although records indicate that sea levels have been rising by an increasing rate over the past 130 years. Records indicate that the sea level has risen by approximately 1 to 2 mm per year over the past 50 years and in the first half of the 19th century global sea levels were about 200 mm below the present levels (AGO Climate Trends 2007).

Sea level is likely to rise by 18 to 59 cm by 2100, but this does not include possible changes in big ice sheets such as Greenland and the Antarctic that could lead to more rapid sea level rise. Low-lying coastal areas and islands may be inundated more often by storm surges (IPCC 2007).

Impacts of sea level rises may include increased intensity and frequency of storm surges, increased erosion, loss of important wetlands and mangroves, impact on coastal ecosystems (i.e. coral reefs), and impact on human settlements (CSIRO Marine Research 2007). Low lying coastal terrain may become inundated resulting in beaches being eroded, infrastructure being damaged or destroyed, and human injuries and/or fatalities. Sea level rises may have impacts on soft sediment shorelines and intertidal ecosystems, which will especially be vulnerable to change with additional impacts from extreme events.

4.3 NSW Impacts

Possible impacts of climate change in Australia are addressed on the AGO webpage (AGO Climate Change Impacts 2007). Projected impacts listed for NSW include:

- New South Wales is expected to become warmer with more hot days and less cold nights.
- By 2030 the annual average number of days over 35 °C in Sydney could grow from the current 3 to 4-7 days, in Canberra from 5 to 6-12 days and in Cobar from 41 to 45-65 days.
- Growth in peak summer energy demand is likely, due to air-conditioning use, which may increase the risk of blackouts.
- Warmer temperatures and population growth are likely to cause a rise in heat-related illness and death for those over 65; increasing in Canberra from the current 14 deaths annually to 37-41 by 2020 and 62-92 by 2050. In Sydney increases are projected in annual deaths from the current 176 to 364-417 by 2020 and 717-1,312 by 2050.
- Warmer conditions may also help spread vector-borne, water-borne and food-borne disease further south. These health issues could increase pressure on medical and hospital services.
- Urban water security may be threatened by projected increases in demand and climate-driven reductions in water supply.
- Little change in annual rainfall and higher evaporation would likely lead to less runoff in rivers in many catchments by 2030. Run-off across the Murray-Darling Basin may decrease 10-25 percent by 2050.
- More frequent and severe droughts, with greater fire risk, are likely.
- By 2020 the annual number of days with very high or extreme fire danger could average 13-14 in Richmond (now 11.5), 26-29 in Canberra (now 23) and 53-57 in Wagga Wagga (now 50).
- By 2020 a 10-40 percent reduction in snow cover is likely with potentially significant consequences for alpine tourism and ecosystems.
- Some agricultural crops may benefit from higher CO_2 concentrations however protein content is likely to decline.
- Frost-sensitive crops, such as wheat, may respond well to some warming however more hot days and less rainfall may reduce yields.
- Adverse effects for agriculture include reduced stone fruit yields in warmer winters, livestock stress and an increased prevalence of plant diseases, weeds and pests.
- CO_2 benefits experienced by forestry may be offset by a decline in rainfall, more bushfires and changes in pests. Centres dependent upon agriculture and forestry may be adversely affected.
- Increases in extreme storm events are expected to cause more flash flooding affecting industry and infrastructure, including water, sewerage and stormwater, transport and communications, and may challenge emergency services.
- In coastal areas infrastructure is vulnerable to sea level rise and inundation.

4.4 Abatement Measures

BHPBIC abates approximately 2.5 Mt CO_2-e/year through utilisation of methane for energy generation, and is one of NSW's largest GHG abaters. BHPBIC has a proud history of developing and implementing technological innovations to reduce GHG emissions, and implements a number of abatement measures including the WestVAMP project, conveyance of drained coal seam gas for energy generation at EDL's Appin and Appin West Power Stations, and the development of Energy Savings Plans. Each of these is described further in the following sections.

4.4.1 WestVAMP

West Cliff Ventilation Air Methane Project (WestVAMP) is a major project that is substantially reducing GHG emissions from BHPBICs West Cliff Colliery. The WestVAMP project is the final step in proving the thermal flow reversal reactor technology, which was first piloted at BPHBICs Appin Colliery in 2001. The technology is capable of mitigating the bulk of the company's remaining GHG emissions, while producing 6 MW of electricity.

BHPBIC has built a $13 million electricity plant at West Cliff that oxidises the methane in Mine Ventilation Air (MVA) that would otherwise be vented into the atmosphere and contribute to global warming. The West Cliff Ventilation Air Methane Project (WestVAMP) utilises 20 % of West Cliff's available MVA.

WestVAMP uses VOCSIDIZER™ technology produced by Megtec Systems, which converts low concentration methane to carbon dioxide and water vapour through a flameless combustion process. High efficiency heat exchangers will recover large levels of thermal energy to produce steam. This steam will be used to drive a conventional steam turbine to produce 6 MW of electricity that will be used by the West Cliff Colliery and put back into the NSW grid.

WestVAMP is achieving a reduction in GHG emissions of up to 250,000 t CO_2-e per year. This is equivalent to producing enough electricity for 20,000 homes, or removing emissions from 45,000 cars from the environment each year.

4.4.2 Energy Developments Limited – Appin and Tower Power Stations

Coal seam methane from BHPBIC's Appin/Appin-West and West Cliff Collieries is supplied to two interconnected gas fired power stations operated by Energy Developments Limited (EDL) at Appin No 2 shaft and the Appin West pit top (formally known as Tower). The 94 MW of electricity generated is supplied to Integral Energy and is sufficient to supply all BHPBIC's electricity requirements and that of approximately 90,000 homes. The power station abates greenhouse gas emissions by up to 2.2-2.5 Mt CO_2-e/year.

4.4.3 Energy Savings Plans

All BHPBIC mines have developed and are now implementing Energy Savings Plans. Opportunities for reduced energy consumption have been identified and will contribute to reduced greenhouse gas emissions.

5 Alternatives for the Utilisation of the Goaf Gas

5.1 Overview

The Methane to Markets Coal Subcommittee and Project Network (MMCSPN) describe two viable options for use of coal mine methane or ventilation air methane. These are the combustion of methane and ventilation of waste heat to the atmosphere; or combustion of methane and capturing the energy released.

Both of these options consist of combusting methane, but only one captures the energy released from this combustion. MMCSPN stress, however, that capturing this energy is not always economically feasible and certain factors need to be taken into consideration, including (Creedy et al, 2001):

- Rate of gas production;
- Gas Reserves;
- Direct or indirect market for gas;
- Contract conditions; length of supply, gas availability, back up fuel source;
- Capital and operating costs;
- Availability and cost of alternate fuels;
- Existing energy distribution infrastructure; and
- Environmental, planning and regulations.

MMCSPN discuss that the decision of which option to use be environmental and economically feasibility.

BHPBIC's preferred option is to pipe goaf gas to pre-existing infrastructure located 5km away to convert methane into electricity at the EDL Power Station, with a small amount of venting only as necessary for safety reasons. This proposal maximises the potential to utilise the energy content of the goaf gas and reduce GHG emissions.

There are limited alternatives that are both environmentally and economically feasible, and the proposed project represents the most environmentally and economically feasible operation at this time. However, the limited alternatives for the utilisation of goaf gas are discussed in the following sections.

5.2 Increased Flare Capacity

Previous goaf gas drainage applications have used smaller capacity flaring units than those proposed for in this project. Flaring unit capacity in previous projects has generally been in the order of 125 L/s per unit. As part of this project, BHBPIC may use a state of the art flaring unit with a capacity of 800L/s in order to and minimise the amount of gas vented directly to the atmosphere, and maximise the amount of goaf gas extracted and oxidised, where ongoing venting occurs. The capacity of the proposed flare (if needed) is matched to the capacity of the extraction plant.

5.3 Installation of VAMP Plants at Other Ventilation Shaft Sites

The success of the trial VAMP plant at West Cliff Colliery has highlighted the feasibility of installing similar plants at other BHPBIC upcast ventilation shaft sites. It may be feasible, depending on environmental policy and economic conditions, to implement similar technology at other upcast

ventilation shafts to firstly abate the methane within the MVA and secondly utilise the waste heat produced from the abatement process to power a turbine and produce energy.

Whilst VAMP plants provide a means of utilising the small percentage of coal seam gas present in MVA, they do not provide a feasible alternative to goaf gas extraction and as such the proposed project is still required to extract gas from the goaf to maintain a safe methane concentration in the MVA.

5.4 Increased Power Generation Capacity

The Appin and Douglas EDL Power Stations have capacities of 54 and 40 MW, respectively, and utilise a combined total of over 650,000 m^3 of methane per day (Heggies, 2008). The Appin Area 7 goaf gas extraction project proposes to extract seam gas at a maximum rate of 800 L/s, which equates to 69,120 m^3 per day. As such, the existing EDL Power Station at Appin has sufficient capacity to utilise the extracted gas from Longwalls 703 and 704, and the amount of extracted goaf gas that can be reused for electricity generation at EDL is not governed by power station capacity. Where there is a shortfall in the available extracted seam gas, the additional amount of gas is made up using sourced externally natural gas. Therefore the goaf gas extracted as part of the proposed project will displace the use of externally sources natural gas.

Therefore, an increase in power station capacity would not facilitate an increase in potential reuse of extracted gas from the proposed project. Furthermore, the project proposes to convey as much of the extracted gas as possible to the EDL, the amount of which will be maximised if approval is granted to underbore the Hume Highway and Main Southern Rail Line. This will provide a connection between the surface drainage networks for Longwalls 703 and 704 and facilitate drainage of extracted goaf gas from Longwall 703 extracted gas to EDL (in addition to the extracted goaf gas from Longwall 704).

6 Conclusions and Recommendations

This assessment shows that the project is likely to result in a net reduction in GHG emissions of approximately 334 kt CO_2-e (an annual equivalent of 196 kt CO_2-e based on a project timeframe of 1.7 years), which represents a reduction of 0.15 % of the NSW total annual GHG emissions. The utilisation of extracted coal seam gas at the EDL Power Station is also estimated to result in a minimum GHG emission offset of approximately 44 - 89 kt CO_2-e/yr.

BHPBIC are in consultation with Integral Energy and propose to connect the preferred extraction plant located on the property described as Lot 2 DP576136, to the existing 11kVA mains located on the adjacent property described as Lot 1 DP576136. This GGA has taken a conservative approach in assessing GHG emissions associated with proposed project and has therefore assumed the worst case scenario in that the preferred extraction plant and contingency extraction plant (if utilised) will be powered by a diesel generator.

Should the preferred extraction plant be able to be powered by electricity and not diesel, the actual GHG emissions associated with the operation of the extraction plant will be significantly lower due to this; however, the GHG emissions determined by this GGA has assumed the use of diesel fuel for operation of the extraction plant/s.

Greenhouse gas emissions have been linked to global climate change, and it is predicted that average temperatures will rise by up to 6.4 °C between 1990 and 2100 (AGO, 2007). The implications of this rise in temperature are increased flooding, droughts and heat waves, and a number of other environmental, social and economical impacts. BHPBIC is one of NSW's largest abaters of GHG emissions, abating approximately 2.5 Mt CO_2-e per year through projects such as WestVAMP, utilisation of extracted coal seam gas, and energy savings plans. The further reduction in GHG emissions associated with the proposed project demonstrates BHPBIC's ongoing commitment to sustainable mining practices and minimising GHG emissions.

The project proposes to convey as much of the extracted goaf gas to the EDL Power Station at Appin Colliery for energy generation as possible. Where utilisation of the goaf gas at EDL is not possible or cannot be routinely achieved then flaring of the gas will be considered. Both options result in significant reductions in GHG emissions. There are limited alternative gas management systems that are both environmentally and economically feasible, and represent a better environmental outcome than the proposed project. Notwithstanding this, the alternatives for the utilisation of goaf gas discussed in this assessment include:

- Increased flare capacity;
- Installation of VAMP plants at other ventilation shaft sites; and
- Increased power generation capacity at the existing EDL Power Stations.

We conclude that none of the above alternatives are feasible or reasonable in this instance and the project represents the most environmentally and economically feasible alternative for the management of the extracted goaf gas.

We recommend that the goaf gas extraction project aim to maximise the amount of gas utilised in the following order of priority:

1. Utilisation for energy generation at the EDL Power Station; and
2. Onsite flaring if ongoing venting occurs;
3. Emergency venting.

BHPBIC will minimise the amount of goaf gas vented directly to the atmosphere and the consumption of diesel and petrol fuel wherever possible during the construction and installation phase of the project.

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