The Wallerawang Collieries Limited

Environmental Assessment – Ventilation Shaft and Powerline Corridor for South Eastern Mining Area, Baal Bone Colliery

June 2007

Umwelt
Environmental Consultants

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Prepared by

Umwelt (Australia) Pty Limited

on behalf of

The Wallerawang Collieries Limited

Project Director:	Barbara Crossley	
Project Manager:	Katie Sachs	
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Umwelt
Environmental Consultants

2/20 The Boulevarde
PO Box 838
Toronto NSW 2283

Ph: 02 4950 5322
Fax: 02 4950 5737
Email: mail@umwelt.com.au
Website: www.umwelt.com.au

Executive Summary

The Project

Baal Bone Colliery is located near Cullen Bullen, approximately 25 kilometres north-west of Lithgow. The operation extracts coal via longwall mining methods. Baal Bone Colliery proposes to construct a ventilation shaft adjacent to the south eastern main headings. The shaft will provide air for the development and extraction of the south-eastern panels (Longwalls 29, 30 and 31). Longwalls 29-31 are the subject of a separate Subsidence Management Plan process.

The proposed development is a major project, in accordance with the State Environmental Planning Policy (Major Projects). The preparation of an Environmental Assessment (EA) is therefore required under Part 3A of the EP&A Act. The Minister for Planning is responsible for determining this application.

The proposed ventilation shaft site and powerline corridor are located near the boundary of Ben Bullen and Wolgan State Forests. The unnamed forestry track that accesses the proposed development site from Wolgan Road forms part of the boundary between these two State Forests. The proposed ventilation shaft and powerline corridor are located to the west of this forestry track within Ben Bullen State Forest.

The shaft will be a maximum of 3.15 metres in diameter and will be sunk using raised bore techniques within an area of disturbance of approximately 50 x 50 metres. This method limits disturbance on the surface because all spoil is left underground and removed into the underground workings.

The shaft sinking operations will require a power supply. It is proposed that this will be in the form of a surface aerial bundle cable between a pole mounted transformer at the proposed ventilation shaft site and an existing pole mounted transformer at a dewatering borehole located approximately 1.7 kilometres to the northwest. The specific route of the powerline within the 50 metre wide corridor that was assessed for this project has not yet been finalised. The aerial bundle cable will require limited clearing because pole locations can be chosen to minimise the number of trees that need to be disturbed. The poles will generally be between approximately 6 to 8.5 metres high and 0.45 metres in diameter. Adjacent vegetation will be lopped to ensure a limited bushfire asset protection zone of 0.5 metre radius around the cable and 2 metres around the poles.

Preliminary site works and presinking activities will be undertaken during daylight hours five days per week (Monday to Friday), possibly extending to Saturdays during peak periods and/or to allow for equipment maintenance. Raise drilling will be undertaken 24 hours per day, seven days per week.

The duration of the construction phase, from preliminary site works to fan commission, is expected to be approximately 20 weeks, subject to site conditions. The ventilation shaft will operate 24 hours per day seven days per week.

The ventilation shaft and transmission line will be in use for approximately three years, the estimated time it will take to extract Longwalls 29-31. The shaft and transmission line will be dismantled once longwall mining has been completed and both areas will be rehabilitated.

Need for the Project

Total coal production from the southeastern reserves is expected to be approximately 5 Mt and provide continuity of underground mining at Baal Bone Colliery for a further three years. The operation will provide continued employment for approximately 170 fulltime workers and there will be flow on economic benefits to the local community and wider region. A short term workforce of approximately ten will be employed during the construction of the ventilation shaft and powerline.

Consultation Process

A number of government agencies were consulted regarding the proposed development. The main issues raised included sediment/surface water control during and following construction, potential impacts on flora and fauna, rehabilitation plans, potential noise impacts and bushfire management. The nearest local residents were also consulted and their main issues were noise and visual amenity. Community interest group consultation raised the issues of visual impact and impacts on rock formations. Further road construction was not supported and an alternative powerline route was suggested. All of the issues raised by government agencies, local residents and interest groups have been addressed throughout this EA.

Environmental Assessment and Management

A survey and assessment of the flora and fauna issues associated with the proposed ventilation shaft and powerline were undertaken in September 2006. Three vegetation communities were mapped including Tablelands Sheltered Valley Forest, Sandstone Dry Ridgetop Woodland and Tablelands Dry Woodland. The assessment did not identify any known or potential individual or populations of threatened flora species. No Ecologically Endangered Communities listed under the *Threatened Species Conservation Act 1995* (TSC Act) were recorded, nor any Threatened Ecological Communities listed on the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

No threatened fauna species were identified during the assessment, however, based on habitat types, it was considered that there was potential for six species listed under the TSC Act to occur within or in proximity to the site. It was determined that any such populations were unlikely to be impacted by the proposed development. One of these species is also listed on the Commonwealth EPBC Act, however it was again determined that the proposed development would not have a significant impact.

The proposed management of flora and fauna includes minimising vegetation clearance, felling habitat trees appropriately where necessary, and ensuring that appropriate rehabilitation be undertaken upon completion of construction as well as decommissioning of the proposed facilities.

An Aboriginal heritage assessment of the proposed ventilation shaft and powerline was also undertaken. No Aboriginal heritage sites were located during a survey undertaken with Bathurst Local Aboriginal Land Council and Warrabinga Native Title Claimants Aboriginal Corporation.

Noise levels associated with the construction (including traffic noise) and operation of the facility will be well within DEC guidelines. The operation of the ventilation shaft and fan will not be audible to nearest residences.

There will also be minimal air quality impacts associated with the construction and operation of the facility. Dust, TSP and PM_{10} levels will be well within DEC criteria.

Greenhouse gas sources associated with the proposed development include the combustion of fuel by mobile equipment and vehicles during the construction phase (Scope 1 emissions), methane released from the mined coal (Scope 1 emissions) and the consumption of electricity during the operational phase (Scope 2 emissions). The total estimated annual emissions of CO_2-equivalent as a result of the construction and operation of the proposed facilities are likely to be in the order of 16,489 t of CO_2 equivalent per annum. This would represent an annual increase of approximately 0.0029% of the total baseline Australian emissions.

Sediment and water controls will be implemented during both the construction and operational phases of the project in order to protect water quality in the catchment. The vent shaft disturbance area will be maintained as a bushfire asset protection zone during the operational phase, and will then be rehabilitated to natural bushland once site decommissioning is complete. Sediment and erosion controls will also be implemented along the forestry access track in accordance with the relevant Forests NSW Code of Practice.

The temporary visual impacts associated with the project will be minimised by limiting vegetation disturbance as much as possible and ensuring that all structures are of a colour which will blend with the surrounding environment where possible. The power pole locations will be chosen to avoid elevated sandstone outcrops and to minimise spanning across rock exposures.

The primary transport route for both light and heavy vehicles will be from the Castlereagh Highway to Wolgan Road and then along an unnamed forestry track to the site. A construction traffic management plan will be prepared in consultation with Lithgow City Council prior to project commencement. Additionally the forestry access track will be used and maintained in accordance with the relevant Forests NSW Code of Practice and the RTA's Traffic Control at Worksites. An access protocol will also be prepared in consultation with Forests NSW which may include temporary signage and wet weather closures.

Conclusion

Overall, the assessment of issues identified by relevant government agencies and community interest groups has found that the environmental and community impacts of the proposed ventilation shaft and powerline, with appropriate controls, will be short term and minimal. The benefits of the project include the fact that it will facilitate access to the remaining coal reserves in the area and thus extend the life of the Baal Bone Colliery for approximately three years. The operation will provide continued employment for approximately 170 full time workers, and a short term construction workforce of approximately ten. This will result in flow on economic benefits to the local community and wider region.

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APPENDICES

1.0 Introduction

Baal Bone Colliery is located near Cullen Bullen, approximately 25 kilometres north-west of Lithgow (refer to **Figure 1.1**). The operation extracts coal via longwall mining methods. Baal Bone Colliery proposes to construct a ventilation shaft adjacent to the planned south-eastern main headings. The shaft will provide air for the development and extraction of the south-eastern panels (Longwalls 29, 30 and 31) (refer to **Figure 1.2**). These south-eastern reserves were previously deemed inaccessible due to a fault zone (referred to as the Coxs River Fault Zone), however, recent drilling has found that it is possible to mine through this feature. The planned longwalls are currently the subject of a separate Subsidence Management Plan approval process.

It is proposed that power supply for the operation of the ventilation fan will be in the form of a surface aerial bundled cable between a pole mounted transformer at the proposed ventilation shaft site and an existing pole mounted transformer at a dewatering borehole located approximately 1.7 kilometres to the north-west.

Following consultation with the Department of Planning (DoP), it has been determined that the proposed development is a major project, in accordance with the State Environmental Planning Policy (Major Projects) 2005 (see **Section 4.3.1**). Consequently, the Minister for Planning is responsible for determining this application.

A Major Projects Application was lodged with the Department of Planning in March 2007. The Proposed Development Area is shown on **Figure 1.3**. The Project Area is located entirely within Ben Bullen State Forest and Wolgan State Forest.

This Environmental Assessment (EA) has been prepared by Umwelt (Australia) Pty Limited (Umwelt) on behalf of The Wallerawang Collieries Limited, in accordance with the DoP Director-General's Requirements (DGRs), issued under Part 3A of the Environmental Planning & Assessment Act (EP&A Act) (refer to **Section 2.1**).

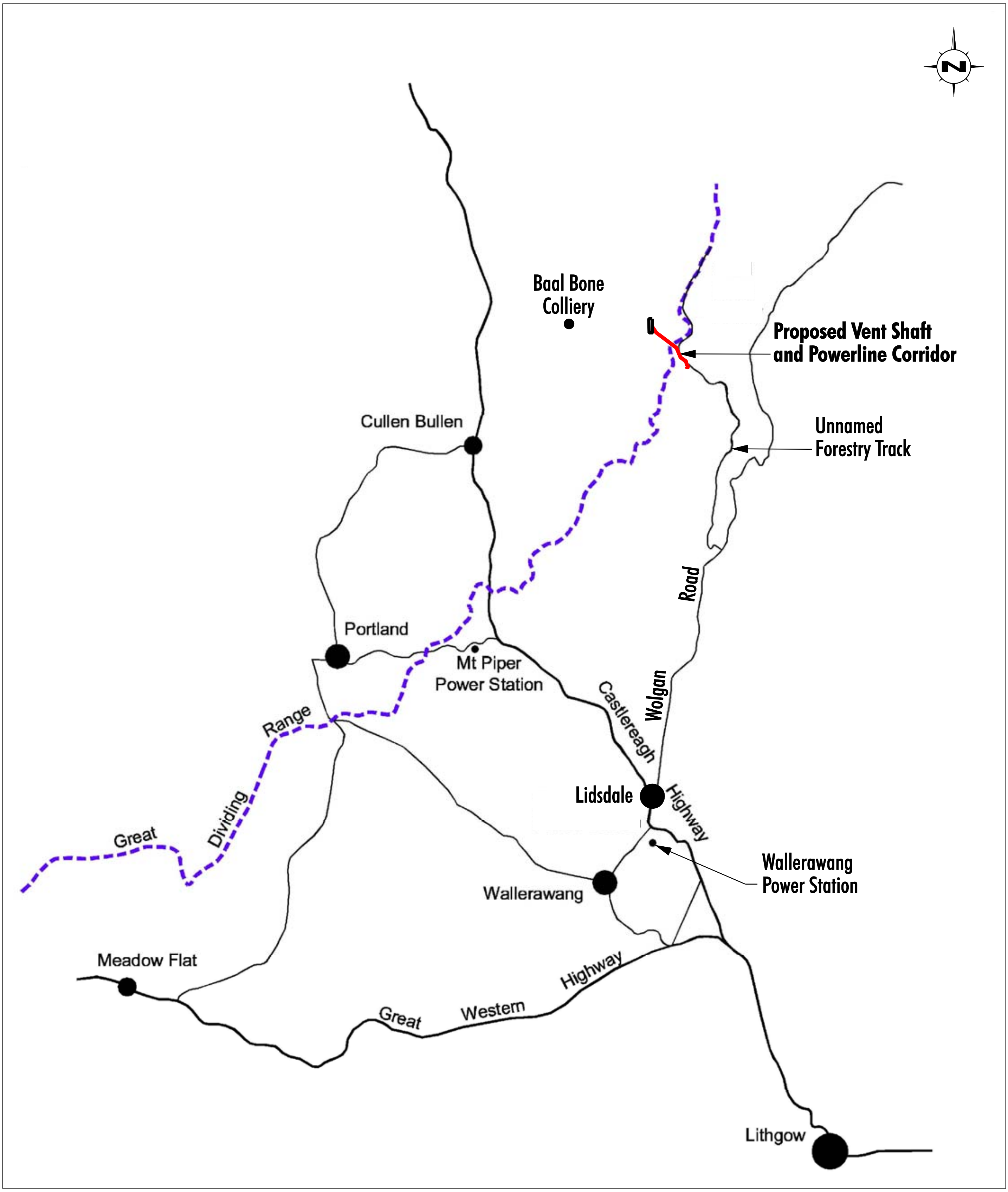
1.1 Existing and Approved Operations

Baal Bone Colliery is operated by The Wallerawang Collieries Limited, a company that is 95% owned by Oakbridge Pty Ltd and 5% owned by Sumitomo Pty Ltd. The major shareholder in Oakbridge Pty Ltd is Xstrata Coal Pty Ltd, which currently manages the colliery.

Baal Bone Colliery is one of a number of active mining operations in the Western Coalfields of NSW. Mining commenced in the late 1940s with the Ben Bullen Open Cut Mine being operated by NSW Mining Co Limited (a subsidiary of the State and Federal Government owned Joint Coal Board). These operations ceased in the 1950s. The Wallerawang Collieries Limited commenced underground mining at the Baal Bone Colliery in 1982. Open cut mining on the site recommenced in February 2005. The Colliery operates under Consolidated Coal Lease (CCL) 749, Mining Leases (ML) 1302-1389 Coal Lease 391 and Mining Purposes Lease (MPL) 261. The existing mining operations are shown on **Figure 1.2**.

Baal Bone Colliery is a major employer in the Lithgow area, employing a fulltime workforce of approximately 170 people.

Underground coal mining is carried out in the Lithgow Seam using retreat longwall mining methods. Coal within the longwall panel is removed by a longwall shearer, which travels



Source: The Wallerawang Collieries Limited

0 2.5 5 7.5km
1:150 000

FIGURE 1.1

Locality Map

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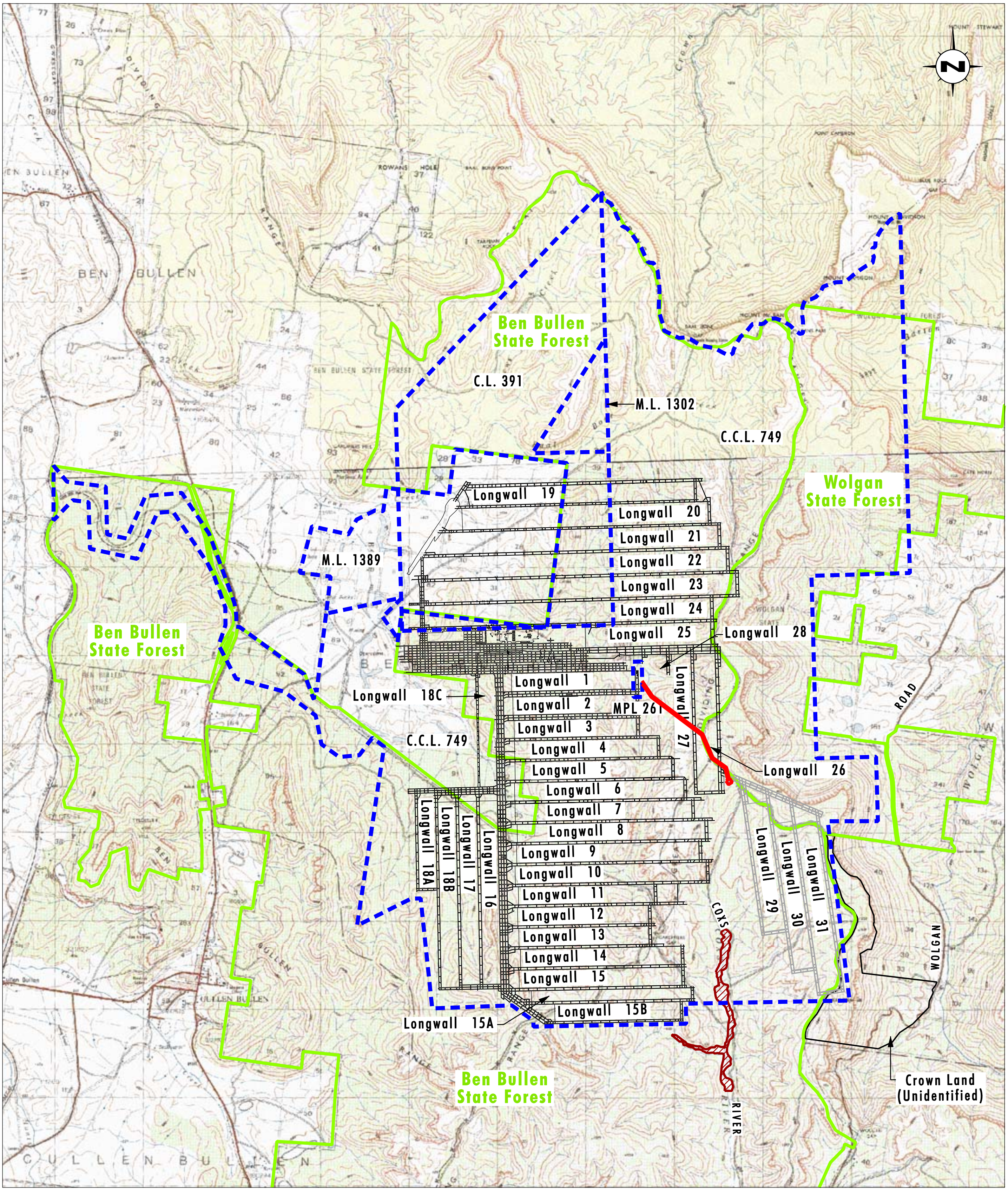

Source: LPI, NSW 2000

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1:60 000

Legend

- Proposed Vent Shaft and Powerline Corridor
- Planned Longwall
- Existing Longwall
- Mining Lease Boundary
- State Forest Boundary
- Coxs River Swamp

FIGURE 1.2

Existing Operations

File Name (A4): R03_V1/2359_013.dgn

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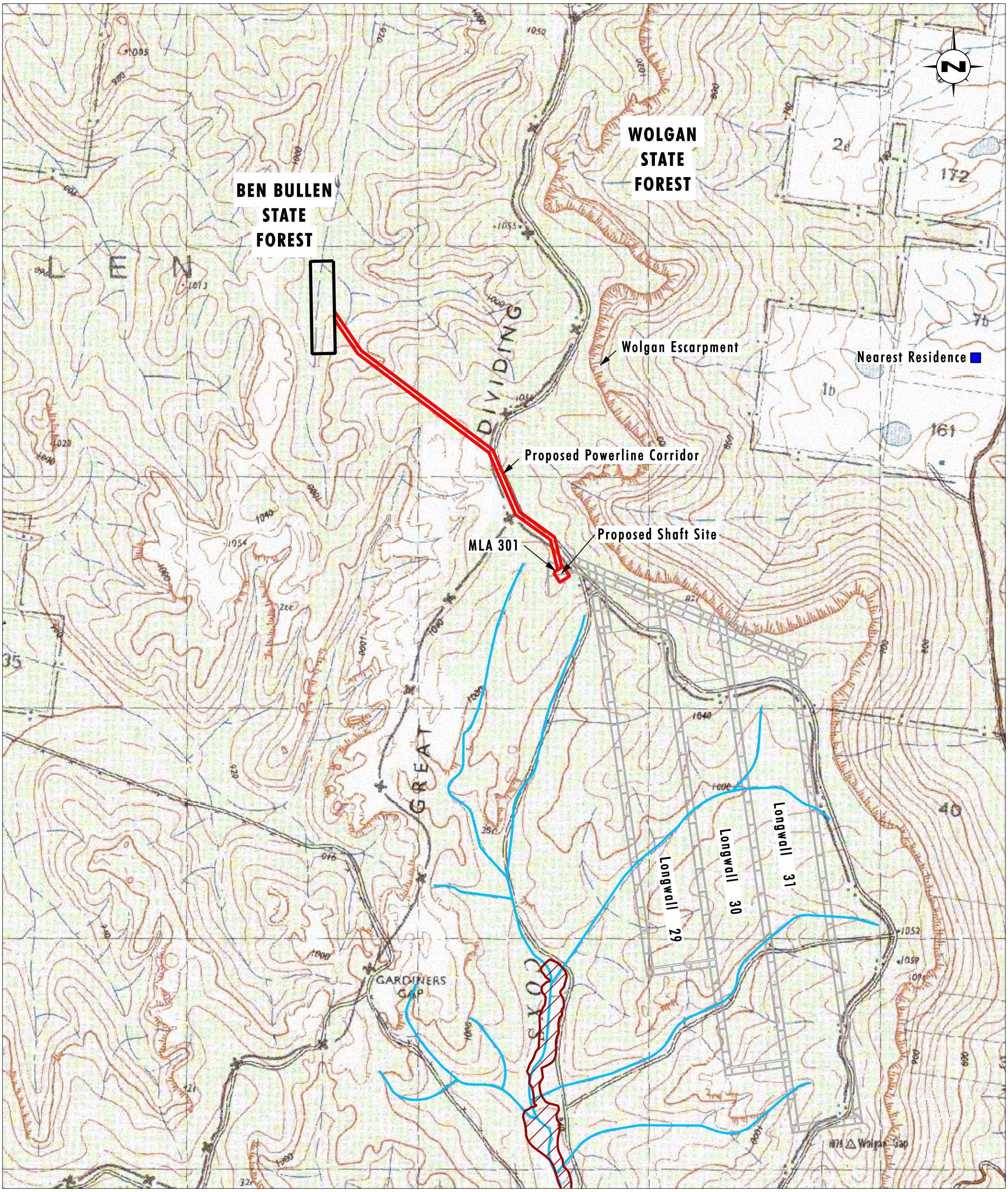

Source: LPI, NSW 2000

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1:23 000

Legend

- Proposed Vent Shaft and Powerline Corridor
- Planned Longwall
- MPL 261 Containing Existing Transformer
- Coxs River Swamp
- Coxs River Headwaters
- County Boundary

FIGURE 1.3

Proposed Ventilation Shaft and Powerline Corridor

back and forth across the coal face. The longwall mining machinery cuts a slice of coal from the coal face on each pass. A face conveyor, located across the full length of the coal face, transports the coal away from the face and discharges onto a conveyor belt. A series of conveyors are located in development headings and carry the coal to the surface where it is either stockpiled or conveyed directly into the coal preparation plant. Twenty-eight previous panels have been extracted using this method. Another panel is currently being extracted and three further small panels will be extracted before the longwall commences extraction in the south-eastern area.

Approximately 2.4 million tonnes (Mt) of saleable thermal and PCI quality coal is produced annually. Access to Longwalls 29-31 will provide about 5 Mt ROM coal.

The mining of Longwalls 29-31 will require approval under the *Mining Act 1992* in the form of a Subsidence Management Plan, which will be lodged in the near future. The mining of Longwalls 29-31 will extend the life of the mine for approximately three years.

Baal Bone Colliery made application to DPI (Forests NSW) to extend their existing Occupation Permit in Ben Bullen and Wolgan State Forests in February 2007 for the shaft site and powerline corridor area. Baal Bone Colliery has also lodged an application with the DPI (Mineral Resources) for a surface mining lease (MLA301) that covers the area which contains the proposed ventilation shaft and the southern end of the powerline corridor (refer to **Figure 1.3**). This application has been advertised and is currently being processed.

1.2 The Project

The site for the proposed ventilation shaft and powerline corridor is Ben Bullen and Wolgan State Forests. While the majority of the site is within Ben Bullen State Forest, the powerline corridor follows the boundary of the Forests for approximately 700 metres (see **Figure 1.3**). The State government is currently exploring the possibility of reserving parts of these Forests as State Conservation Areas. The objectives of State Conservation Areas permit the co-existence of mining activities.

A 200 x 200 metre area was initially identified for the location of the ventilation shaft based on its suitable topographic attributes, its proximity to existing access roads, and relatively low density of vegetation. The specific location within this area was subsequently identified based on further geotechnical and environmental investigations. The shaft site will be a maximum of 50 x 50 metres in area and will provide sufficient area for both the shaft construction and subsequent fan installation.

The proposed corridor of the powerline is approximately 1.7 kilometres in length and is shown on **Figure 1.3**. In order to minimise overall disturbance, an aerial bundled cable is proposed, possibly in combination with some underground cabling in areas adjacent to access roads or other areas where there is existing ground surface disturbance. An aerial bundled cable requires minimal disturbance to the surrounding vegetation and ground surface and poles can be placed to avoid particular trees and rock outcrops. A 50 metre wide corridor was therefore inspected during this assessment to allow for flexibility in the final route.

No new access roads or major upgrades to existing roads will be required for the proposed project. Some maintenance to drainage will be undertaken along the forestry road used to access the site through State Forest. More details regarding the components of the project are contained in **Sections 3.1** to **3.8**.

The ventilation shaft and transmission line will be in use for approximately three years, the estimated time it will take to develop and extract Longwalls 29-31. The shaft and transmission line will be decommissioned and removed once longwall mining has been completed and the areas of the power line and shaft will be rehabilitated.

1.3 Project Alternatives

As discussed in **Section 1.0**, the primary purpose of the ventilation shaft is to provide adequate ventilation to the underground workings as the mine is extended to the south east. The location of the proposed development was chosen in order to best achieve this purpose. The following factors were considered:

- to provide sufficient ventilation for the development and extraction of Longwalls 29-31, ventilation studies indicate that the shaft should not be located any further west than the proposed location;

- the surface topography is suitable at the chosen site, avoiding steep slopes and gullies to the south and the Wolgan escarpment to the east. Additionally, the substantial visual impact that the shaft/fan would have on the Wolgan Valley if it was located closer to the edge of the valley (north and east of the unnamed forestry track) would not be acceptable; and

- the chosen location is in line with the present main development headings. Locating the shaft to the south of the main development headings would mean reconfiguring the mine layout.

The layout of the ventilation shaft facility has been designed based on the results of geological and geotechnical investigations. Additionally, the raise boring technique will minimise disturbance relative to other shaft sinking techniques. For example, other shaft sinking methods require the erection of a headframe for the entire sinking process, the construction of large dams for silt residue, and the disposal of spoil on-site. Such features would result in a larger scale impact than that associated with raise boring.

Alternative routes for the powerline corridor were also considered, although the existing transformer at its northern end remained a constant. Alternatives that were considered included using the existing Integral Energy powerline to the south and constructing a powerline between this line and the ventilation shaft along the forestry track. This alternative was not considered feasible due to a combination of factors, including insufficient capacity (a large industrial load is required to operate the ventilation shaft), safety (the residential power supply provided by Integral Energy does not have the required level of protection) and cost (the construction of a longer length of powerline would involve a relatively high cost). The required level of protection for the shaft supply powerline is set out in *AS 3007:2004 Electrical Installations – Surface Mines and Associated Processing Plant*, a standard required by the *Coal Mines Health and Safety Regulation 2006*. In accordance with this standard the supply must be both earth fault limited and have sensitive earth leak protection. This level of protection is provided on the proposed power supply source but not on the alternative Integral Energy powerline.

A direct route between the ventilation shaft site and transformer was also considered and ruled out based on a reduced impact by the utilisation of the existing corridor along the forestry road for about 500 metres.

Various types of powerlines between the transformer and ventilation shaft site were also considered. Other alternatives, such as standard overhead powerlines or buried powerlines for the entire route require substantial clearing and ground surface disturbance and so, impacts are relatively more severe than those associated with a bundled cable.

The alternative of not proceeding was not considered justifiable because the project itself will not result in a significant environmental impact. It will, however, enable the life of Baal Bone Colliery to be extended and therefore continue to contribute to the local and regional economy.

1.4 Project Justification

The south-eastern reserves of Longwalls 29-31 were previously deemed inaccessible due to the Coxs River Fault Zone, however, recent drilling has found that it is possible to mine through this feature.

The existing underground mine is ventilated from fans at the main mine adits, however the current system will not provide sufficient ventilation to complete the development or extraction of Longwalls 29-31.

The proposed ventilation shaft, fan and associated transmission line will facilitate access to the remaining coal reserves in the area and thus extend the life of the Baal Bone Colliery by approximately three years.

Total coal production from the south-eastern reserves is expected to be approximately 5 Mt. The operation will provide continued employment for approximately 170 full time workers and there will be flow on economic benefits to the local community and wider region.

A short term workforce of approximately ten will be employed during the construction of the ventilation shaft and powerline.

1.5 Project Team

Umwelt prepared this EA on behalf of The Wallerwang Collieries Limited. Specialist Studies as part of the EA process, were undertaken by:

- Heggies Pty Ltd - Noise, Air Quality & Greenhouse Assessment
- OzArk Environmental & Heritage Management Pty Ltd - Flora & Fauna and Aboriginal Heritage Assessment

Further details of the Project Team are provided in **Appendix 1**.

1.6 Environmental Assessment Structure

The purpose of this EA is to enable consideration of the implications of proceeding with the project. The EA has been prepared in accordance with the EP&A Act and the *Environmental Planning and Assessment Regulation* 2000 (refer to EA Statement of Authorship in **Appendix 1**). An overview of the layout of this EA is provided below:

The Executive Summary provides a brief overview of the Project and the major outcomes of the environmental assessment.

Section 1.0 introduces the Project, outlines the project background and existing operations, provides a summary of the key project details, outlines the Project team involved in producing the EA and the structure of the EA.

Section 2.0 contains a description of the stakeholder consultation program and the environmental and community issues identified as part of this process for detailed assessment in the EA.

Section 3.0 contains a detailed description of the proposed project.

Section 4.0 describes the planning context for the Project, including the applicability of Commonwealth and State legislation.

Section 5.0 provides an overview of the environmental context for the Project.

Section 6.0 contains a description of the existing environment and a comprehensive analysis and assessment of the key environmental assessment issues relevant to the Project, including the Project specific and cumulative impacts.

Section 7.0 details the draft Statement of Commitments proposed to be adopted throughout the life of the Project in order to mitigate impacts.

Section 8.0 contains a conclusion as required by the DGRs.

Section 9.0 contains a list of references referred to in the EA.

2.0 Stakeholder Consultation and Issues

2.1 Authority Consultation

The authority consultation process commenced with an initial project briefing with the Department of Planning (DoP). The Project Application and Preliminary Environmental Assessment (Preliminary EA) for the ventilation shaft and transmission line was lodged with DoP on 7 March 2007. DoP subsequently provided the Director-General's Requirements (DGRs) for the project on 10 April 2007 (refer to **Appendix 2**), confirming that the project requires approval under Part 3A of the EP&A Act 1979. A checklist of compliance with the DGRs is included in **Table 2.1**, indicating where each requirement is addressed within this EA document.

Table 2.1 - Director-General's Requirements

Requirement		Relevant Section
General Requirements	The Environmental Assessment (EA) must include:	
	• an executive summary;	Executive Summary
	• a detailed description of the project including the: ▪ need for the project; ▪ various components and stages of the project; and ▪ the likely inter-relationship between the proposed works and the existing or approved mining operations at Baal Bone Colliery;	**Sections 1** and **3**
	• consideration of any relevant statutory provisions;	**Section 4**
	• a general overview of the environmental impacts of the project, identifying the key issues for further assessment, and taking into consideration the issues raised during consultation;	**Sections 6.1** – **6.3**
	• 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; and ▪ an assessment of the potential impacts of the project including potential cumulative impacts (particularly on noise, surface water and groundwater) that may arise from the combined operation of the project, together with the other approved and mining operations in the region;	**Sections 5** and **6**
	• a description of the measures that would be implemented to avoid, minimise, mitigate, offset, manage and/or monitor the impacts of the project, and how the existing environmental monitoring and management programs/plans at Baal Bone Colliery would be revised to accommodate the proposed changes;	**Sections 6** and **7**
	• a draft Statement of Commitments outlining environmental management, mitigation and monitoring measures;	**Section 7**
	• a conclusion justifying the project, taking into consideration the environmental impacts of the project, the suitability of the site, and the benefits of the project; and	**Section 8**

Table 2.1 - Director-General's Requirements (cont)

Requirement		Relevant Section
	• a signed statement from the author of the Environmental Assessment certifying that the information contained in the report is neither false nor misleading;	**Appendix 1**
Key Issues	• Water Quality – particularly sediment/surface water control during and following construction;	**Section 6.2.5** and **Appendix 3**
	• Flora and Fauna – including impacts on native vegetation and the requirement for offsetting vegetation to be removed;	**Section 6.2.1** and **Appendix 4**
	• Traffic – particularly heavy traffic movements during construction;	**Section 6.2.7**
	• Energy and Greenhouse Gases – a greenhouse gas assessment relating to construction and operation of the project;	**Section 6.2.4** and **Appendix 5**
	• Aboriginal Cultural Heritage;	**Section 6.2.2** and **Appendix 6**
	• Bushfire Risk Management;	**Section 6.2.8**
	• Noise; and	**Section 6.2.3** and **Appendix 7**
	• Rehabilitation of the site.	**Section 6.2.9**
References	The Environmental Assessment should take into account relevant State Government technical and policy guidelines. While not exhaustive, guidelines which may be relevant to the project are included in the attached list.	**Whole EA**
Consultation	During the preparation of the Environmental Assessment, you should consult with the relevant local, State or Commonwealth government authorities, service providers, community groups or affected landowners. The consultation process and the issues raised must be described in the Environmental Assessment. The consultation process and the issues raised must be described in the Environmental Assessment.	**Section 2**

Following the submission of the Preliminary EA and Project Application, contact was made with the following government agencies:

- Lithgow City Council;
- Department of Environment and Conservation (DEC) (now the Department of Environment and Climate Change (DECC));
- Department of Primary Industries (Forests NSW) (DPI (Forests NSW));
- Department of Primary Industries (Mineral Resources) (DPI (Mineral Resources));
- Department of Natural Resources (DNR) (now Department of Water and Energy (DWE)); and
- Sydney Catchment Authority (SCA).

Based on the Project Application and Preliminary EA, a number of government agencies identified issues that should be assessed in the EA. These issues are outlined in **Table 2.2** along with the relevant section of this document in which each issue is addressed.

Table 2.2 - Specific Issues Identified by Government Agencies

Government Agency	Issue	Relevant Section
DECC	• The potential impact on noise amenity of the local area from the exhaust fan;	**Section 6.2.3** and **Appendix 7**
	• sediment/surface water control during and following the construction of the powerline and ventilation shaft;	**Section 6.2.5**
	• waste management;	**Section 6.3.3**
	• the potential impacts on Threatened Species, Flora, Fauna and Endangered Ecological Communities and their habitats;	**Section 6.2.1** and **Appendix 4**
	• the potential impacts on Aboriginal Cultural Heritage; and	**Section 6.2.2** and **Appendix 6**
	• the environment protection licence (No. 765) will require modification to incorporate the property details of the subject land.	**Section 4.2.2**
DPI (Forests NSW)	• Measures to protect the environment during construction and while operating the facility;	**Sections 6 & 7**
	• detailed rehabilitation plans for the shaft, powerline and any access trails constructed; and	**Section 6.2.9** No access trails will be constructed
	• bushfire management, including controlling the risk of ignition from the construction and operation of the facility and measures to facilitate its protection in the advent of a significant incident.	**Section 6.2.8**
Lithgow City Council	• Flora and fauna; and	**Section 6.2.1** and **Appendix 4**
	• details regarding size of shaft and area of disturbance.	**Sections 3.1 – 3.9**
DWE	• Groundwater impacts relative to the shaft and mining underneath the escarpment;	**Section 6.2.5.3**
	• surface water impacts relative to the potential upgrade of the substation;	**Sections 6.2.5.2** and **6.2.5.4.** The substation (existing transformer) will not be upgraded.
	• erosion and sediment control in relation to construction and maintenance road for the powerline; and	**Section 6.2.5.**
	• rehabilitation of the corridor and shaft area when works are redundant.	**Section 6.2.9**

As discussed in **Section 1.1** Baal Bone Colliery has made application to DPI (Forests NSW) to extend their existing Occupation Permit in Ben Bullen and Wolgan State Forests in February 2007 for the shaft site and powerline corridor area. Requirements associated with the current Occupation Permit approval are summarised in **Table 2.3**.

Table 2.3 - DPI (Forests NSW) Occupation Permit Requirements

Requirement	Relevant Section
Environment	
Baal Bone Colliery must notify Forests NSW on commencement and completion of works	Baal Bone Colliery responsibility
If any threatened species or cultural heritage items are identified all work must cease and the relevant authorities including Forests NSW must be notified immediately.	**Sections 6.2.1** and **6.2.2** and **Appendices 3** and **4**
A short report during the operations on the progress of the project and any environmental issues that arise is to be provided to Forests NSW fortnightly.	Baal Bone Colliery responsibility
Safety	
The road in the vicinity of the work is to be securely closed to the public with adequate signage as specified within the RTA document "Traffic Control at Worksites"	**Section 6.2.7**
General	
"Forests Practices – Miscellaneous" conditions for operating within State forests are attached. The conditions must be read by all contractors involved in this project. The conditions regarding fire management must be followed now that the Bushfire Threat Period has been declared.	**Sections 6.2.1**, **6.2.2**, **6.2.5**, **6.2.8** and **6.3.2**

2.2 Other Stakeholder Consultation

Under Clause 8F(3) of the Environmental Planning and Assessment Regulation 2000, a Part 3A project application must be advertised in the local newspaper. This advertisement appeared in the Lithgow Mercury on Saturday 31 March 2007. A letter describing the project and approval process was forwarded to each of the local landholders and known community interest groups. Follow up phone calls were made to each of these individuals and groups in order to identify any issues they wished to see addressed in the EA.

2.2.1 Local Residents

The proposed ventilation shaft and powerline corridor are located within the Ben Bullen and Wolgan State Forests (see **Section 1.2**). The nearest residences are located over 1.5 kilometres away in the valley below the Wolgan Escarpment to the north-east and south-east. The main issues raised by these nearest local residents were the noise and vibration associated with the ventilation shaft (refer to **Section 6.2.3**).

A resident located on the eastern side of the Wolgan Valley and a representative of the Emirates Wolgan Valley Resort also provided feedback regarding the proposal. Their main issues were noise and visual impacts. These issues are addressed in **Sections 6.2.3** and **6.2.6**.

2.2.2 Community Interest Groups

The Colong Foundation for Wilderness Limited and the Blue Mountains Conservation Society Inc. were also specifically consulted regarding the proposal. The issues raised by these groups are summarised in **Table 2.4** along with a reference to the relevant section of this EA.

Table 2.4 - Issues Raised by Community Interest Groups

Community Group	Issue	Relevant Section
Colong Foundation for Wilderness Limited	Alternative powerline routes and variations of routes should be considered so as to minimise the potential visual impact.	**Section 1.3**
	The proposed shaft or powerline easement should not be located on or over exposed rock surfaces.	**Section 6.2.6**. The power pole locations will be chosen in order to directly avoid sandstone outcrops and to minimise spanning across rock outcrops.
	It appears from the map provided that the proposed powerline corridor comes very near to or overlies exposed rock where it travels north-west departing from the fire road on the Great Dividing Range at CMA Cullen Bullen 293 142. It is proposed that this route be realigned so that it touches the road at a point some 50 metres further north to avoid passing over the rock features.	See above
	The alternative of taking a powerline from the existing high tension power along the Long Swamp fire road should be considered, particularly if such a route avoids further road construction.	**Section 1.3**
	Pushing a road from the pumping station eastwards to the existing road on the Great Divide would be very damaging.	**Sections 1.2 and 6.2.7.3.** No new access roads or major upgrades to existing roads will be required.
	Colong Foundation seek confirmation that the powerline corridor will not be associated with further track construction, including any upgrade of the old mining exploration track that commences from CMA Cullen Bullen 293 144 on the old AMG co-ordinates.	See above
	The existing impacts of trail bike recreation and associated camping at Long Swamp on the head of Coxs Creek indicates the potential impacts arising from further vehicle access in this sensitive area.	**Section 6.2.7.3**
Blue Mountains Conservation Society Inc.	There may be more environmentally acceptable powerline corridor routes.	See **Section 1.3**
	Should the powerline route transgress significant rock exposure, the Society would deem it unacceptable.	**Section 6.2.6**
	The environmental merit in sourcing power from the existing high-tension supply along the Long Swamp fire road should be evaluated.	**Section 1.3**
	The suprastructure should be located a short distance to the west so that it is below the skyline at least when looking from the ENE. In doing this, it should also be possible to avoid damaging any outcrop located at the high point.	**Section 6.2.6**

2.2.3 Aboriginal Community

Aboriginal community consultation was an integral part of the Aboriginal Heritage Assessment undertaken by OzArk (2006) (refer to **Section 6.2.2**). The Bathurst Local Aboriginal Land Council (BLALC), Warrabinga Native Title Claimants Aboriginal Corporation (WNTCAC) and North East Wiradjuri Native Title Party (NEWNTP) were provided information regarding the proposed project and the BLALC and WNTCAC participated in the Aboriginal heritage survey. No Aboriginal heritage sites or issues associated with the proposed ventilation shaft and powerline corridor were identified during the Aboriginal heritage assessment process.

Baal Bone Colliery is negotiating directly with the Gundungurra Tribal Council Aboriginal Corporation (GTCAC) with regard to their Native Title Claim which covers the mining lease application area for the proposed ventilation shaft and part of the powerline corridor. The GTCAC have been briefed on the proposed project and provided with a copy of the Aboriginal Heritage Assessment prepared by OzArk (**Appendix 6**). Consultation is continuing with regard to the mining lease application.

3.0 Project Description

3.1 Ventilation Shaft

The shaft will be a maximum of approximately 3.15 metres in diameter and will be constructed using raised bore techniques within an area of disturbance less than 50 x 50 metres. As discussed in **Section 1.3**, the raise bore method is best practice and limits disturbance on the surface by leaving spoil underground (refer to **Figure 3.1**). The shaft will be raise bored from a depth of approximately 220 metres in the Lithgow Seam. On completion an exhausting fan will be placed over the shaft in order to draw air out of the workings. A vertical evasee will be fitted for noise reduction. This can be installed to expel air in any direction. Approximate dimensions of the fan and evasee will be 10 metres in length, 5 metres wide and 6 metres high. The associated switch gear (motor control room) will be approximately 5 x 5 x 5 metres.

The surface facilities required during the shaft construction period will include one to two sumps as shown on **Figure 3.2**. It is estimated that up to 60 litres of water per minute will be required for approximately five days while the pilot hole is being drilled. This water will be supplied by water tankers (an estimated total of 20 tanker loads). Surface facilities will also include a generator, and a concrete pad (approximately 5 x 5 metres in area) for the raise bore machine. **Figure 3.2** also shows the water and sediment controls that will be in place during construction (refer to **Section 6.2.5** for more detail).

A conceptual layout of the final ventilation shaft facility is shown on **Figure 3.3**. It includes the ventilation shaft and housing, a motor control room, a small transformer yard and permanent water and sediment controls. A security fence will border the 50 x 50 metre area (refer to **Section 3.7**).

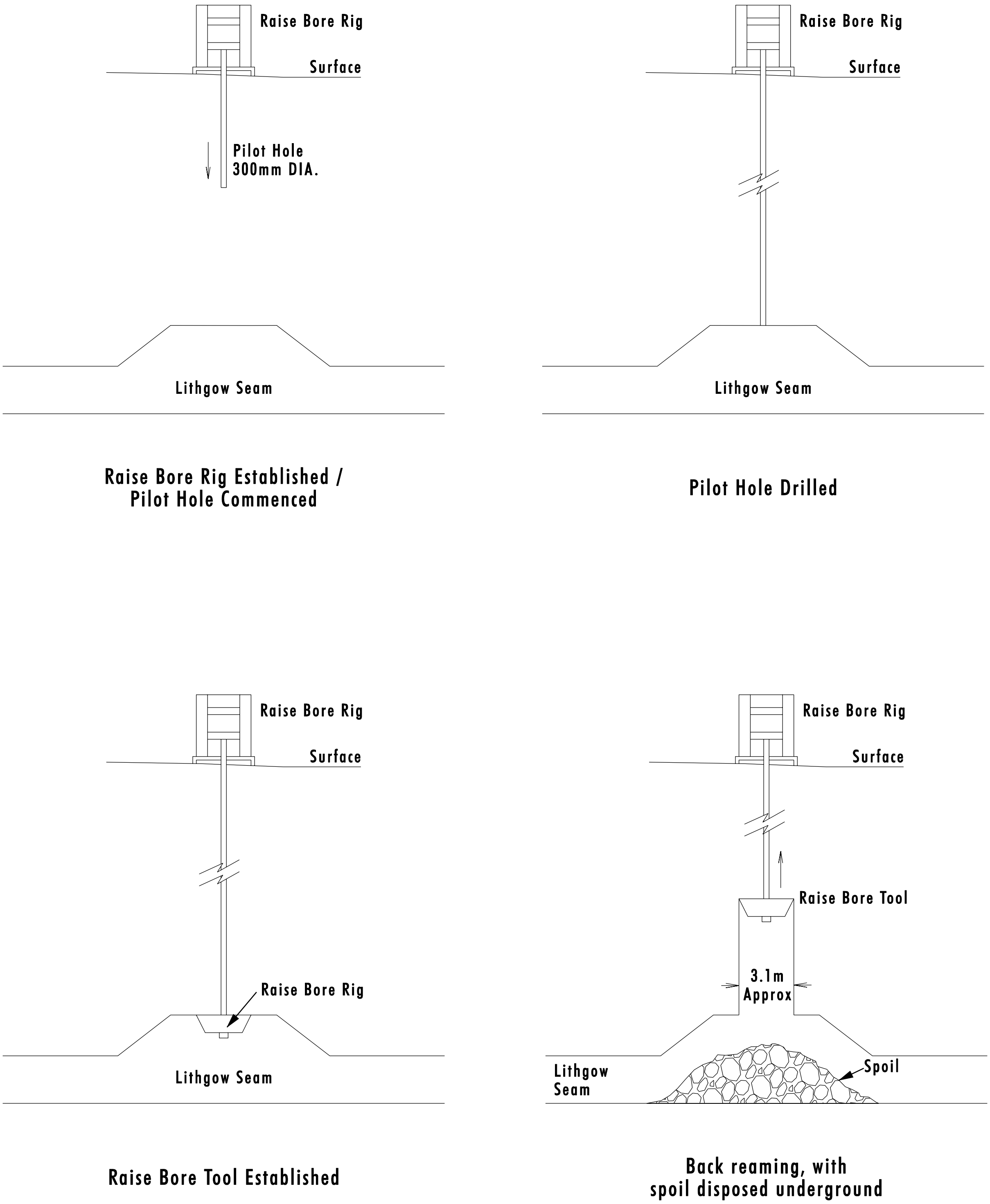
3.2 Powerline Corridor

As discussed in **Section 1.2**, the powerline will consist of aerial bundled cable (insulated cable). This requires limited clearing and pole locations can be chosen to minimise the number of trees that need to be disturbed. Additionally, this type of cable requires minimal maintenance, removing the need for an associated access track.

The poles will generally be between approximately 6 to 8.5 metres high and in the order of 0.45 metre in diameter. Adjacent vegetation will be lopped to ensure a limited bushfire asset protection zone of a 0.5 metre radius around the cable and 2 metres around the pole. This may require the removal of a few small trees, however, the pole locations will be chosen to minimise the need for clearance. An inspection of the vegetation surrounding the cable will be undertaken annually to ensure that the clearance radius is maintained (Energy Australia 2002 and *ISSC3 Guideline for Managing Vegetation Near Power Lines 2005*) (also refer to **Section 6.2.8**). While the number of poles required has not yet been confirmed, pole spacing can be up to 200 metres. Consequently, a minimum of ten poles will be required and will be placed so that creek lines and other sensitive landscape features will be avoided.

Some underground (buried) cabling may also be necessary but this will occur, for example, where the cable crosses an access road. Underground cabling will only be installed in areas where there is existing ground surface disturbance, if at all.

The powerline will run between an existing pole mounted transformer at a dewatering borehole and a pole mounted transformer at the shaft site (refer to **Figure 1.3**).



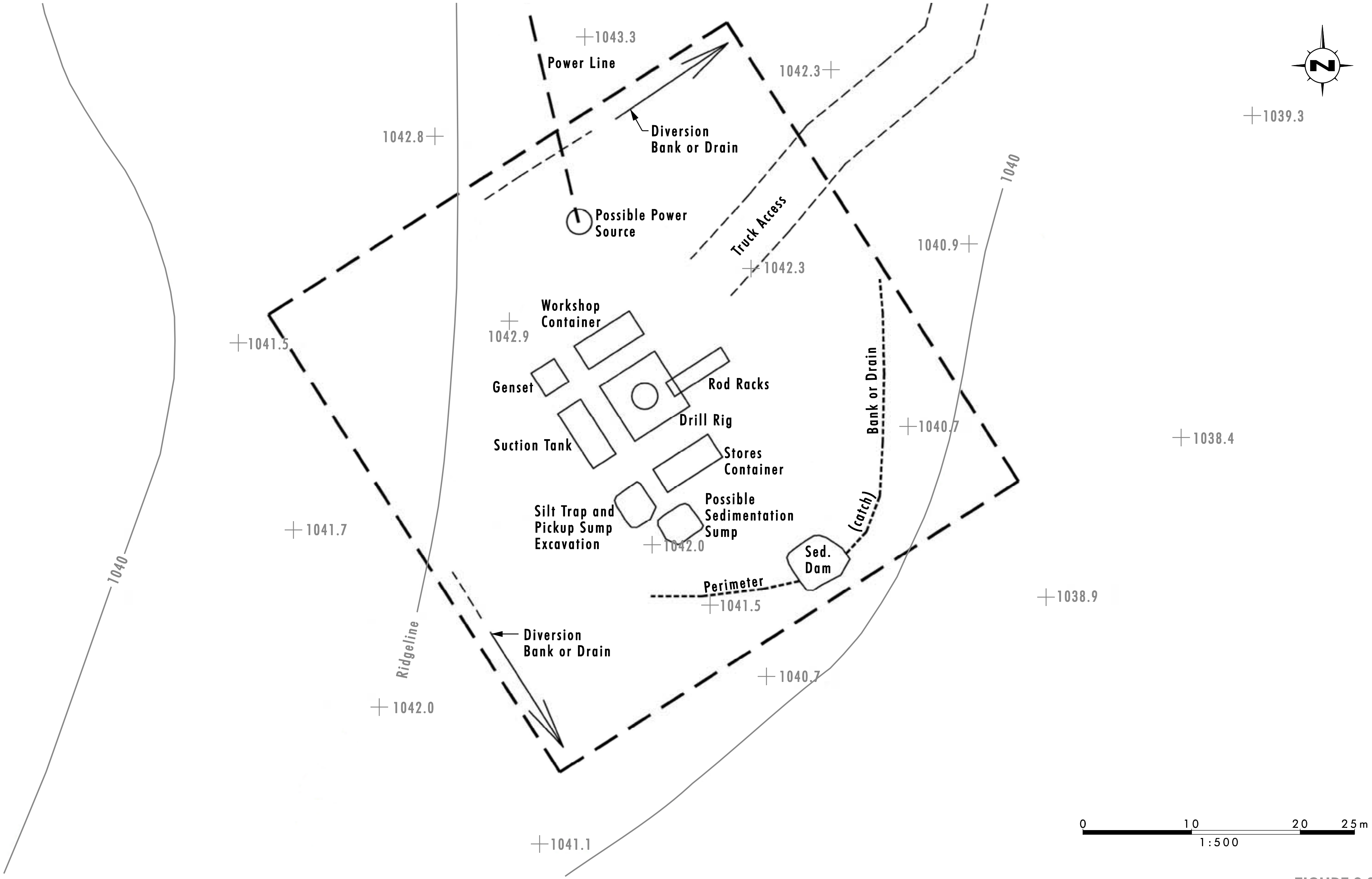
Depth about 220 metres

FIGURE 3.1

**Ventiliation Shaft Raise Bore
Indicative Sequence Sketch**

Source: Baal Bone Colliery
File Name (A4): R03_V1/2359_024.dgn

Umwelt
Environmental Consultants



Legend
Contours
1042.0 Spot Heights

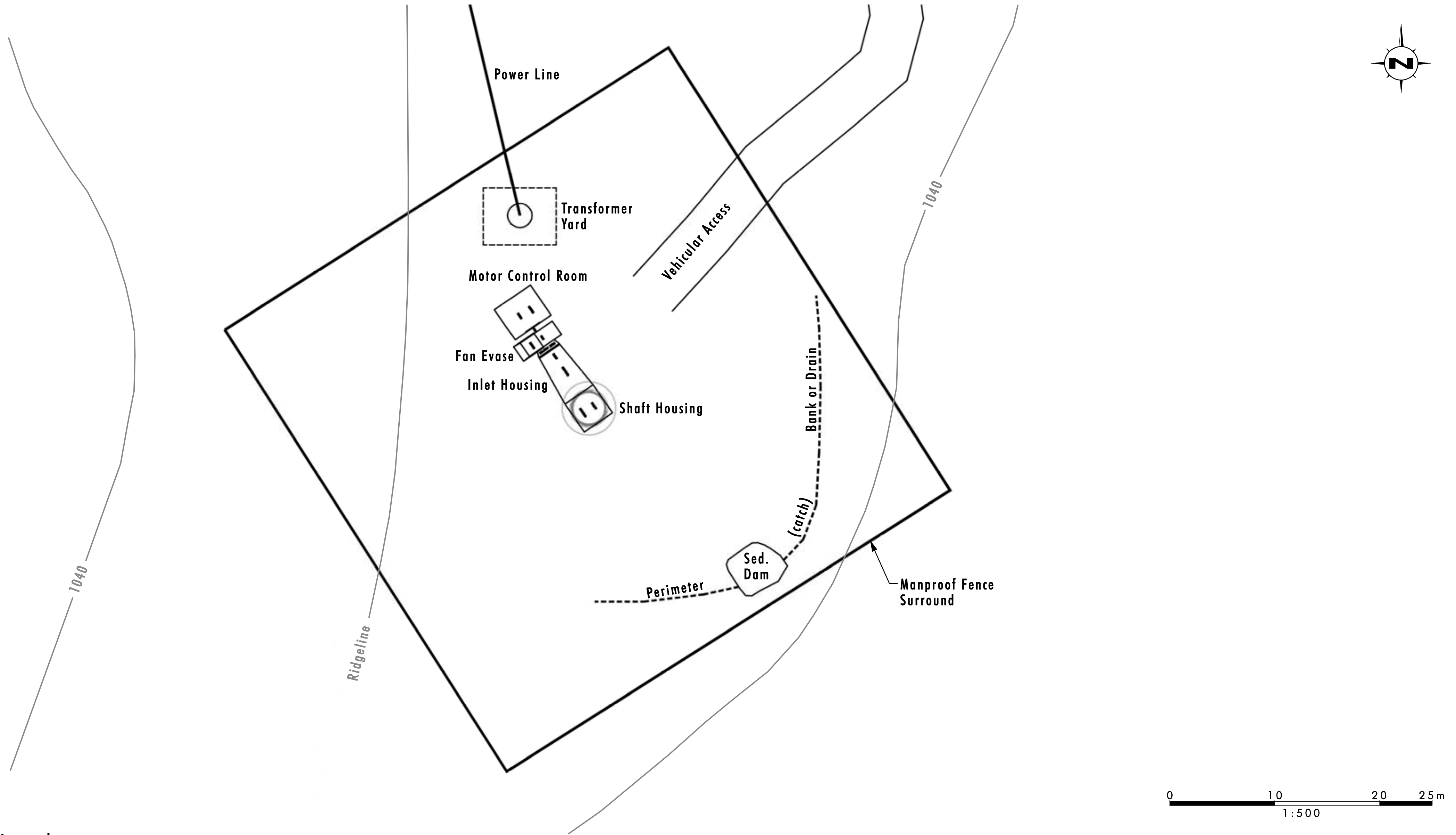
FIGURE 3.2

Conceptual Layout of Ventilation Shaft Construction

Source: Baal Bone Colliery

File Name (A4): R03_V1/2359_019.dgn

Umwelt
Environmental Consultants



Legend

—— Contours

FIGURE 3.3

Conceptual Layout of Final Ventilitation Shaft Facility

Source: Baal Bone Colliery

File Name (A4): R03_V1/2359_020.dgn

3.3 Site Services

The proposed development requires minimal access. Access during the construction period will be along an existing forestry track that runs north off Wolgan Road for a distance of approximately 6 kilometres. Road maintenance will meet the standards and requirements of DPI (Forests NSW) as outlined in the State Forests of NSW Forest Practices Code Part 4 – Forest Roads and Fire Trails (see **Sections 6.2.5.1** and **6.2.7.3**). Access to the powerline for maintenance will be via either end of the corridor, or from the existing forestry track. No new access road will be required.

A workshop container, site office and portable chemical toilet facility will be installed on the site prior to the commencement of construction. No bathhouse or sewage system will be installed on site due to the short term nature of the construction phase.

Power will be provided during shaft construction by a generator. It will be installed with an approximate 10,000 litre self bunded fuel tank. Power will be distributed to the office, containerised workshop, compressor, and to the shaft collar for the use of the raise bore and lining equipment. Lights will be installed in the working areas and these will be directed downward to ensure minimal visual impact (refer to **Section 6.2.6**).

The 11 kV powerline will provide power to the ventilation fan once constructed.

3.4 Site Preparation and Construction Activities

A general description of site preparation and construction activities is provided in the following sections.

3.4.1 Preliminary Site Works

An area of approximately 50 x 50 metres will be cleared of vegetation and topsoil. The topsoil will be stockpiled within the 50 x 50 metre area and spread across the site once the construction phase is complete.

The site will be drained to two adjoining sumps (see **Figure 3.2**). The sumps are designed for both containing runoff and for recirculating raw water during pilot drilling. These sumps will be plastic lined. A return pump and line will be installed in the lower sump.

The machinery required to undertake preliminary site work will include a pump, bobcat or backhoe, crane, excavator, compactor and grader.

3.4.2 Shaft Construction

The proposed stages of shaft construction are illustrated on **Figure 3.1** and described below:

- Raise Bore Rig Establishment

  A concrete slab (foundation for the raise bore rig) and shaft collar form the initial part of shaft construction. The shaft collar would normally be formed to a depth of approximately 5 metres. If presinking is required below this depth, then the diameter of the collar would be larger than the finished diameter of the shaft. The following sections describe the construction method in the event that a presink beyond the shaft collar is needed.

The collar and the subsequent presink would be approximately 3.5 metres in diameter. The presink collar will be progressively excavated to a depth of approximately 5 metres. Concrete will then be poured to form a smooth flat floor to allow construction of the presink collar. The presink structure will then be progressively built upwards in two metre lifts.

At the completion of the final pour, the inner formwork will be removed and the concrete face cleaned. Temporary hardstand material will then be placed around the collar area to provide a working area around the shaft.

At this stage it is not known whether a presink will be needed. This matter will be determined with the successful shaft construction contractor. If a presink is needed, the presink would be extended from the collar using a mini excavator. On completion of excavation, a steel pipe would be cast into the floor to accommodate the raise drill string.

Spoil from the collar excavation will either be spread on-site or removed to be incorporated in the mine's rehabilitation program. It is likely that the construction method will allow most, if not all of the remaining spoil to be disposed of underground.

- Pilot Hole Drilling

  Prior to placing the raise bore rig on the collar of the first shaft, two raise bore beams will be placed across the collar. The rig will then be lifted onto the beams and the remaining gaps over the top of the collar securely covered in decking. Drilling of the pilot hole (expected to be about 300mm diameter) will then commence.

  Water used to remove the cuttings will be recirculated from the sump at the base of the presink through the two surface sumps. Any make up water required will be trucked from Lidsdale.

- Reaming

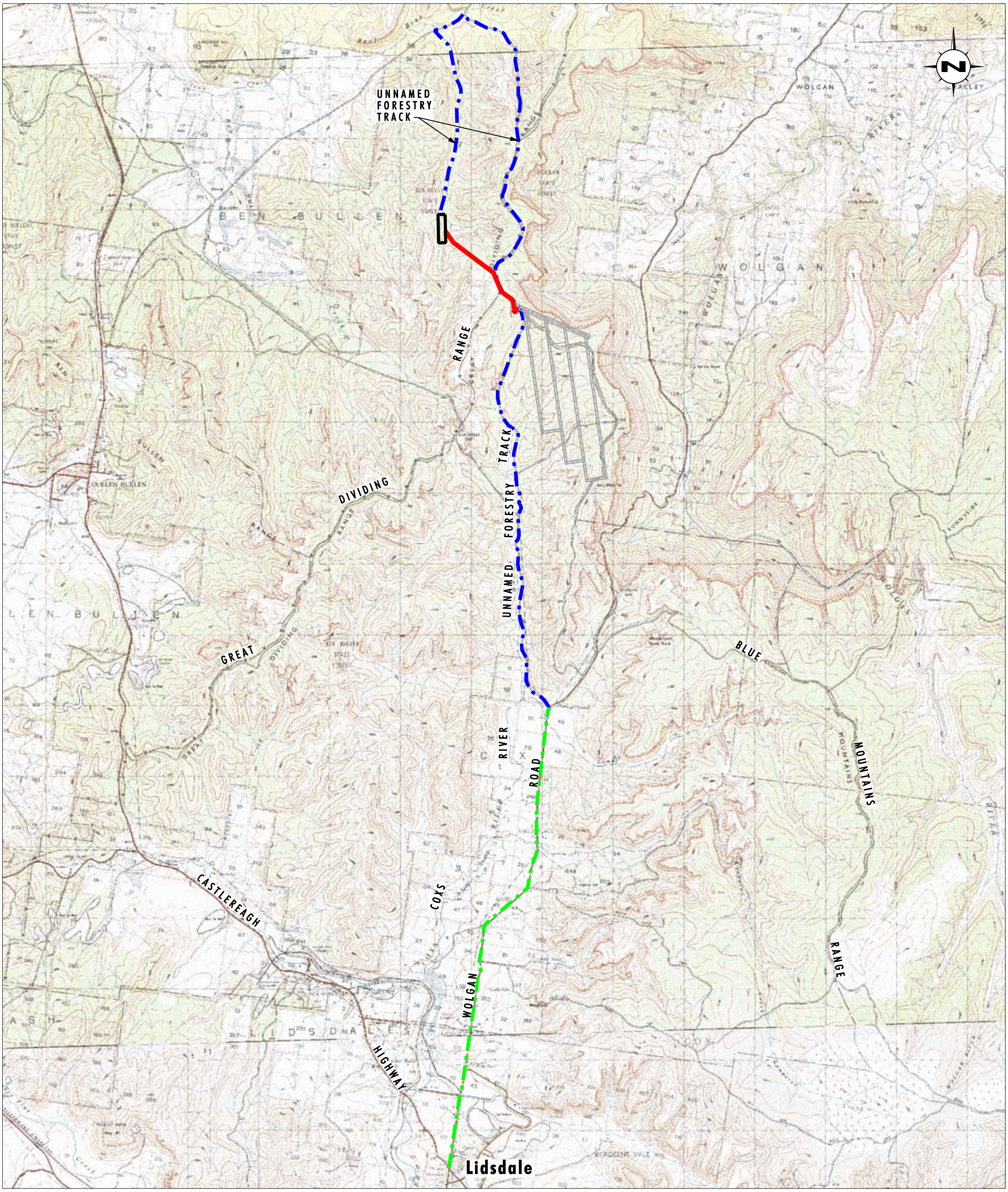
  On completion of the pilot hole backreaming of the hole will commence. The reaming head will be transported to the bottom of the pilot hole via the underground workings where it is assembled and positioned prior to backreaming. All material from the backreaming will be disposed of underground. Upon breakthrough at the bottom of the shaft collar or any presink, the head will be brought to the surface and secured beneath the raise bore beams until the raise bore is removed. The reaming head is then lifted from the hole. The shaft will then be lined as required.

  If lining is required, a headframe and associated winches and conveyances will be erected and mobilised during raise boring. This will allow access to the shaft for any final shaft lining works and checks.

3.5 Transport Routes

3.5.1 Construction Phase

The primary transport route for both light and heavy vehicles is from the Castlereagh Highway to Wolgan Road, and then along an unnamed forestry track to the site (refer to **Figure 3.4**). The forestry track route runs adjacent to the Coxs River Swamp for approximately four kilometres. An alternative route along another forestry track that runs off



Source: LPI, NSW 2000

0 1 2 3km
1:75 000

Legend

- Proposed Vent Shaft and Powerline Corridor
- Planned Longwall
- MPL 261 Containing Existing Transformer
- Proposed Sealed Access Route
- Proposed Unsealed Access Route

FIGURE 3.4

Proposed Access Route

Wolgan Road and along a ridgeline past Wolgan Gap trig station is not considered suitable for site access due to its steep gradient.

Access to the majority of the 11 kV powerline is via the same forestry track, or either end of the corridor. No new access tracks will be required. Access to the existing pole mounted transformer at the dewatering borehole is via an existing access track that connects to the Baal Bone Gap fire trail to the north-west of the shaft site (refer to **Figure 3.4**).

The number of heavy vehicle movements during the construction phase can only be estimated at this time. During preliminary site works and presinking there may be up to six heavy vehicle round trips per day, however, vehicle movements will not be continuous with the delivery of materials such as concrete being periodic (refer to **Section 6.2.7**). During pilot hole drilling, water trucks may be making up to five round trips daily between the shaft site and Lidsdale for a short period.

Light vehicle movements to and from the site will occur daily during construction activities, with an estimate of up to ten vehicle round trips per day during peak periods.

3.5.2 Operational Phase

The site access route during the operational phase of the ventilation shaft will be the same as the route used during construction. Occasional heavy vehicle movements may be required at the site for maintenance operations or repair work.

Routine light vehicle traffic will include vehicles for security checks and routine equipment inspections and monitoring. Some light vehicles will also be involved in maintenance and repair work when required. The estimated average number of light vehicle traffic movements during the operational phase is one vehicle round trip per day.

3.6 Hours of Operation

3.6.1 Construction Phase

Preliminary site works and any presinking activities will be undertaken during daylight hours five days per week (Monday to Friday), possibly extending to Saturdays during peak periods and/or to allow for equipment maintenance. Raise boring will be undertaken 24 hours per day, seven days per week.

The duration of the construction phase, from preliminary site works to fan commission, is expected to be a maximum of approximately 20 weeks, subject to site conditions.

3.6.2 Operation Phase

The ventilation shaft will operate 24 hours per day seven days per week, except for short duration shutdown periods for maintenance. The operational phase is expected to be approximately three years. The facility will not be permanently staffed but will be inspected by security personnel on a random basis generally daily, with routine statutory inspections and periodic maintenance activities also undertaken.

3.7 Security

As discussed in **Section 3.6.2**, the ventilation shaft site will not be staffed but will be subject to inspections by security personnel. Access to the site will be restricted by a security fence approximately two metres in height, in accordance with *AS 1725-2003 Security Fences*. Signage will indicate that access to the site is restricted to authorised personnel only.

3.8 Site Decommissioning and Rehabilitation

Detailed requirements for site decommissioning will be developed and included as part of Baal Bone Colliery's Mining Operations Plan as required by the DPI (Mineral Resources). The following decommissioning measures will be undertaken:

- all site infrastructure will be removed and reused or recycled where possible;
- the ventilation shaft will be securely covered, then filled and sealed in accordance with DPI (Mineral Resources) requirements;
- the entire site will be recontoured to achieve the pre disturbance landform; and
- the site will be rehabilitated using any remaining topsoil stockpiled from the initial site establishment works and supplemented with locally occurring native species in consultation with DPI (Forests NSW).

Further detail regarding rehabilitation of the site is contained in **Section 6.2.9**.

Following the completion of site decommissioning works, Baal Bone will undertake ongoing monitoring and maintenance of the site until the site achieves an acceptable level of regeneration, as determined in consultation with DPI (Forests NSW) and DPI (Mineral Resources).

4.0 Planning Context

4.1 Commonwealth Legislation

4.1.1 Environment Protection and Biodiversity Conservation Act 1999

Under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act), approval from the Minister for the Environment and Heritage is required for any action that may have a significant impact on matters of national environmental significance. These matters are:

- World Heritage places;
- National Heritage places;
- Ramsar wetlands;
- Migratory species, threatened species, critical habitats, or ecological communities listed in the EPBC Act;
- Commonwealth land and marine areas or reserves; and
- Nuclear actions.

No threatened species listed on the EPBC Act have been observed in the proposed project area, however, it does contain habitat that the listed Eastern Long-eared Bat could utilise (refer to **Sections 6.2.1.2** and **6.2.1.3**). An assessment undertaken in accordance with the requirements of the EPBC Act concluded that the project will not result in a significant impact on the species' habitat. The project is therefore not a controlled action and approval from the Minister for the Environment and Heritage is not required.

4.2 NSW Legislation

4.2.1 Environmental Planning and Assessment Act 1979

The *Environmental Planning and Assessment Act 1979* (EP&A Act) defines the approval process for proposed developments in NSW. The EP&A Act is administered by the DoP with local councils responsible for some local planning decisions. The objectives of the Act relevant to the project are:

(a) to encourage:

(i) the proper management, development and conservation of natural and artificial resources,

(ii) the promotion and co-ordination of the orderly and economic use and development of land,

(iii) the protection of the environment, including the protection and conservation of native animals and plants, including threatened species, populations and ecological communities, and their habitats, and

(iv) ecologically sustainable development, and

(b) to provide increased opportunity for public involvement and participation in environmental planning and assessment.

The proposed ventilation shaft requires approval under Part 3A of the *EP&A Act* as it is of a class of development, namely 'mining related works', listed in Schedule 1 of State Environmental Planning Policy (SEPP) (Major Projects) 2005 which has been declared by the Minister as requiring approval under Part 3A of the Act. This class of development is referred to as a 'major project' and is considered to be of State significance.

The proposed ventilation shaft will be constructed within CCL 749, however, this lease does not cover the surface of the land. It is therefore not physically on or part of a 'mine' (and current mining lease) or an approved mine and therefore an approval under Part 3A is required.

As the project requires approval under Part 3A of the EP&A Act, the Minister for Planning will be the consent authority.

In addition to approval under the EP&A Act, the proposed ventilation shaft may also require approval under a number of additional Acts or assessment under State Environmental Planning Policies. The additional Acts and policies relevant to this project are discussed in the following sections.

4.2.2 Protection of the Environment Operation Act 1997

The *Protection of Environment Operation Act 1997* (PoEO Act) is administered by the DECC and establishes the procedures for issue of licences for environmental protection including waste, air, water and noise pollution control. The owner or operator of a premises that is engaged in scheduled activities is required to hold an Environment Protection Licence (EPL) and comply at all times with the conditions of that licence.

Baal Bone Colliery's EPL (No. 765) will require modification to incorporate the property details of the subject land. A separate licence variation application to have this information incorporated in the licence will be submitted to the DECC if project approval is granted.

4.2.3 Roads Act 1993

The *Roads Act 1993* is administered by the RTA, local Council or the Department of Lands. The RTA has jurisdiction over major roads, the local Council over minor roads, and the Department of Lands over Road Reserves.

Under Section 138, Part 9, Division 3 of the Act, a person must not:

(a) erect a structure or carry out a work in, or over a public road, or

(b) dig up or disturb the surface of a public road, or

(c) remove or interfere with a structure, work or tree on a public road, or

(d) pump water into a public road from any land adjoining the road, or

(e) connect a road (whether public or private) to a classified road, or

(f) otherwise than with the consent of the appropriate roads authority.

Although there will be a short term increase in traffic volumes during the construction phase the project will not involve any works on Council roads. This issue is addressed in **Section 6.2.8**.

4.2.4 Forestry Act 1916

The provisions of the *Forestry Act 1916* apply to this proposal as the ventilation shaft and powerline route is located on DPI (Forests NSW) land. The objectives stated under Clause 8A of the Forestry Act are as follows:

(a) To conserve and utilise the timber on Crown-timber lands for building to the best advantage of the state.

(b) To provide adequate supplies of timber from Crown-timber lands for building, commercial, industrial, agricultural, mining and domestic purposes.

(c) To preserve and improve, in accordance with good forestry practice, the soil resources and water catchment capabilities of Crown-timber lands.

(d) To encourage the use of timber derived from trees grown in the State.

(e) Consistent with the use of DPI (Forests) for the purposes of forestry and of flora reserves for the preservation of the native flora thereon:

- to promote and encourage their use as a recreation area, and
- to conserve birds and animals thereon.

It is an offence to destroy or damage forest materials in State forests without an appropriate authority. As discussed in **Section 2.1**, consultation has been undertaken with DPI (Forests NSW) and extension to the existing occupation permits for the State forests will be obtained. Environmental protection measures and rehabilitation plans will be implemented consistent with those used during previous mining and associated activities undertaken by Baal Bone Colliery in Ben Bullen and Wolgan State Forests. Appropriate bushfire management measures will also be implemented.

Overall, the proposed ventilation shaft and powerline corridor have been designed to ensure that it will not cause significant adverse impacts on the environment or use of State Forests.

4.2.5 National Parks and Wildlife Act 1974

This Act provides for the protection, preservation and management of all Aboriginal relics throughout NSW.

Under Part 3A of the EP&A Act, a Section 90 Consent and a Section 87 Preliminary Research Permit (required under the NPW Act to destroy a known site or undertake research) are not required where development consent is granted for a Major Project. However, any disturbance to archaeological objects must be undertaken in accordance with the conditions of development consent.

The Aboriginal Heritage Assessment for the proposed ventilation shaft and powerline corridor (refer to **Section 6.2.2**).

4.2.6 Threatened Species Conservation Act 1995

The TSC Act provides protection for threatened plants and animals native to NSW (excluding fish and marine vegetation which are protected under the *Fisheries Management Act 1994*). The Act integrates the conservation of threatened species into development approval processes under the EP&A Act.

Under Part 3A of the EP&A Act, seven-part tests and Species Impact Statements are not required. However, an assessment of the impact of the proposal on species and communities protected under the TSC Act has been carried out (refer to **Section 6.2.1**).

4.2.7 Mining Act

The *Mining Act 1992* is administered by the Minister for Primary Industries and, amongst other legislative instruments, places controls on methods of exploration and mining, the disposal of mining waste, land rehabilitation and environmental management activities.

A mining lease application over the proposed ventilation shaft site and powerline corridor has been submitted to the DPI (Mineral Resources). Under Part 3A of the EP&A Act, a mining lease application must be granted consistent with a Part 3A approval granted for a Major Project.

4.2.8 Heritage Act 1977

The *Heritage Act 1977* provides for the conservation of the State's natural and built heritage. The Act provides for the constitution of the NSW Heritage Council, which is the body that administers the Act.

Under Section s75U of the EP&A Act, if a project is approved under Part 3A of the EP&A Act, approvals such as Interim Heritage Orders and Excavation Permits are not required.

No items listed on the State heritage register are located on the site.

4.2.9 Water Act 1912

The licencing provisions of the *Water Act 1912* remain in force within the project area as a water sharing plan under the *Water Management Act 2000* has not yet been developed for this area. A licence must be obtained under Part 2 of the Act for works undertaken for the purpose of changing the course of a river or stream, with a licence required under Part 5 of the Act to extract groundwater.

As any significant water inflow will be sealed during the shaft construction process and water extraction from the shaft6 is not proposed, a licence, under Part 5, will not be required.

4.3 State Environmental Planning Policies

4.3.1 State Environmental Planning Policy (Major Projects) 2005

As discussed in **Section 4.2.1**, the proposed ventilation shaft is of a class of development declared by the Minister for Planning under Schedule 1 of the *State Environmental Planning Policy (Major Projects) 2005* as requiring approval under Part 3A of the EP&A Act. The Minister for Planning will be the consent authority for this project.

4.3.2 State Environmental Planning Policy (Mining, Petroleum Production and Extractive Industries) 2007

The State Environmental Planning Policy (Mining, Petroleum Production and Extractive Industries) 2007 (Minerals SEPP) was gazetted in February 2007. The Minerals SEPP repeals *State Environmental Planning Policy 37 - Continued Mines and Extractive Industries* and *State Environmental Planning Policy 45 - Permissibility of Mining*. The SEPP also removed mining developments from Schedule 1 of *State Environmental Planning Policy 11-Traffic Generating Development*, meaning that SEPP 11 no longer applies to mining projects.

The new SEPP aims to:

a) 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;

(b) facilitate the orderly and economic use and development of land containing mineral, petroleum and extractive material resources; and

(c) establish appropriate planning controls to encourage ecologically sustainable development through the environmental assessment, and sustainable management, of development of mineral, petroleum and extractive material resources.

With regards to mining, the Minerals SEPP outlines where various minerals activities are permissible both with and without development consent. The Minerals SEPP also defines mining developments that are prohibited, exempt or complying developments. These provisions do not affect the requirement for approval under Part 3A of the EP&A Act for the current project.

4.3.3 State Environmental Planning Policy 33 – Hazardous and Offensive Development

SEPP 33 requires the consent authority to consider whether an industrial proposal is a potentially hazardous industry or a potentially offensive industry. A hazard assessment is completed for potentially hazardous development to assist the consent authority to determine acceptability.

Baal Bone Colliery's existing operations are not classed as hazardous or offensive and as this project is a component of continuation of mining operations, it is not considered hazardous or offensive. A hazard assessment is therefore considered unnecessary.

4.3.4 State Environmental Planning Policy 44 – Koala Habitat Protection

SEPP 44 restricts granting development consent for proposals on land identified as core koala habitat without the preparation of a plan of management.

A koala habitat assessment was completed as part of the ecological assessment (refer to **Section 6.2.1**). No core koala habitat was found.

4.4 Regional Environmental Plans

4.4.1 Drinking Water Catchments Regional Environmental Plan No.1

This Regional Environmental Plan (REP) is administered by the Sydney Catchment Authority (SCA) and aims to protect the drinking water catchments of Sydney. The REP was prepared under the EP&A Act as a requirement of the *Sydney Water Catchment Management Act 1998*.

The proposed development area is located within the upper reaches of the Cox's River Catchment and is therefore within the area to which this REP applies. However, Section 75R of the EP&A Act provides that environmental planning instruments, other than SEPPs, do not apply to major projects defined under Part 3A of the Act. Nevertheless, the guidelines which support the REP (*Neutral or Beneficial Effect on Water Quality Assessment Guidelines*) have been used in assessing the impact of the proposed development (refer to **Section 6.2.5** and **Appendix 3**).

4.5 Local Planning Context

Baal Bone Colliery is within the Lithgow City Local Government Area and development in this area is subject to the *Lithgow City Local Environmental Plan 1994* (LEP). However, section 75R of the EP&A Act provides that environmental planning instruments, such as the LEP do not apply to projects approved under Part 3A of the EP&A Act. Therefore, compliance with the LEP is not required.

5.0 Environmental and Community Context

5.1 Land Ownership

The proposed ventilation shaft site and powerline corridor is located near the boundary of Ben Bullen and Wolgan State Forests (refer to **Figure 5.1**). The forestry road to the proposed development site (unnamed forestry track that runs north off Wolgan Road) forms part of the boundary between these two State Forests. The proposed ventilation shaft and powerline corridor are located to the west of this forestry road within Ben Bullen State Forest.

As discussed in **Section 1.1**, Baal Bone Colliery made an application to the DPI (Forests NSW) to extend their existing Occupation Permit in Ben Bullen and Wolgan State Forests in February 2007. A Review of Environmental Factors and an Addendum to include the ventilation shaft site and powerline corridor was attached to the application (R.W. Corkery & Co Pty Limited 2005 and 2006). The current Occupation Permit conditions have been incorporated into this EA (refer to **Section 2.1**).

Baal Bone Colliery has also lodged an application with the DPI (Mineral Resources) for a surface mining lease (MLA301) that covers the area which contains the proposed ventilation shaft and part of the powerline corridor (refer to **Figure 5.1**). This application has been advertised and is currently being processed.

5.2 Land Use

The proposed development is located within State Forest which is mainly used for recreational purposes. Bushwalking, motorcycling, four wheel driving and camping are popular activities in the area. Forestry activity is infrequent in and around the proposed development area.

A section of the Bicentennial National Trail follows the north–south oriented forestry track which runs adjacent to the proposed development site (refer to **Figure 5.1**). This track was a bicentennial project initiated by R.M. Williams. It links up stock routes along the length of eastern Australia and is used by horse riders, walkers and mountain bike riders. The forestry access track forms a section of the Barrington Tops to Jenolan Caves' leg of the Trail.

The ventilation shaft is approximately 1.5 kilometres from the nearest residence and will not result in noise or visual amenity impacts due to shielding by steep topography and vegetation (refer to **Sections 6.2.3** and **6.2.6**).

5.3 Climate

The closest Department of Meteorology automatic weather station to the proposed development is at Lithgow 25 kilometres to the south-east. Average annual rainfall for the area is approximately 850 mm with the range typically between 700 mm and 900 mm. Winter and summer total rainfalls are relatively consistent however intense rainfalls, often associated with thunderstorms, are more common in summer.

Mean daily temperature maxima range from 23 ^{o}C in summer to 11 ^{o}C in winter, whereas mean daily temperature minima range between 12 ^{o}C in summer to –1 ^{o}C in winter.

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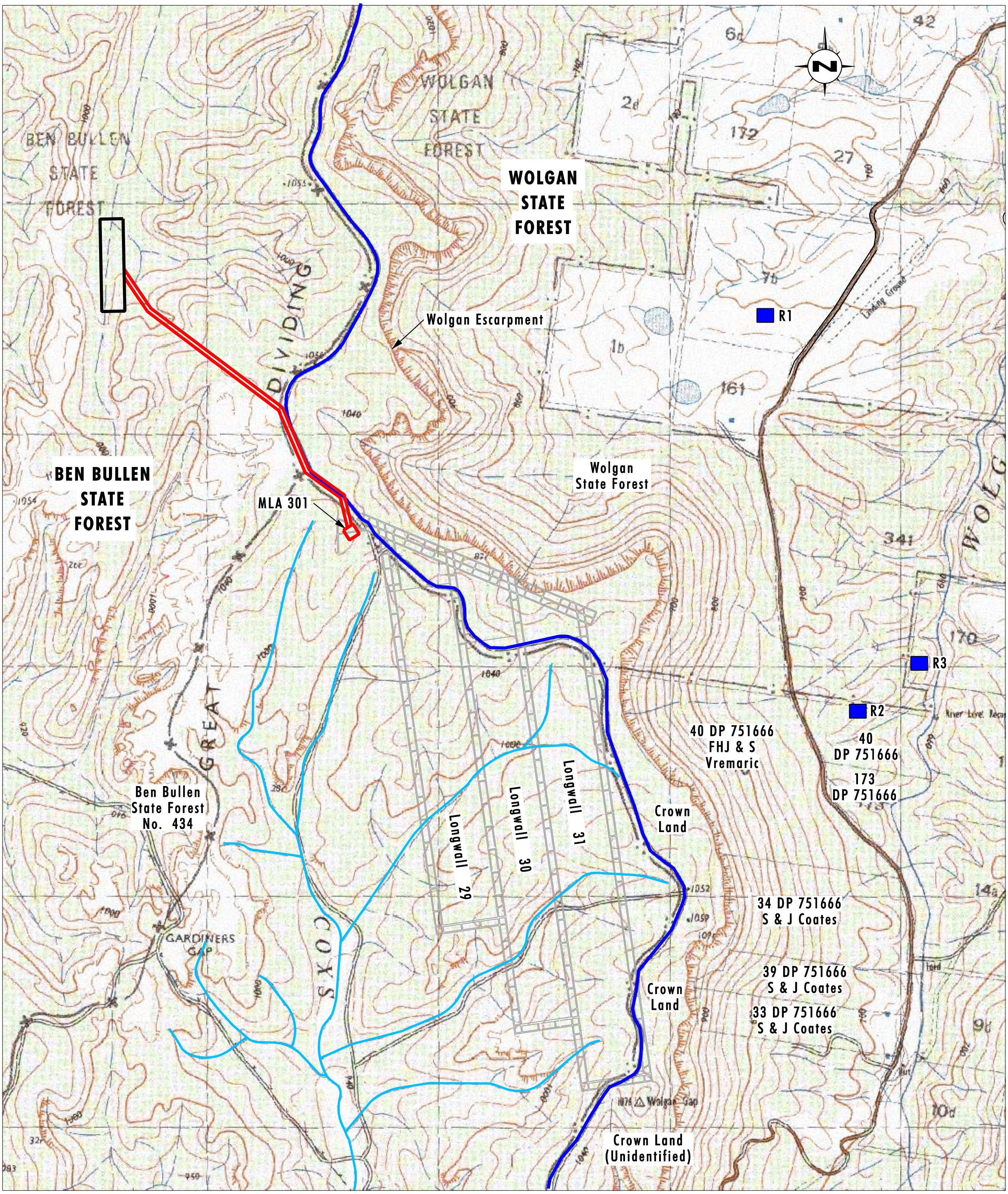


Source: LPI, NSW 2000

0 0.25 0.5 1km
1:23 000

Legend

- Proposed Vent Shaft and Powerline Corridor
- Planned Longwall
- MPL 261 Containing Existing Transformer
- Coxs River Headwaters
- Bicentennial National Trail
- County Boundary
- Residence

FIGURE 5.1

Land Ownership

File Name (A4): R03_V1/2359_018.dgn

Winds also show seasonal patterns between summer and winter with strong westerly winds (10m/s) common in winter and light northerly winds predominant in summer.

5.4 Geology and Topography

The geology of the area consists mostly of sandstones belonging to the Narrabeen Group, which are interbedded with bands of shale and siltstone. This is underlain by the Illawarra Coal Measures, which comprise interbedded sandstone, siltstone and shale. The general dip of the bedding is to the north-east at about 1 degree (Connell Wagner 2006).

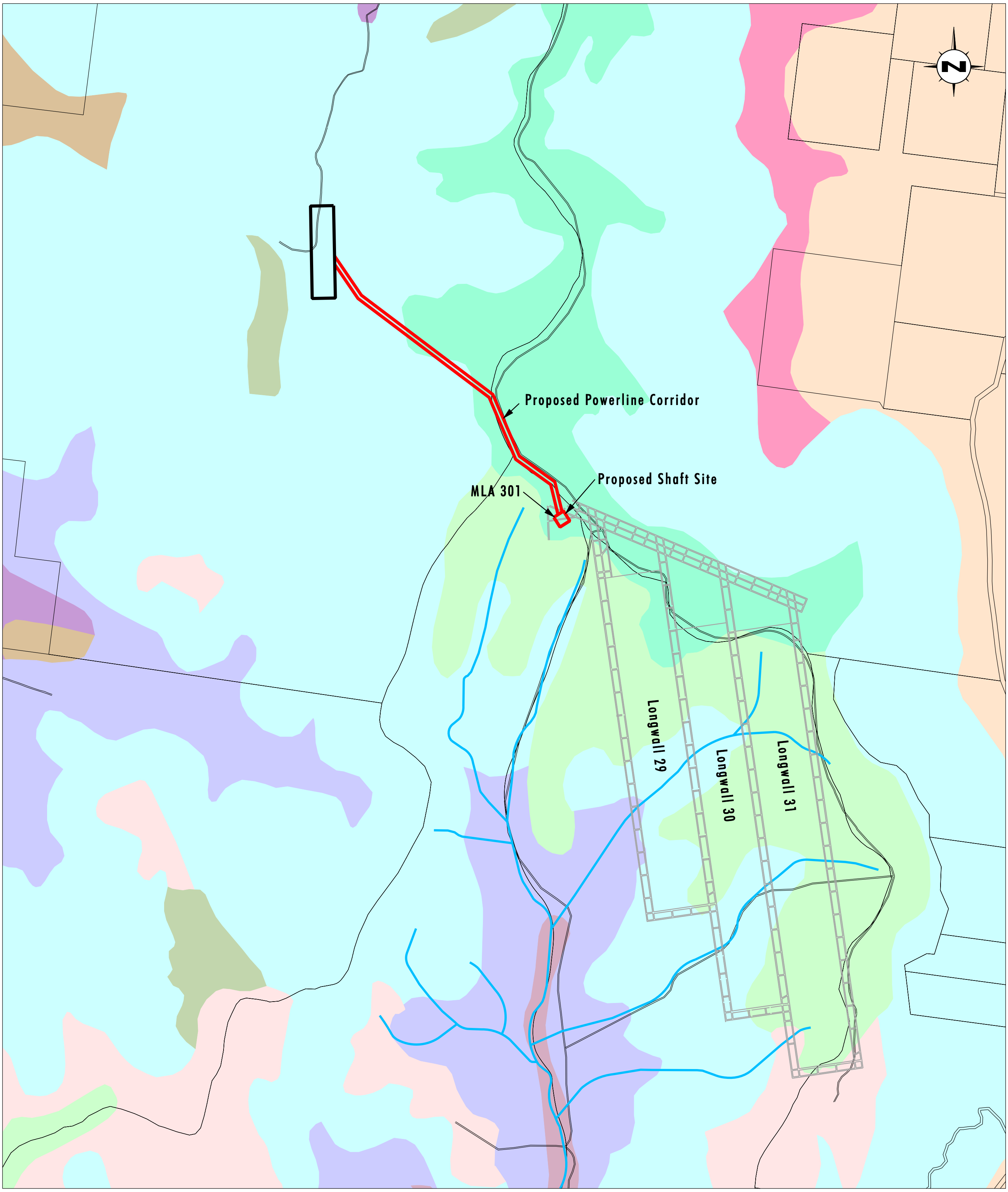
The area borders the Wolgan Valley and is characterised by ridgetops, sandstone cliffs and rock formations, and steep gullies. The ventilation shaft site and southern section of the proposed powerline is located within the upper reaches of the Coxs River catchment (see **Figure 1.3**). The Cox's River eventually flows to Warragamba Dam, the main water supply for Sydney (refer to **Section 6.2.5.4**). The northern section of the proposed powerline corridor and existing dewatering borehole flows to an unnamed creek, which joins Baal Bone Creek and then Jews Creek. Jews Creek is a tributary of the Turon River, which flows into the Macquarie River.

The ventilation shaft site is located on a ridgeline of the Great Dividing Range (the Wolgan Plateau) at an elevation of approximately 1040 metres AHD. It is located immediately to the west of a forestry track which runs off Wolgan Road. This forestry track forms the boundary of the Ben Bullen and Wolgan State Forests. The proposed powerline runs in a north-north-westerly direction immediately adjacent to the forestry track for approximately 500 metres. A small first order tributary of the unnamed creek will be crossed twice by the proposed powerline, near the existing dewatering borehole, which is located adjacent to the unnamed creek. These tributaries are in the form of small gullies and, where possible, poles will be placed to avoid disturbance of the ground surface within 40 metres of these channels.

5.5 Soils and Erosion Potential

The soil across the ventilation shaft site and southerly section of the transmission line corridor is characterised by the Newnes Plateau Soil Landscape (King 1993) (refer to **Figure 5.2**). Soils are shallow on crests and associated with rock outcrop. The loose quartz-rich sand (topsoil) contains sandstone fragments and is strongly to moderately acid. The subsoil consists of earthy sandy clay loam and is moderately to slightly acid. The erodibility of the soil is low to moderate but is susceptible to erosion following bushfire or logging (King 1993:30).

Soils in the northern section of the transmission line corridor are characterised by the Hassans Walls Soil Landscape. The topsoil consists of brownish black loamy sand with abundant sandstone gravel and boulders. The subsoils consist of yellowish brown pedal clays. Severe erosion is common throughout this soil landscape (King 1993:52-53).



Source: Department of Conservation and Land Management (1984)

0 0.25 0.5 1km
1:23 000

Legend

- Proposed Vent Shaft and Powerline Corridor
- Planned Longwall
- MPL 261 Containing Existing Transformer
- Wollangambe
- Newnes Plateau
- Medlow Bath
- Long Swamp
- Hassans Walls
- Glen Alice
- Canobla Gap
- Cullen Bullen
- Pipers Flat
- Mount Sinai
- Lithgow

FIGURE 5.2

Soil Landscapes

File Name (A4): R03_V1/2359_017.dgn

6.0 Environmental Assessment and Management

6.1 Preliminary Environmental Risk Analysis

To assist in identifying the key environmental and community issues that required detailed assessment in the EA, a preliminary environmental risk analysis was undertaken as part of the Preliminary Environmental Assessment. Environmental risks were categorised as low, medium, high or extreme. The construction and operation of the ventilation shaft were determined to be low to moderate level risks across the range of environmental aspects. Moderate risk levels were identified for ecology, cultural heritage and traffic. However, as a result of further assessment and the implementation of appropriate controls, these risk levels have now been reduced to low (refer to **Sections 6.2.1**, **6.2.2** and **6.2.7**).

The key issues identified by government agencies and incorporated into the DGRs included: water quality, flora and fauna, traffic, energy and greenhouse gases, Aboriginal heritage, bushfire risk management, noise, and site rehabilitation. The key issues identified by local residents and community interest groups included visual amenity, noise and alternative routes for the powerline corridor. All of these issues have been assessed in detail in **Sections 6.2** and **1.3**. Other issues including air quality, European heritage and waste management have also been considered in **Section 6.3**.

6.2 Key Environmental Assessment Issues

6.2.1 Flora and Fauna

OzArk Environmental and Heritage Management Pty Ltd (OzArk) undertook a survey and assessment of the ecological issues associated with the proposed ventilation shaft and powerline in September 2006. The detailed methodology and results of this investigation are contained in **Appendix 4** and are summarised in **Sections 6.2.1.1** to **6.2.1.3**.

Prior to undertaking the flora and fauna surveys, a desktop review of the DECC threatened species and BioNet websites was undertaken. The BioNet database uses the combined resources of the NSW DECC Wildlife Atlas for Threatened Flora and Fauna, NSW Fisheries, Australian Museum, NSW Royal Botanic Gardens and Forests NSW. Threatened species of national significance that could occur in the area were identified through a search of the DEWR Protected Matters Report via an online database (2006). This information was combined with a review of past studies focused on the region, specifically, Lembit (2005) and Denny (2005). This process determined the diversity of plant and animal species of conservation significance that have been previously recorded or have the potential to occur within the study area.

6.2.1.1 Flora

Methods

The flora survey was conducted using the Random Meander Method with slight modification such that habitat for threatened species was targeted for intensive assessment (refer to **Appendix 4**).

Results

Three vegetation communities were mapped:

- Tablelands Sheltered Valley Forest;
- Sandstone Dry Ridgetop Woodland; and
- Tablelands Dry Woodland (refer to **Figure 6.1**).

The proposed ventilation shaft area is characterised by Sandstone Dry Ridgetop Woodland. Trees are dominated by Inland Scribbly Gum (*Eucalyptus rossii*), Narrow-leaved Stringybark (*E. sparsifolia*), Silvertop Ash (*E. sieberi*) and Blaxland's Stringybark (*E. blaxlandii*). Common understorey species include Prickly Moses Wattle (*Acacia ulicifolia*), Sunshine Wattle (*Acacia terminalis*), Heath-leaved Banksia (*Banksia erecifolia*), *Calytrix tetragona*, among others. Groundcover species include Purple Flag Iris (*Patersonia longifolia*), Redanther Wallaby Grass (*Joycea pallida*), Wiry Panic (*Entolasia stricta*), *Lomandra multiflora, L. glauca*, *Dianella revolute*, and the grasses *Austrostipa pubescens*, Silvertop Wallaby Grass (*Chionocholoa pallida*) and tussock (*Poa labillardieri*).

The Sandstone Dry Ridgetop Woodland continues for approximately 500 metres along the proposed powerline route where the ground begins to slope toward a drainage line. This community then becomes interchangeable with Tablelands Dry Woodland. Tablelands Dry Woodland is dominated by Broad-leaved Peppermint (*E. dives*), Red Stringybark (*E. macrorhyncha*), Inland Scribbly Gum (*E. rossii*) and Brittle Gum (*E. mannifera*). The low density shrub layer consists of Silver Wattle (*Acacia dealbata*), *Persoonia linearis*, *Pultenaea microphylla*, *Hibbertia obtusifolia*, Mountain Holly (*Podolobium ilicifolium*), and *Acacia buxifolia*. The ground layer is grassy and species include: Wallaby Grass (*Austrodanthonia racemosa*), Redanther Wallaby Grass (*Joycea pallida*), Rock Fern (*Cheilanthes sieberi*), Blue-leaved Snow Grass (*Poa sieberiana spp. Cyanophylla*) and *Dianella revolute*.

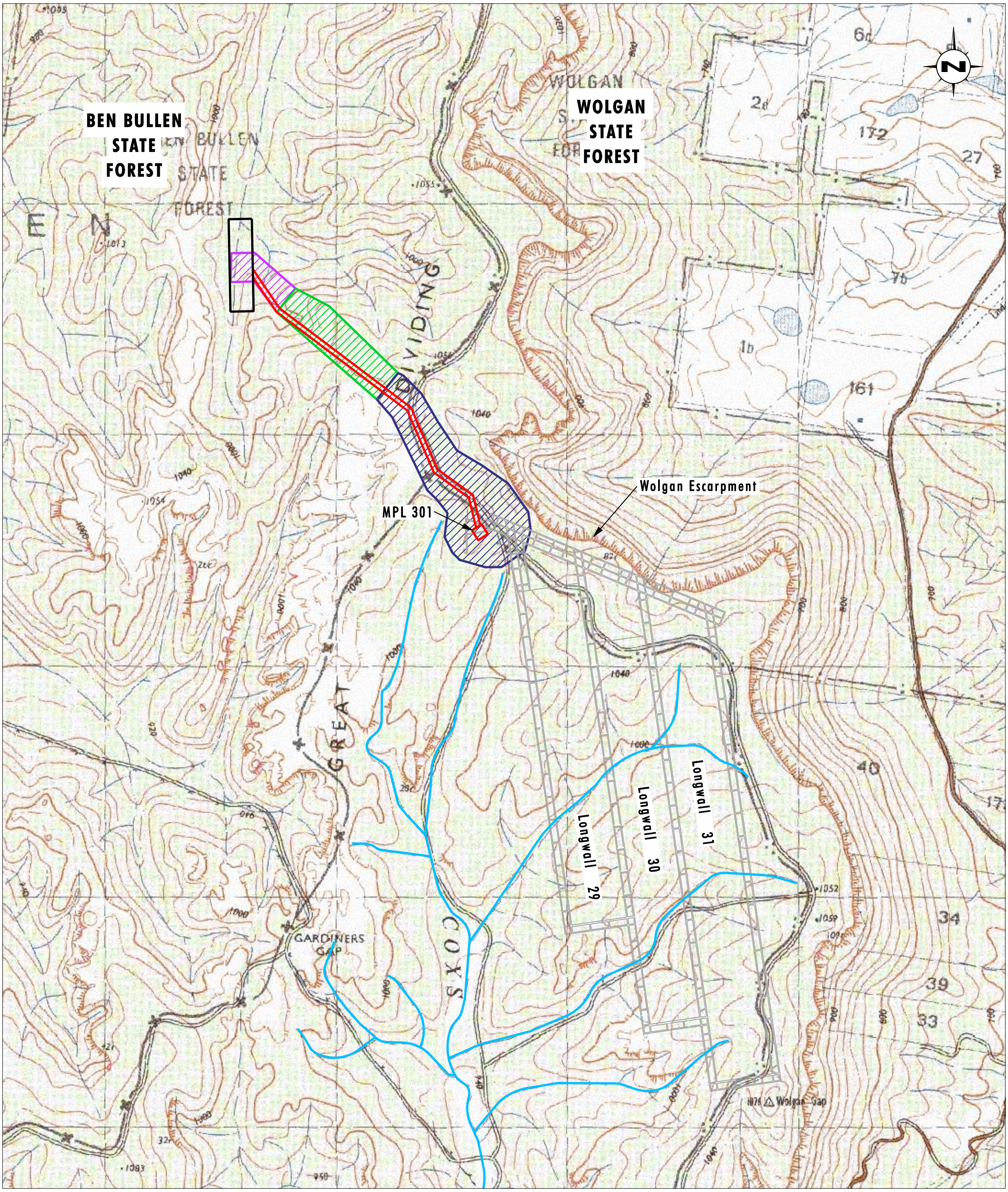
Tablelands Sheltered Valley Forest occupies the bed and banks of a drainage line and area at the north-western end of the proposed powerline route. This community is dominated by Mountain Gum (*E. dalrympleana*) and Broad-leaved Peppermint (*E. dives*). Common shrub species include Chinese Scrub (*Cassinia arcuata*), *Acacia buxifolia*, and Yellow Tea Tree (*Leptospermum polygalifolium*). Common ground layer species include Wallaby Grass (*Austrodanthonia racemosa*), Snow Grass (*Poa sieberiana ssp. sieberiana*), Bracken Fern (*Pteridium esculentum*), and *Viola betonicifolia*.

The field survey did not identify any individual or populations of threatened flora species known or having the potential to occur within the Lithgow LGA (as specified in the NSW BioNet database and the DEWR Protected Matters Report). Additionally, no Ecologically Endangered Communities listed under Schedule 1 Part 3 of the *Threatened Species Conservation Act 1995* were recorded within the study area, nor were any Threatened Ecological Communities listed under the Commonwealth EPBC Act as occurring within the Lithgow LGA found within the study area.

6.2.1.2 Fauna

Methods

The fauna survey was also conducted using the Random Meander Method described with slight modification for fauna surveys and using an adapted method of Gibbons (2003) targeted fauna searches (refer to **Appendix 4**). This method entails targeted searches for particular types of animals within a given timeframe (e.g. a timed targeted reptile search). The benefits of this are that the abundance of a particular species can be drawn from different study areas within a similar landform or environment.



Source: LPI, NSW 2000

Legend

- Proposed Vent Shaft and Powerline Corridor
- Planned Longwall
- MPL 261 Containing Existing Transformer
- Coxs River Headwaters
- Tablelands Sheltered Valley Forest
- Sandstone Dry Ridgetop Woodland (higher elevation) and Tablelands Dry Woodland (lower elevation)
- Sandstone Dry Ridgetop Woodland

FIGURE 6.1

Vegetation Communities

Habitat areas were assessed with the likely occurrence of threatened species in mind. Particular care was taken to survey potential nesting or roosting sites, vegetative connectivity, ground debris and any artificial habitats (rubbish piles, rock piles). Features including potential feed trees, suitable aquatic environments, intact vegetation layers and any other important ecological niche of any species identified as "threatened" within the Lithgow LGA were assessed.

Fauna identification was achieved via:

- identification of scats, diggings, tracks and other traces;
- direct observation, i.e. bird watching, frog searches;
- ground, leaf litter and other refuge searches; and
- call identification.

Results

No threatened fauna species were identified by OzArk, however, based on habitat types, it was considered that there was potential for the following species listed under the *Threatened Species Conservation Act 1995* to occur within the project area:

- brown treecreeper (*Climateris picumnus*);
- gang-gang cockatoo (*Callocephalon fimbriatum*);
- eastern bent-wing bat (*Miniopterus shreibersii oceanensis*);
- eastern long-eared bat (*Nyctophilus timoriensis*);
- eastern false pipistrelle (*Falsistrellus tasmaniensis*); and
- squirrel glider (*Petaurus norfolcensis*).

Seven Part Tests were undertaken for the above species and it was determined that none of the local populations were likely to be significantly impacted by the proposed development.

The eastern long-eared bat is also listed on the Commonwealth EPBC Act, however, it was determined that the proposed development would not have a significant impact on the species.

The TSC Act also lists key threatening processes. As the clearing of native vegetation is a key threatening process, the process was considered when assessing impacts on threatened species.

6.2.1.3 Flora and Fauna

The proposed management of flora and fauna in relation to the proposed ventilation shaft and powerline corridor is outlined below:

1. Vegetation removal within the ventilation shaft site will be undertaken as follows:

- habitat and non-habitat trees (less than 40 centimetres in diameter, no hollow limbs, no thick shaggy bark on the trunk under which small animals can hide) will be identified and clearly marked;
- all trees will be checked for the presence of bird or nestlings and arboreal mammals before felling or pushing. Tree removal will commence immediately after visual inspection;
- non-habitat trees will be removed first to ensure that the associated disturbance will flush out any animals from within the habitat trees;
- habitat trees will be felled 24 hours (or overnight) after all non-habitat trees have been removed. This will allow any animal occupying a habitat tree to vacate the area after the initial disturbance period; and
- hollows will be checked for injured animals and advice will be sought from Western Plains Zoo or the local WIRES group if injured wildlife is discovered. Bat species will not be handled due to the potential dangers associated with the transmission of a virus that is detrimental to the health of humans.

2. The location of the power poles will be chosen so that the number of trees required to be removed is minimised. Impacts to the understorey and ground layers will be minimised.
3. Lopping and minimal vegetation removal will be undertaken where necessary along the powerline corridor. This will involve a 2 metre radius around poles and a 0.5-1 metre radius around the bundled cable.
4. Disturbance of vegetation outside the footprint of the ventilation shaft and powerline corridor will be avoided.
5. No vegetation will be burnt on site, it will be retained and used as a bush mulch to rehabilitate disturbed areas following construction.
6. A weed management program will be implemented to combat the spread of weeds during construction, operation and site decommissioning.
7. All disturbed areas will undergo rehabilitation upon completion of construction and decommissioning to restore the land to a condition similar to the condition existing before disturbance (refer to **Section 6.2.9**). Vegetation and topsoil removed during the course of the work will be stockpiled on site and spread across the shaft site after the completion of works to enhance the potential for endemic propagules.

It is considered that vegetation offsets are not required in relation to the proposed ventilation shaft and powerline corridor due to the limited extent of vegetation clearance (i.e. <0.25 hectare), the large expanse of similar vegetation that surrounds the site, and the fact that the site will be rehabilitated following a short operational period of approximately two to three years.

6.2.2 Aboriginal Heritage

An Aboriginal heritage assessment of the proposed ventilation shaft site and powerline route was undertaken by OzArk (2007). A 200 x 200 metre area (within which the 50 x 50 metre disturbance area will be located) was surveyed, along with a 50 metre wide linear area, 1.7 kilometres in length along the powerline corridor. Jodie Benton and Phillip Cameron of OzArk, Richard Peters of Bathurst Local Aboriginal Land Council (Bathurst LALC) and

Wendy Lewis of the Warrabinga Native Title Claimants Aboriginal Corporation (WNTCAC) participated in the survey. The detailed results of this assessment are contained in **Appendix 6** and summarised below.

Aboriginal community consultation for the project was undertaken in accordance with the DECC's "Interim Community Consultation Requirements for Applicants". An advertisement was placed in the local print media seeking expressions of interest from any Indigenous stakeholder groups. Letters regarding the proposed development were also forwarded to relevant government agencies, as well as to groups already known to OzArk (Bathurst LALC, North East Wirradjuri Native Title Party (NEWNTP), WNTCAC, and Gundungurra Tribal Council Aboriginal Corporation (GTCAC). All groups who registered an interest will be kept informed of the assessment process.

The local and regional heritage context was developed using the DECC Aboriginal Heritage Information Management System (AHIMS), the NSW State Heritage Register and Inventory, the Australian Heritage Database, the Register of the National Estate, and the Lithgow Council LEP, a literature review (previous consulting reports, academic theses, articles or published works), and Indigenous community consultation. Considering this background information and the local terrain, the model for site location and distribution indicated that:

- On major creeklines and rivers, archaeological evidence indicates more permanent or repeated occupation. Sites may be complex, with a range of lithic activities represented, and may even be stratified. Proximity to resource rich zones also indicates a higher likelihood of the presence of complex occupation sites.

  The only waterway in the study area is ephemeral and the gullies have significant slopes. Consequently, large open campsites are considered unlikely.

- At a distance from permanent water, sites are likely to be smaller, less complex and more likely to be the result of one-off occupation episodes.

  The current study area appears to fall within this category, consequently small sites may be located on elevated, well drained areas near ephemeral water. However, few such suitable places were noted during the survey.

- In escarpment country or upper hillslopes where appropriate, habitable sandstone overhangs and caves are present, occupation sites are likely and their size will be determined by the extent of available space in the shelters.

  There was potential for shelter and art sites to occur within the study area but none were located during the survey.

The study area was traversed using both pedestrian transects and through driving all available vehicle tracks. The entire length of the powerline route was surveyed. No heritage sites were located and consequently there are no heritage constraints to the proposed development. Additionally, Bathurst LALC and the WNTCAC have provided written confirmation that they have no objections to the proposal (see **Appendix 2** of **Appendix 6**).

6.2.2.1 Aboriginal Heritage Management

There are no specific heritage management recommendations for the proposed development because no sites were located, however, in the unlikely event that a 'relic' or other Aboriginal site is found during the course of construction or maintenance work, work should cease and the DECC and the relevant Aboriginal community organisations or LALC be contacted to discuss a way to proceed.

6.2.3 Noise

A comprehensive noise impact assessment was carried out by Heggies Pty Ltd (2007a) and is contained in **Appendix 7**. The findings of the assessment are summarised below.

Rather than conducting a background noise monitoring program for the subject site, a conservative approach was adopted and a level of 30 dBA (the NSW Industrial Noise Policy (INP) (2000) default level) was used to represent the background noise level. Background noise levels at these locations are low and less than 30 dBA. The site specific noise emissions criteria were subsequently set with reference to the INP.

6.2.3.1 Construction Phase

Criteria

The DECC's Environmental Noise Control Manual (ENCM) details the preferred approach to the control of construction noise. This includes noise level restrictions, time restrictions, and noise mitigation, when there is a likelihood of annoyance due to noise from construction. For a cumulative period of exposure to noise from construction activity of between 4 weeks and 26 weeks duration, the $L_{A10(15minute)}$ noise level emitted by the works, when measured at a residential receiver should not exceed the $L_{A90(15minute)}$ RBL by more than 10 dBA.

The DECC's INP requires consideration of prevailing weather conditions. Wind has the potential to increase noise at a receiver when it is light and stable and blows from the direction of the noise source. Additionally, temperature inversions, which predominantly occur at night during winter months, have the ability to increase noise levels by focusing sound waves.

The prevailing winds in the Lithgow region were found to be of a speed and frequency that required consideration. Additionally, temperature inversions were found to occur relatively frequently and so required consideration in the noise prediction modelling.

Based on the construction noise guidelines and the default daytime $L_{A90(15minute)}$ RBL of 30 dBA, the appropriate construction noise criteria for the nearest residential receivers are summarised in **Table 6.1**. **Figure 5.1** shows the locations of the nearest residences.

Table 6.1 - Construction Noise Criteria - Residential Receivers

Receiver	Representative Locality	Default Background Level (RBL) $L_{A90(15minute)}$	Construction Criteria $L_{A10(15minute)}$	
			Day	Evening/Night
R1	North East of Vent Shaft	30 dBA	40 dBA	35 dBA
R2	South East of Vent Shaft	30 dBA	40 dBA	35 dBA
R3	South East of Vent Shaft	30 dBA	40 dBA	35 dBA

Assessment

The noise prediction model was prepared using the SoundPLAN V6.4 Industrial Module. The following scenarios were taken into consideration when developing the model:

1. raise boring – 25 t excavator, generator, raise boring machine; and

2. construction of shaft and support equipment – 25 t excavator, water tanker, generator, concrete trucks.

The predicted noise levels from the raise boring and construction of shaft and support equipment are contained in **Table 6.2**.

Table 6.2 - Predicted Scenario 1 and 2 Construction Noise Levels – dBA re 20 μPa

Residential Assessment Point	Predicted $L_{Aeq(15minute)}$ Noise Level					
	Daytime Calm	Evening Calm	Night-time Calm	Evening Wind 3m/s	Night Wind 3m/s	Night-time Inversion
R1 – Scenario 1	13	13	13	18	18	18
R1 – Scenario 2	15	16	16	21	21	21
R2 – Scenario 1	2	2	2	7	7	7
R2 – Scenario 2	0	0	0	3	3	4
R3 – Scenario 1	1	1	1	6	7	7
R3 – Scenario 2	0	0	0	3	3	3

The noise modelling results indicate that noise emissions during all construction activities under all meteorological conditions are predicted to be well below the construction criteria at all three residences.

6.2.3.2 Operation Phase

Criteria

As discussed in **Section 6.2.3.1**, the DECC's INP provides a framework and process for deriving noise criteria and assessing noise impacts. Establishing the operational noise criteria included an assessment of the default RBL, the intrusiveness criteria and the amenity criteria.

The intrusiveness criterion essentially means that the equivalent continuous noise level (L_{Aeq}) of the source should not be more than 5 dBA above the measured (or default) RBL at a residential receiver. The intrusiveness criteria in this case has been set for the various hours of operation based on the default RBL of 30 dBA.

The closest residences to the ventilation shaft are best described by the "rural" receiver type and the relevant rural amenity criteria have been adopted from the INP. The resulting operational noise criteria are provided in **Table 6.3**. The lower of the intrusive criterion and the amenity criterion is the controlling criterion that is a LAeq (15minutes) criterion of 35 dBA.

Table 6.3 - Operational Noise Emission Criteria - dBA

Receiver	Intrusiveness Criterion LAeq(15minutes)			Amenity Criterion LAeq(period)		
	Daytime 0700-1800 Hours	Evening 1800-2200 Hours	Night-time 2200-0700 Hours	Daytime 0700-1800 Hours	Evening 1800-2200 Hours	Night-time 2200-0700 Hours
R1, R2, R3	35	35	35	50	45	40

Assessment

The predicted noise levels from the operation of the proposed ventilation shaft are contained in **Table 6.4**.

Table 6.4 - Predicted Ventilation Shaft Operational Noise Levels - dBA re 20 μPa

Residential Assessment Point	Predicted LAeq(15minute) Noise Level					
	Daytime Calm	Evening Calm	Night Calm	Evening Wind 3m/s	Night Wind 3 m/s	Night-time Inversion
R1, R2, R3	0	0	0	0	0	0

The noise modelling results indicate that noise emissions from the ventilation shaft will not be discernible at the nearest residences under any of the modelled weather scenarios.

Based on the minimal noise impacts predicted for the construction and operation of the ventilation shaft, no additional noise mitigation measures are necessary.

6.2.3.3 Traffic Noise

Criteria

A construction traffic noise assessment was undertaken by Heggies Pty Ltd along Wolgan Road in accordance with the *Environmental Criteria for Road Traffic Noise* (DEC 1999). The detailed results of the assessment are contained in **Appendix 7** and summarised below.

The relevant assessment criteria as specified in the DECC's ENCM are outlined in **Table 6.5**.

Table 6.5 - New Land Use Road Traffic Criteria

Type of Development	Criteria LAeq(1hour) Daytime	Criteria LAeq(1hour) Night-time	Where Criteria are Already Exceeded
8. Land use developments with potential to create additional traffic on collector roads	60 dBA	55 dBA	Where feasible and reasonable, existing noise levels should be mitigated to meet the noise criteria. Examples of applicable strategies include appropriate location of private access roads; regulating times of use; using clustering; using "quiet" vehicles; and using barriers and acoustic treatments. In all cases, traffic arising from the development should not lead to an increase in existing noise levels of more than 2 dBA.

Assessment

An estimate of the worst case hourly construction traffic volume is 3 heavy vehicles and 2 light vehicles. Offset distances of residences on Wolgan Road vary between 16 and 108 metres within the Lidsdale township and 18 to 156 metres north of Lidsdale in the 80 km/hr section of the road. Given the traffic noise impacts would be greatest at higher vehicle speeds, the 18 metre offset distance was used in the prediction.

In terms of existing traffic flows on Wolgan Road, reference was made to traffic flow data collected between Thursday 9 March 2006 and 17 April 2006 at the northern end of Wolgan Road. The data indicates a maximum daytime hourly traffic flow throughout the whole survey period of 45 vehicles. In the absence of any traffic mix data, a conservative mix of one heavy vehicle to every four light vehicles was assumed (i.e. 20% heavy vehicles).

A prediction of the L_{Aeq} traffic noise levels was made using an internationally accepted model devised by the US Environment Protection Agency. The model was used to determine the existing traffic noise level and the future construction traffic noise level for comparison with the DECC's recommended $L_{Aeq(1\ hour)}$ 60 dBA daytime criteria. The results are presented in **Table 6.6**.

Table 6.6 - Traffic Noise Levels

Offset Distance	Existing Traffic		Existing Noise Level ($L_{Aeq(1\ hour)}$)	Existing + Construction Traffic		Total Traffic Noise Level ($L_{Aeq(1\ hour)}$)
	Light	Heavy		Light	Heavy	
18 metres	36	9	54 dBA	38	12	55 dBA

The results in **Table 6.6** indicate that the combined existing and proposed construction traffic noise level at the closest residence to Wolgan Road (and therefore at more distant residences) complies with the DECC's recommended daytime and night time criterion. Additionally, the temporary increase in traffic noise during the construction period is within the DECC's specified criterion of less than 2 dBA.

6.2.4 Energy and Greenhouse Management

The construction and operation of the proposed ventilation shaft has the potential to generate greenhouse gas emissions from a number of sources. Heggies (2007b) have undertaken an assessment of potential emissions (refer to **Appendix 5**) in accordance with the following policies and guidelines:

- the World Business Council for Sustainable Development (WBCSD) and World Resources Institute (WRI) *Greenhouse Gas Protocol* 2004 (GHG Protocol);
- the Australian Greenhouse Office (AGO) *Factors and Methods Workbook December 2006 (Workbook)* (AGO Workbook); and
- the draft *NSW Energy and Greenhouse Guidelines (EIA Guidelines) for Environmental Impact Assessment*, Sustainable Energy Development Authority and Planning NSW, 2002 (Draft NSW EIA Guidelines).

The results of the greenhouse gas emission assessment are summarised below.

Three ‘scopes’ of emissions are defined for greenhouse gas accounting and recording purposes, including:

- Scope 1 emissions are those which result from activities under a company’s control or from sources which they own. Scope 1 emissions are also referred to as direct emissions.
- Scope 2 emissions are those which relate to the generation of purchased electricity consumed in its owned or controlled equipment or operations. Scope 2 emissions are also referred to as indirect emissions.
- Scope 3 emissions are defined as those which do not result from the activities of a company although arise from sources owned or controlled by the company (e.g. off-site transportation of purchased fuels, the use of sold products and services). There are no Scope 3 emissions associated with the construction and operation of the proposed ventilation shaft.

Greenhouse gas sources associated with the proposed development include:

- the combustion of fuel by mobile equipment and vehicles during construction phase (Scope 1 emissions);
- methane released from the mined coal (Scope 1 emissions); and
- the consumption of electricity during operational phase (Scope 2 emissions).

6.2.4.1 Diesel Combustion

The expected diesel consumption associated with the construction and on-site electricity generation activities during the construction phase will be approximately 230 000 litres.

The annual emissions of CO_2 and other greenhouse gases from this source have been estimated using the AGO Workbook. It has been assumed that the energy content of automotive diesel oil is 38.6MJ/L.

A summary of the predicted emissions from diesel consumption are provided in **Table 6.7**.

Table 6.7 - Predicted Annual Greenhouse Gas Emissions from Diesel Fuel Combustion

Diesel Consumption (kL)	Energy Content (MJ/kL)	Emission Factor (kg CO_2-e/GJ)	Greenhouse Gas Emissions (t)
230	38.6	69.8	619.7

6.2.4.2 Electricity

Electricity will be used to power the ventilation shaft during the operational phase of the project. The annual electricity consumption is estimated to be of the order of 1.75 GWh/annum, based on the ventilation fan power requirements of 200 kW.

An estimate of the annual emissions of carbon dioxide from the consumption of electricity associated with the operation of the proposed ventilation shaft has been derived using the AGO Workbook's emission factor of 1.068 kg CO_2-equivalent/kWh.

Based on this assumption, it is predicted that the use of electricity associated with the operation of the proposed ventilation shaft will result in the emission of approximately 1869 t of CO_2-equivalent per annum.

6.2.4.3 Coal Bed Methane

The process of coal formation creates significant amounts of methane (CH_4). This CH_4 remains trapped in the coal until the pressure on the coal is reduced, which occurs during the coal mining process. The stored CH_4 is then released to the atmosphere.

An estimate of the annual emissions of CH_4 from the extraction of coal at Longwalls 29-31 that are to be vented by the proposed ventilation shaft has been derived using the AGO Workbook's emission factor of 8.4 kg CO_2-equivalent/tonne of raw coal. It is noted that due to the Class B "non-gassy" classification of the Baal Bone underground mine in Appendix A of the *Australian Methodology for the Estimation of Greenhouse Gas Emissions and Sinks* (AGO 2005), this emission factor relates to "non gassy" underground mines. .Annual extraction of coal is assumed to be 1.7 Mt per year, based on the estimated 5 Mt of coal within Longwalls 29-31 and the expected three year mining campaign to access it.

Based on these assumptions, it is predicted that release of coal bed CH_4 through the operation of the proposed ventilation shaft will result in the emission of approximately 14,000t of CO_2-equivalent per annum.

6.2.4.4 Total Greenhouse Gas Emissions

A summary of the predicted greenhouse gas emissions resulting from all operations at the site are presented in **Table 6.8**. It is noted that the diesel combustion related emissions are only expected to occur during the initial construction phase of the project (assumed to be 20 weeks). However, for the purpose of deriving worst case annual emissions from the proposed project, **Table 6.8** includes all construction and operation emissions on an annual basis.

Table 6.8 - Predicted Worst Case Greenhouse Gas Emissions from Proposed Ventilation Shaft

Source	Predicted Emissions CO_2-e (t)
Diesel	619.7
Electricity	1,869
Coal Bed CH_4	14,000
Total	**16,489**

As shown in **Table 6.8**, the total estimated annual emissions of CO_2-equivalent as a result of the proposed project are likely to be in the order of 16,489 t of CO_2-equivalent per annum.

Greenhouse gas estimates are assessed relative to 1990 baseline levels for reporting purposes. The AGO estimates that in 1990, Australian greenhouse gas emissions totalled 551.9 Mt CO_2-equivalent. A comparison of the predicted emissions with the 1990 estimate demonstrates that the construction and operation of the proposed ventilation shaft would represent an annual increase of approximately 0.0029% of the total baseline Australian emissions.

Xstrata Coal has signed on to the Greenhouse Challenge Plus Program and is striving for energy conservation and increased energy efficiencies within all operations. Some relevant actions include:

- being actively involved in the Federal Government's Energy Efficiency Opportunities programme;
- contributing to the $300 million COAL 21 Fund, to work with the electricity generation industry and demonstrate promising technologies for reducing greenhouse gas emissions from coal-fired power stations;
- playing an active role in the $3 Billion Futuregen project; and
- continually updating its action plans and implementing measures to reduce the Company's use of all forms of energy, not just electricity.

6.2.5 Soil and Water

6.2.5.1 Sediment and Erosion Control

The soil and water controls associated with the construction and operation of the ventilation shaft are shown on the conceptual site layout and are included in the general controls outlined below (refer to **Figure 3.2**).

The following general controls will be adopted for areas disturbed during construction of the proposed ventilation shaft:

- the disturbance area will be clearly identified prior to any site works commencing so as to minimise disturbance outside the defined work area;
- topsoil will be stockpiled in the compound for later use in rehabilitation;

- as discussed in **Section 3.4.1**, two adjoining sumps will be constructed for both containing runoff and for re-circulating raw water during pilot drilling. These sumps will be plastic lined and a return pump and line will be installed in the lower sump;

- a downslope perimeter (catch) bank or drain and a sedimentation dam will also be constructed and maintained to contain sediment laden runoff from the disturbed area (refer to **Figure 3.2**);

- diversion (catch) drains will be constructed upslope of the disturbance area in order to convey clean runoff away from this area (refer to **Figure 3.2**). Level spreaders will also be constructed if necessary;

- the invert of both clean and dirty water diversions may be lined with needle-punched geotextile material, if required, to prevent scour;

- all erosion and sediment control works will be regularly maintained; and

- where possible, disturbed areas will be rehabilitated as soon as earthworks are complete (refer to **Section 6.2.9** for details regarding rehabilitation).

These controls will be constructed to a standard consistent with *Managing Urban Stormwater: Soils and Construction* (Landcom 2004) as required by the Sydney Catchment Authority. The controls are also consistent with DPI (Forests NSW) *Forest Practices – Miscellaneous*.

State Forest Access Track

As discussed in **Section 3.3** no new access tracks within the State Forest are required for the proposed project. For existing tracks, surface water drainage controls will be established and maintained in accordance with the DPI (Forests NSW) *Forest Practices Code (Part 4 – Forest Roads and Fire Trails* (also refer to **Section 6.2.7**). This code sets out the standards to be followed by Forest NSW employees and all forest road users in all aspects of forest road and trail use and management.

The following controls with regard to forestry tracks will be applied during the construction and operation of the proposed ventilation shaft and powerline:

- an initial inspection of the access road will be undertaken to assess the effectiveness of existing control measures;

- if required effective road surface drainage will be installed as specified in the Forest Practices Code (Part 4 – Forest Roads and Fire Trails);

- regular visual inspection of the access road will be undertaken to ensure that road drainage controls are effective;

- use and maintenance of the road in accordance with Forest NSW guidelines; and

- the preparation of an access protocol in consultation with Forests NSW. This may include:

  - automatic wet weather closures; and

  - temporary signage regarding increase in traffic volume and heavy vehicle usage.

6.2.5.2 Creek Tributaries

There will be no direct impact to the first order tributaries that are crossed by the proposed powerline. The poles will be located so that neither the beds nor banks of the tributaries are disturbed. Vegetation and groundcover will not be removed. If limited lopping is required, it will not affect the tributaries. The tributary located near the existing dewatering borehole will not be impacted by the proposed development.

6.2.5.3 Groundwater

The upper stratigraphy of the Western Coalfield comprises mostly sandstones of the Narrabeen Group underlain by the Illawarra Coal Measures (Connell Wagner 2006). The sandstone is generally interbedded with shale and siltstone. These strata include water bearing aquifers.

During the ventilation shaft construction process, it is possible that there will be some inflow into the shaft. Any substantial water bearing strata intersected in the shaft will be sealed as part of the construction process. This will ensure that groundwater impacts from ventilation shaft construction are minor and localised and that there is no significant ongoing impact during shaft operation.

Groundwater impacts associated with Longwalls 29-31 are addressed in the Subsidence Management Plan application for the longwalls (Baal Bone Colliery 2007). The proposed construction of the powerline will have no impact on local groundwater.

6.2.5.4 Water Quality

The *Drinking Water Catchments Regional Environmental Plan No. 1* (the REP) forms part of the Sydney Catchment Authority's *Sustaining the Catchments – The Regional Plan for the Drinking Water Catchments of Sydney and Adjacent Regional Centres* (the Regional Plan). This plan has been developed to protect drinking water quality and improve the health of Sydney's drinking water catchments. It replaces State Environmental Planning Policy No. 58 – Protecting Sydney's water supply (SEPP 58) and commenced on 1 January 2007.

As discussed in **Section 4.3.5**, part of the proposed development area is located within the upper reaches of the Cox's River Catchment and is therefore within the area to which this REP applies. However, Section 75R of the EP&A Act provides that environmental planning instruments, other than SEPPs, do not apply to major projects defined under Part 3A of the Act. Nevertheless, the guidelines which support the REP (*Neutral or Beneficial Effect on Water Quality Assessment Guidelines*) (the Guidelines) were used in the following assessment of the impact of the proposed development because they set out all relevant assessment criteria.

The guidelines include an Assessment Template for the assessment of Neutral or Beneficial Effect on Water Quality (NorBE). The completed template is contained in **Appendix 3** and it concludes that the proposed ventilation shaft and powerline will have a neutral effect on the catchment's water quality. The soil and water controls outlined for the proposed project (refer to **Section 6.2.5.1**) are based on Landcom's *Managing Urban Stormwater: Soils and Construction* (2004). These guidelines are endorsed by the Sydney Catchment Authority.

6.2.5.5 Water Requirements

There are no facilities associated with the ventilation shaft that will require water during the operational phase. There is therefore no need for a permanent water supply at the site.

Water required during the construction phase will be transported to the site by water tanker, with small amounts of water being sourced from the sumps following rainfall events.

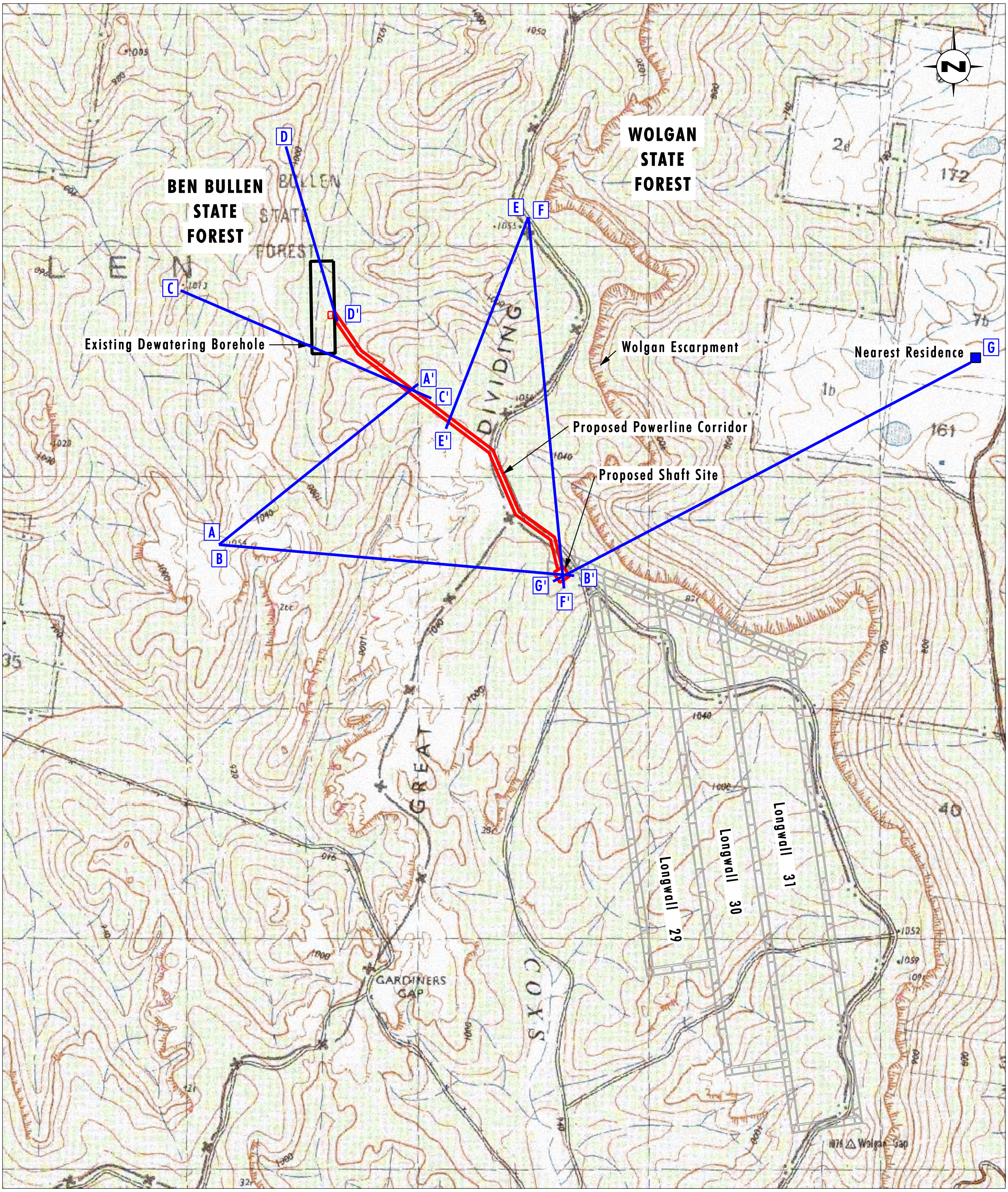
6.2.6 Visual Impact

The proposed ventilation shaft site and powerline route are located in an area with a predominantly natural visual character, with intermittent occurrences of infrastructure and forestry activities detracting from the natural visual character. The ventilation shaft will be located approximately 1.5 kilometres away from the nearest residences in the Wolgan Valley. These residences are shielded from the proposed development site by the Wolgan Valley escarpment. The proposed shaft site and powerline route are located on the crest and slopes of a plateau. The shaft site is located at an elevation of 1040 metres AHD and the powerline route descends from this elevation to approximately 960 metres AHD. The proposed development will therefore have no impact on the views of residences.

A number of visual transects were developed between representative elevated locations on the Wolgan Plateau to the sites of the proposed ventilation shaft and powerline (refer to **Figures 6.2** to **6.4**). It was considered that there was a possibility that there would be a sight line between these locations and the structures. A transect was also developed between the nearest residence and the proposed ventilation shaft site to illustrate that the lack of visual impact from the Wolgan Valley (refer to **Figure 6.5**). The transects indicate that the ventilation shaft and powerline may be visible from limited locations within Ben Bullen State Forest by bushwalkers and people utilising forestry tracks. However, in general, both structures will be screened by the dense intervening vegetation and natural topography. An approximate 690 metre section of the 11 kV powerline will be located adjacent to the forestry track which runs past the proposed development area. This track forms a section of the Bicentennial National Trail (see **Section 5.2**). The fact that there will be minimal clearing, however, will ensure that the visual impact of the powerline is low. Glimpses of the ventilation shaft and associated fan may also be possible from this track, but intervening vegetation will effectively shield the majority of potential views of the infrastructure. Additionally, the infrastructure will be of a colour that blends with the surrounding landscape.

Sandstone outcrops in the form of pagodas and low rock expanses are common across the Wolgan Plateau and contribute to the visual amenity of the area. The proposed ventilation shaft and powerline corridor will not impact on any sandstone pagodas. The power pole locations will be chosen to avoid elevated sandstone outcrops and to minimise spanning across rock outcrops.

The presence of large equipment on site during construction will have increased visibility during the short term construction phase. Lighting will be used during particular stages of construction. This lighting will be pointed downward but, given the lack of lighting in the surrounding nightscape, a minor night glow may be visible from the Wolgan Valley and other locations during night time hours during some of the construction phase. Post construction, the ventilation shaft and powerline structures will be a maximum height of approximately 6-8.5 metres and will be shorter than the surrounding vegetation which extends to a height of approximately 12 metres, therefore screening the site. All structures will be dismantled and removed from the site once longwall mining is complete. Overall, the proposed development will have a low and short term impact on the wider visual landscape of the area.



Source: LPI, NSW 2000

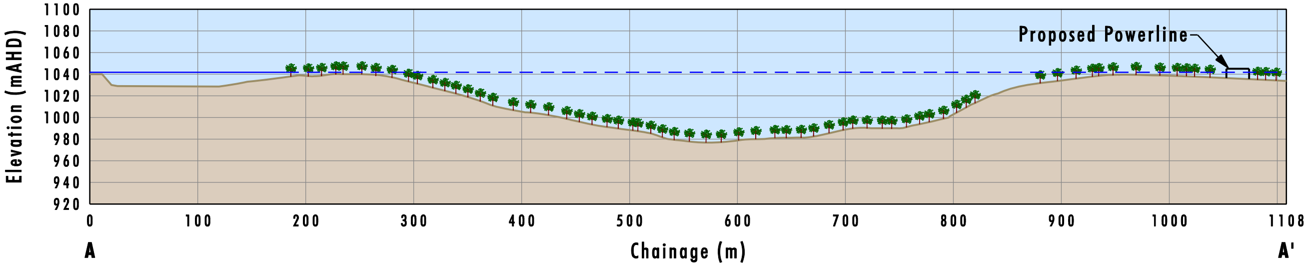
0 0.25 0.5 1km
1:23 000

Legend

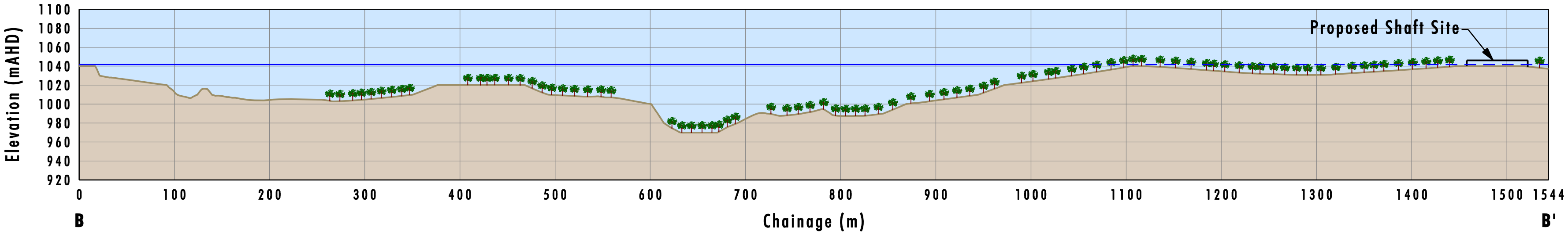
- Proposed Vent Shaft and Powerline Corridor
- Planned Longwall
- MPL 261 Containing Existing Transformer
- Cross Section Locations

FIGURE 6.2

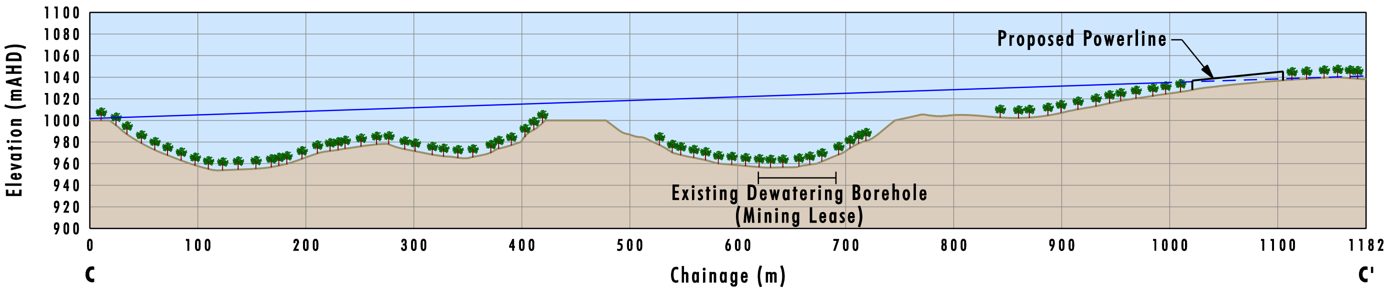
Location of Visual Cross Sections



Cross Section A-A'



Cross Section B-B'



Cross Section C-C'

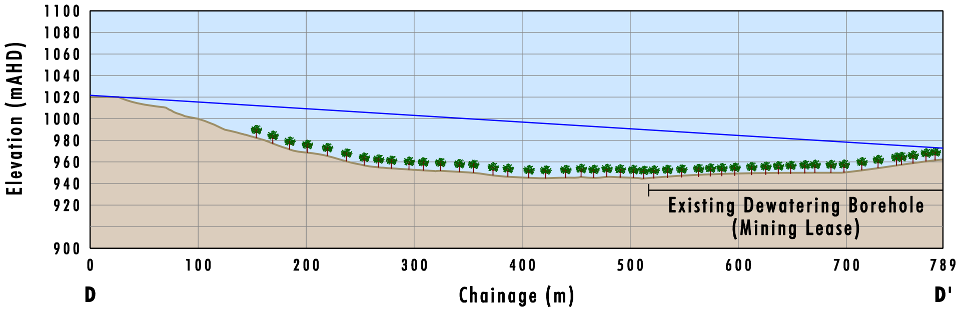
0 100 200 300m
1:7000

Legend

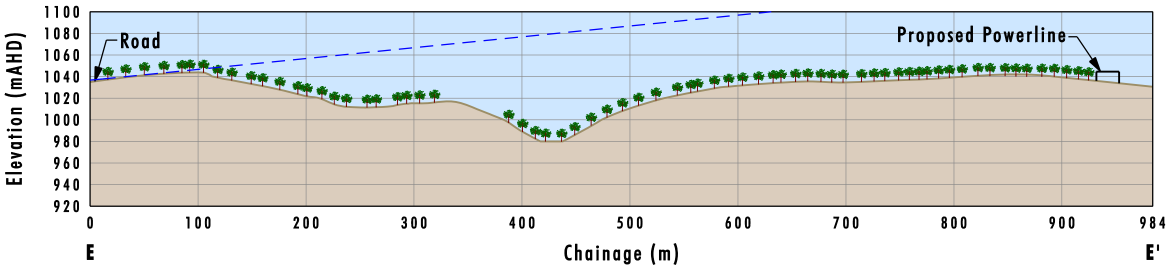
- Viewline
- Filtered Viewline
- Existing Vegetation

FIGURE 6.3

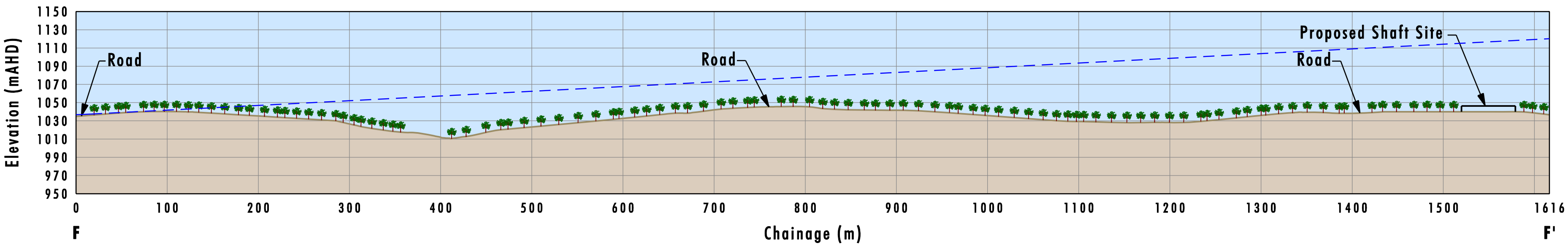
Cross Sections A-A', B-B' & C-C'



Cross Section D-D'



Cross Section E-E'



Cross Section F-F'

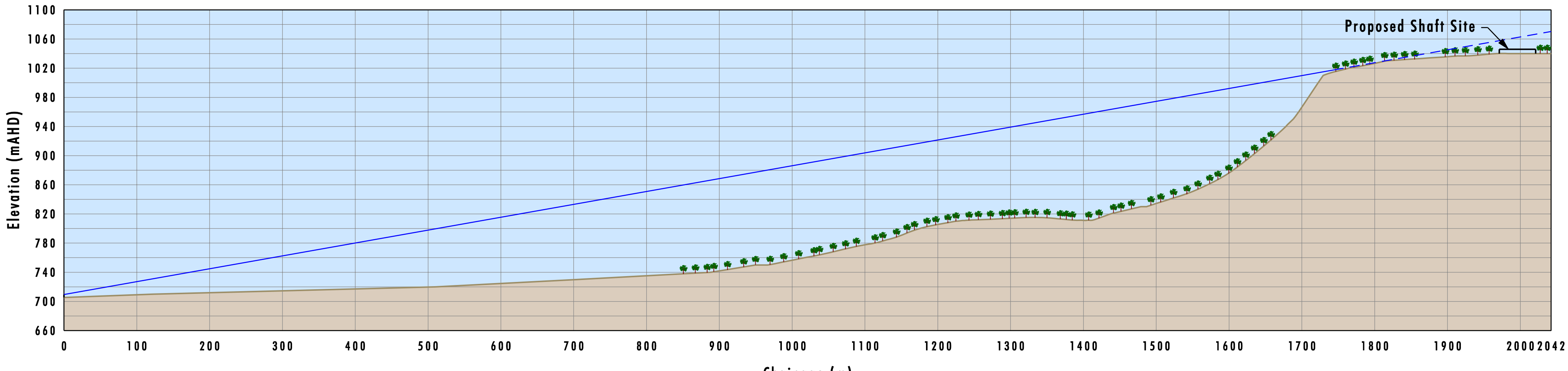
0 100 200 300m
1:7000

Legend

- Viewline
- Filtered Viewline
- Existing Vegetation

FIGURE 6.4

Cross Sections D-D', E-E' & F-F'



Cross Section G-G'

0 100 200 400m
1:8000

Legend

Viewline
Filtered Viewline
Existing Vegetation

FIGURE 6.5

Cross Section G-G'

6.2.7 Traffic

6.2.7.1 Existing Conditions

As discussed in **Section 3.5**, access to the proposed development site will be via Wolgan Road and then an unnamed forestry access track (see **Figure 3.4**). Wolgan Road is a sealed two lane two way local road managed by Lithgow City Council. The speed limits along the road are 50 km/hr within the Lidsdale township, increasing to 80 km/hr between the outer limit of Lidsdale and the intersection with the unnamed forestry track. The road has centre line markings. The forestry track is generally a one lane forest track of natural formation.

The intersection between Wolgan Road and the unnamed forestry track is located to the south of an easterly sweeping bend. The sight distance to the north at this intersection is approximately 200 metres; the sight distance to the south is approximately 400 metres. Vehicles will be turning left into the intersection to access the development site, and right across one lane when exiting. There is a 2.5 to 3.0 metre wide verge to the north and south of the intersection, and an approximately 2.0 metre wide verge opposite the intersection.

In terms of existing traffic flows along Wolgan Road, traffic flow data collected by Lithgow City Council between Thursday 9 March 2006 and 17 April 2006 at the northern end of Wolgan Road, indicates a maximum daytime hourly traffic flow throughout the whole survey period of 45 vehicles, a maximum evening hourly traffic flow of 23 vehicles, and a maximum night-time hourly traffic flow of 13 vehicles. No traffic mix data is available (i.e. proportions of heavy and light vehicles), however a conservative mix of one heavy vehicle to every four light vehicles was assumed in the Traffic Noise Assessment (refer to **Section 6.2.3.3**).

6.2.7.2 Expected Traffic Volumes

The expected traffic volumes generated by the development will not add significantly to the current levels of traffic on Wolgan Road during the operational phase. However, during the construction phase, Wolgan Road will be subject to an increased volume of heavy and light vehicle traffic.

As discussed in **Section 3.5.1**, there is likely to be a maximum of six heavy vehicle round trips per day during preliminary site works and presinking. However, movements will not be continuous with the delivery of materials such as concrete being periodic. Heavy vehicles will include an excavator/backhoe, a crane and various delivery trucks. There are also likely to be in the order of ten light vehicle round trips per day during this stage.

During pilot hole drilling, water tankers will travel between Lidsdale and the site. It is estimated that 20 round trips over a five day period will be required, with an estimated peak of 3 truck movements within one hour. Heavy vehicles will also include a Raise Borer (1 trip). It is estimated that there will be 10 light vehicle round trips per day during this 9 week stage.

Fan installation and commission will involve about ten truck round trips over the four week stage to deliver the fan and other items, as well as approximately five concrete truck round trips. A backhoe may also be required (1 trip). It is estimated that there will be ten light vehicle round trips per day during this stage.

Vehicle movements associated with the construction of the powerline are likely to include a backhoe (approximately 5 round trips), equipment delivery trucks (approximately 4 round trips), and approximately ten light vehicle round trips per day over an estimated period of three weeks.

The worst case scenario with regard to traffic movements during the construction phase is estimated to be three heavy vehicle movements and two light vehicles within a one hour period.

During the estimated three year operation period, there is likely to be an average of one light vehicle round trip per day for security and maintenance purposes.

6.2.7.3 Assessment

Based on the existing traffic flow data, and analysis of sight lines and intersection layout, it is unlikely that local traffic flows will be significantly slowed or affected by this periodic increase to traffic during the construction period.

Despite the low impact of increased traffic volumes on Wolgan Road, consideration of traffic safety will be required. A construction traffic management plan will be prepared for the ventilation shaft and powerline construction phase to ensure that appropriate traffic management strategies are implemented. This plan will mainly specify the need for appropriate warning signs along Wolgan Road on either side of the intersection, as well as along the relevant section of the forestry track. The construction traffic management plan will be prepared in consultation with Lithgow City Council.

Impacts on unsealed roads will be managed in conjunction with Forests NSW and with reference to the RTA's *Traffic Control at Worksites* to ensure that impacts are minimised and roads remain in an acceptable condition. No new access tracks will be constructed, ensuring that there will be no cumulative impacts associated with access by trail bike riders and other State Forest users. Trucks will be limited to a maximum of 40 km/hr on all unsealed roads, with traffic movements being limited or ceased in wet periods depending on road conditions. Suitable drainage structures will be erected where necessary along the section of road that runs adjacent to the Coxs River Swamp to ensure that the swamp is not impacted by the increased usage of the road (refer to **Section 6.2.5.1**). Baal Bone Colliery will co-operate with DPI (Forests NSW) to ensure that all forestry tracks remain in an acceptable condition, with maintenance being undertaken as required and in accordance with *Forest Practices Code (Part 4 – Forest Roads and Fire Trails)*.

6.2.8 Bushfire Management

The proposed ventilation shaft and powerline are located in a high risk bushfire area with relatively steep slopes and dense woodland vegetation. An assessment of the bushfire hazard for the site was undertaken by assessing vegetation types and slopes in the vicinity of the proposed development area in accordance with the *Planning for Bushfire Protection* guide developed by DoP and the NSW Rural Fire Service (2006). This document outlines the requirements for Asset Protection Zones (APZs) for residential dwellings based on bushfire hazard.

Although the APZ requirements do not specifically apply to this development because it is not a residential dwelling, they do provide a guide for provision of suitable APZs for protection of site infrastructure. An APZ is comprised of an Inner Protection Zone (IPZ) which should not provide any significant potential fuel for bushfires (e.g. cleared areas with lawn or sealed surfaces) and an Outer Protection Zone (OPZ) which is located adjacent to the hazard but which has reduced fuel loads (e.g. discontinuous trees and reduced shrub layer).

The 50 x 50 metre fenced and grassed ventilation shaft site will allow an APZ of approximately 20 metres in accordance with *Planning for Bushfire Protection*. This will ensure adequate bushfire protection as well as minimal impact to flora and fauna and the visual amenity of the area.

The typical clearance space associated with the bundled cable powerline will also be minimised as much as possible. According to Energy Australia (2002) guidelines and *ISSC3 Guideline for Managing Vegetation Near Power Lines 2005*, aerial bundled cables should be 0.5 metres away from vegetation. Some lopping will therefore be undertaken. Undergrowth beneath the line will not be removed unless it is less than 0.5 metres from the cable.

The risk of ignition associated with the construction and operation of the powerline is minimal. The bundled cable is designed to create a very high level of fire protection. Additionally, the entire length of the powerline will be inspected regularly to ensure that branches are not touching or in danger of touching the cable.

The ventilation shaft will be fitted with an evassee and the switch gear will be enclosed within a small building. The enclosure of the facility means that there is minimal risk of ignition associated with it.

During construction, relevant Forests NSW requirements (outlined in their *Forests Practices – Miscellaneous*) will be adhered to by all contractors. When permitted, ignition sources such as welding and cutting will be restricted to the APZ where vegetation has been cleared. Fire fighting equipment will be contained in relevant contractor vehicles and machinery.

Fire management procedures will be enforced by relevant staff at Baal Bone Colliery. Baal Bone Colliery will also liaise closely with DPI (Forests NSW) with regard to appropriate bushfire hazard management, including fire detection and communication.

6.2.9 Rehabilitation and Site Decommissioning

There are two stages of rehabilitation associated with the proposed ventilation shaft and powerline – post-construction (operation) and site decommissioning.

The conceptual construction layout is shown on **Figure 3.2**. A perimeter (catch) bank or drain and a sediment dam will be constructed on the downslope side of the site and diversion drains will be constructed upslope to divert clean runoff away from the site. Once construction is complete, the 50 x 50 metre area (which will be within an enclosed fence) will be maintained as a bushfire protection zone (refer to **Section 6.2.8**). The stockpiled topsoil will be spread across the site and contoured appropriately. The sediment dam used during the construction phase will be maintained throughout the operational phase to ensure stormwater quality and also to act as a control point in the unlikely event of a fuel or chemical spill.

All infrastructure will be removed during decommissioning. The ventilation shaft will be back-filled with suitable material and capped with concrete, and the entire site will be contoured and re-topsoiled to achieve the pre-disturbance landform. The grass species planted during the operational phase will be removed and the area will be revegetated with a mixture of native seed sourced from the surrounding area (if required). Former power pole locations will be filled, seeded and subject to weed control.

Detailed requirements for site decommissioning will be developed and included as part of Baal Bone Colliery's Mining Operations Plan as required by the DPI (Mineral Resources). Following the completion of site decommissioning works, Baal Bone Colliery will undertake ongoing monitoring and maintenance of the site until the site achieves an acceptable level of regeneration, as determined in consultation with DPI (Forests NSW) and DPI (Mineral Resources).

A weed control program will be implemented during this rehabilitation care and maintenance phase as well as during the operational phase. This will involve regular checks for weeds, and weed spraying and removal if necessary.

6.3 Other Environmental Assessment Issues

6.3.1 Air Quality

Air quality assessment was completed by Heggies Australia. A full copy of the report is included in **Appendix 5** and summarised in this section.

6.3.1.1 Criteria

Air quality goals (criteria) consistent with the Approved Methods for the Modelling and Assessment of Air Pollutants in NSW (DEC 2005) have been applied in this assessment.

In NSW, accepted practice regarding the nuisance impact of dust is that dust-related nuisance can be expected to impact on residential areas when annual average dust deposition levels exceed 4 $g/m^2/month$ (DEC 2005). The allowable increase in dust deposition level over the ambient (background) level is 2 $g/m^2/month$.

Emissions of PM_{10} (particulate matter less than 10 microns in aerodynamic diameter) are considered an important pollutant in terms of impact due to their ability to penetrate into the respiratory system. The DECC PM_{10} impact assessment goals are:

- a 24-hour maximum of 50 $\mu g/m^3$; and
- an annual average of 30 $\mu g/m^3$.

It is noted that the PM_{10} sub-set is typically 50% of Total Suspended Particulate (TSP) (airborne particles typically between 50 microns and 0.1 microns in diameter) in the ambient air of regions where road traffic is not the dominant particulate source. Therefore, as the annual TSP goal is seen to be achieved if the annual PM_{10} goal is satisfied, TSP has not been considered further.

Impacts from odorous air contaminants are often nuisance-related rather than health related. In practice, the character of a particular odour can only be judged by the receiver's reaction to it, and preferably only compared to another odour under similar social and regional conditions. The area surrounding the proposed ventilation shaft is primarily forest and rural. Consequently, the project odour performance goal adopted for the assessment is:

- a maximum of 6.0 odour units per cubic metre (OU/m^3) expressed as a nose response average (1-second) value.

6.3.1.2 Background Parameters

In order to assess the potential air quality impacts of the proposed ventilation shaft, an estimate of background air quality parameters was made based on a range of available data:

- Dust - An annual average ambient dust deposition level of the order of 1.7 g/m²/month;
- PM_{10} - A daily varying 24-hour average concentration and an annual average concentration of the order of 18 µg/m³ (it should be noted that the best available monitoring data was sourced from Bathurst and provides a conservatively high estimate of background PM_{10};
- Odour - Negligible.

Meteorological data (including predominant wind direction) was sourced from the Mt Piper Power Station Automatic Weather Station.

6.3.1.3 Assessment

Atmospheric dispersion model predictions were undertaken using the Ausplume Gaussian Plume Dispersion Model (Ausplume). The atmospheric emissions associated with the installation and operation of the ventilation shaft were predicted using the above data and criteria.

Dust deposition will not be associated with the operational phase of the ventilation shaft. Dust is a fugitive-type emission, typically generated by wind and human-related disturbances of the earth.

Ausplume predictions for dust deposition during the construction phase indicate that the incremental increase in monthly dust deposition will be between 0.4 g/m²/month and 0.1 g/m²/month at each of the three nearest residences and that total dust deposition will be well within the DECC goal of 4 g/m²/month (refer to **Table 6.9**).

Table 6.9 - Background and Incremental Dust Deposition at Nearest Residences - Construction Phase

	Dust – Annual Average (g/m^2/month)			
Residence	**Adopted Background**	**Increment**	**Background + Increment**	**Project Goal**
R1	1.7	0.4	2.2	4
R2	1.7	0.1	1.8	4
R3	1.7	0.2	2.0	4

The maximum 24-hour average concentration of PM_{10} associated with the construction and operation of the proposed ventilation shaft is predicted to be well below the DECC goal of 50 µg/m³ at all residences. Modelling indicated an incremental increase of 1 µg/m^3 at R1 and zero at R2 and R3 during the construction phase, resulting in concentrations below the project goal even with the use of the conservatively high background data recorded at Bathurst. An incremental increase of 0.9 µg/m^3 was estimated during the operational phase at R1 and zero at R2 and R3, again resulting in 24-hour average concentrations below the project goal of 50 µg/m^3.

The annual average PM_{10} concentrations (background plus increment) associated with the ventilation shaft are also predicted to be below the project goal of 30 µg/m³ during both construction and operational at all residences (refer to **Table 6.10**). This assessment used assumptions regarding road, soil and construction dust, and the maximum and annual average predicted PM_{10} concentrations.

Table 6.10 - Annual Average PM_{10} Concentrations at Nearest Residences

	PM_{10} – Annual Average (µg/m^3)			
Residence	**Background**	**Increment**	**Background + Increment**	**Project Goal**
Construction Phase				
R1	18	0.2	18.2	30
R2	18	0.2	18.2	30
R3	18	0.2	18.2	30
Operation Phase				
R1	18	0.4	18.4	30
R2	18	0.2	18.2	30
R3	18	0.2	18.2	30

Ausplume predictions for the maximum odour concentration attributable to the operation of the ventilation shaft indicate that odour concentration will not exceed the project goal of 6.0 OU/m^3 (refer to **Table 6.11**).

Table 6.11 - Predicted Maximum Odour Concentrations at Nearest Receptors

Residence	Maximum (100th percentile) (OU/m^3)	Project Goal
R1	1.4	6
R2	0.9	6
R3	0.8	6

6.3.2 Storage and Handling of Fuels and Other Hazardous Substances

Fuel and lubricating oils will be stored and handled in compliance with the requirements of *AS 1940 – The storage and handling of flammable and combustible liquids* and the DPI (Forests NSW) *Forests Practices - Miscellaneous*.

6.3.3 Waste Management

As discussed in **Section 6.3.2**, substances and materials used at the site will be handled and stored so that there will be no detrimental environmental impacts. No substances or materials will be processed on site and all hazardous waste will be taken to a licenced facility.

Transport of fuel and refuelling of equipment will be done in a manner that prevents the potential for pollution of waters as a result of the escape of fuel; and all waste will be stored in such a way that it does not pose a risk to waterways or contaminating land. These are requirements of Forests NSW *Forest Practices Code (Part 4 – Forest Roads and Fire Trails)*.

During construction, a portable chemical toilet will be provided on site. The effluent from this will be regularly removed from the site by an approved contractor. No human effluent will be treated or disposed of at the site. No toilet facilities will be provided at the site during the operational period of the ventilation shaft as the facility will not be permanently staffed.

6.3.4 European Heritage

In NSW there are different types of statutory listings for local, state and national heritage items. An item is a heritage item if it is listed on: the heritage register of a local council's LEP or a Regional Environmental Plan (REP); on the State Heritage Register (listed items are protected under the Heritage Act 1977 and the EP&A Act); on the National Heritage List and/or the World Heritage List (listed items are protected under the EPBC Act).

A search of these registers revealed that there are no heritage items listed within the proposed ventilation shaft site or powerline corridor.

Heritage items in Australia can also be listed on the Commonwealth Heritage List and the Register of the National Estate. The Commonwealth Government is the only body whose actions are constrained by a listing on these Registers. A search of these registers also did not reveal any items within the proposed development area.

Additionally, no European heritage items were identified during the Aboriginal heritage survey of the area which was undertaken by a qualified archaeologist and Aboriginal community representatives.

6.3.5 Socio-Economic Assessment

Baal Bone Colliery currently employs a full-time workforce of approximately 170. The proposed project will ensure the continued employment of this workforce for a period of approximately two to three years. This workforce provides flow on effects to the local and regional economy. Additionally, the construction of the proposed ventilation shaft and powerline will require a short term workforce of approximately ten. The temporary relocation of these workers to the local area will also contribute economic benefits to the local community.

According to Australian government statistics (workplace.gov.au), the Labour Force Region of which Lithgow is a part (Northern, Far West – North Western and Central West) has an unemployment rate of 6.2%, higher than the average unemployment rate of 5%. In light of this, the continued employment of a substantial workforce, along with the flow on economic benefits of the short term construction workforce will make a positive contribution to the local community.

As discussed in **Section 6.2.6**, there may be a minor visual impact to the immediate natural environment which will affect the enjoyment of the area for a number of people who use the area and pass through the area for recreational purposes. This impact, however, will be short in duration (approximately two to three years) and very minor in relation to the area of land affected.

The issues raised during agency and community consultation regarding the proposed ventilation shaft and powerline corridor were discussed in **Sections 2.1** and **2.2**. These included the need to minimise the visual impact of the development, to ensure that no major sandstone outcrops are impacted, to avoid the construction of additional access roads, to minimise noise impacts, and to ensure that there will be minimal detrimental impacts to Aboriginal heritage and flora and fauna. These issues have been addressed throughout this document and all assessments indicate minimal overall impact.

Baal Bone Colliery also has a Social Involvement Plan based on Xstrata Coal NSW (XCN) *Social Involvement Strategy and Plan*. During 2006, the following community involvement initiatives were implemented:

- restoration of the Cullen Bullen Historic Cemetery;
- upgrade of lift facilities at the Coleman House;
- sponsorship of a livestock judging competition at Portland Agricultural Show;
- donation of steel to the Portland RSL;
- donation of fire equipment to the Cullen Bullen and Capertree Rural Fire Service Brigades;
- upgrade of outdoor facilities at the Lithgow Preschool;
- donation to Lithgow Christian Fellowship to provide Christmas lunch and Christmas hampers to the underprivileged in Lithgow; and
- visit by children from the Cullen Bullen Public School to the CHPP.

Planned community involvement activities for 2007 include:

- investigations regarding the installation of school zone flashing lights on the Castlereagh Highway outside Cullen Bullen Public School;
- support of both the Ironfest and Portland art and cultural festivals;
- repairs to the recreational area at the Portland Aged Care Facility;
- donation to the Zig Zag Public School to assist with library resources;
- donation to assist with the visit of the Life Education Van to Capertee, Cullen Bullen and Wallerawang Primary Schools; and
- mine open day in Autumn 2008 to focus on rehabilitation works (contingent upon weather conditions and the completion of seeding works in Autumn).

6.3.6 Cumulative Impacts

The cumulative environmental impacts of the proposed ventilation shaft and powerline are minimal because of the facility's short term duration and relatively small footprint. Baal Bone Colliery, along with adjacent collieries such as Angus Place and Springvale, have undertaken coal mining activities for many decades and have continued to improve the management of environmental impacts associated with their activities.

The proposed facility has been designed in a way that will minimise impacts to the surrounding flora and fauna, tributaries and general landscape. Some existing damage in the form of erosion and vegetation clearance occurs in the vicinity of the proposed facility as a result of recreational activities such as four-wheel driving, motorcycling and camping. Neither the construction or operation of the proposed ventilation shaft and powerline will contribute to this type of damage because access into the general area will not be increased (no new access roads will be constructed) and the soil and sediment controls put in place to ensure that no contaminated runoff or erosion will be associated with the facility. Additionally, the area will be completely rehabilitated once the operational phase is complete (within approximately two years). All structures will be removed and cleared areas will be revegetated with local native species.

There are intermittent occurrences of mining and forestry infrastructure that currently detract from the natural visual character of the area. As discussed above, no new access roads will be constructed and, while the proposed structures may detract from the visual amenity of the immediate area, the visual impact will be minor and temporary. Assessment of other impacts, such as noise, air quality and traffic have also been found to be short term and insignificant. Consequently, it can be concluded that the proposed ventilation shaft and powerline will not have a significant cumulative environmental impact.

7.0 Draft Statement of Commitments

If project approval is granted for the proposed ventilation shaft and powerline corridor, Baal Bone Colliery will commit to the following controls:

7.1 Life of Facility and Hours of Operation

1. The life of the ventilation shaft and powerline will correlate with the estimated time it will take to extract Longwalls 29-31.

2. The ventilation fan will be in operation 24 hours per day, seven days per week.

3. Preliminary site works and presinking works associated with the construction of the ventilation shaft will be undertaken Monday to Friday during daylight hours, and Saturdays as necessary.

4. The construction of the powerline will be undertaken Monday to Friday during daylight hours.

5. Raise boring will be undertaken 24 hours per day, seven days per week.

7.2 Ecology

6. Vegetation clearance and lopping will be limited to that required for the construction footprint and bushfire risk management.

7. Vegetation clearance will be undertaken in accordance with the procedure outlined in **Section 6.2.1** of this EA.

8. Upon site decommissioning, disturbed areas will be rehabilitated with local native species.

7.3 Aboriginal Heritage

9. In the event that a 'relic' or other Aboriginal site is found during the course of construction or maintenance work, work will cease and the DECC and the relevant Aboriginal community organisations or LALC will be contacted to discuss an appropriate way to proceed.

7.4 Traffic

10. A construction traffic management plan will be prepared and implemented in consultation with Lithgow City Council for the construction phase of the ventilation shaft and powerline.

11. Baal Bone Colliery will use and maintain the forestry access track in conjunction with Forests NSW and in accordance with DPI (Forests NSW) Forest Practices Code (Part 4 – Forest Roads and Fire Trails and the RTA's Traffic Control at Worksites.

7.5 Soil and Water

12. Drainage and sediment controls will be implemented during both the construction and operational phases of the ventilation shaft. The controls will be designed and constructed in accordance with Managing Urban Stormwater: Soils and Construction (Landcom 2004).

7.6 Bushfire Risk Management

13. The powerline will consist of an insulated bundled cable which will minimise bushfire risk. Asset protection zones as outlined in Section 6.2.8 will be maintained around the ventilation shaft and powerline.

7.7 Visual

14. Vegetation clearance and lopping will be minimised within the ventilation shaft site and along the powerline corridor to ensure minimal visual impact.

15. All structures will be of a suitable colour that blends with the surrounding landscape where possible.

16. No new access roads will be constructed.

7.8 Rehabilitation and Site Decommissioning

17. The ventilation fan and powerline will be dismantled, the shaft filled and sealed and site rehabilitation works will commence within 12 months of completion of mining of Longwalls 29-31.

18. Baal Bone Colliery will undertake ongoing monitoring and maintenance of the site until it achieves an acceptable level of rehabilitation, as determined in consultation with DPI (Forests NSW) and DPI (Mineral Resources).

7.9 Waste Management

19. No waste will be disposed of on-site (excluding cleared vegetation and collar spoil).

20. All fuels and chemicals will be stored and transported in a manner that does not pose a risk to waterways or contaminating land.

7.10 Reporting

21. Details of the operation of the ventilation shaft, including compliance with this Statement of Commitments and any Conditions of Approval, will be reported annually in the Baal Bone Colliery Annual Environmental Management Report (AEMR).

Baal Bone Colliery operates in accordance with an approved Mining Operations Plan (MOP), the DPI (Mineral Resources) Subsidence Management Plan process, and in accordance with the Colliery's Environmental Management System (EMS). A review of the EMS is currently being undertaken and any additional management requirements arising from this Statement of Commitments will be incorporated into the updated system.

8.0 Conclusion

The existing underground mine is currently ventilated from fans at the main mine adits, however the current system will not be able to provide sufficient quantities of air to facilitate access to remaining coal reserves to the south-east.

The proposed ventilation shaft, fan and associated powerline will facilitate access to the remaining coal reserves in the area and thus extend the life of the Baal Bone Colliery by approximately three years.

Total coal production from the south-eastern reserves is expected to be approximately 5 Mt. The operation will provide continued employment for approximately 170 fulltime workers and there will be flow on economic benefits to the local community and wider region.

A short term workforce of approximately ten will be employed during the construction of the ventilation shaft and powerline, also resulting in a flow on economic benefit to the local community.

The proposed site for the ventilation shaft and route for the powerline corridor has been identified as the most suitable based on geological and geotechnical investigation and environmental assessment. While the site is within a relatively undisturbed landscape, the area has existing forestry and mining infrastructure and this is managed so that the popular recreational activities undertaken in the area can co-exist with industry. The proposed development will continue this practice and will have a minimal cumulative impact due to its short term nature and minor disturbance footprint.

This Environmental Assessment has found that the project can be completed with minimal short term impact on the local environment. The key issues considered within the EA for the proposed project are flora and fauna impacts, impacts on Aboriginal heritage, water quality during and following construction, increased traffic volumes (particularly heavy vehicles) during construction, energy and greenhouse gas emissions during construction and operation of the facility, noise impacts, bushfire risk management, and site rehabilitation. Visual amenity was also raised as an issue during community consultation.

Detailed assessments of Aboriginal heritage, greenhouse gas emissions, and noise concluded that the proposed project would have minimal impact on Aboriginal heritage, and that the construction and operation of the ventilation shaft would contribute an extremely small proportion of greenhouse gases. The operation of the ventilation shaft will not be audible to local residents and the noise associated with the construction phase noise will be within standard guidelines.

The 50 x 50 metre disturbance area required for the construction of the proposed ventilation shaft is very gently sloping. A sedimentation dam and perimeter (catch) bank or drain will be constructed on the downslope boundary of the site. The sedimentation dam will be maintained during the operational phase to maintain stormwater quality and act as a control point. Clean water diversion drains will also be constructed at the upslope boundary of the site to divert clean water away from the site. All drains will be revegetated and maintained throughout the construction and operational phases. Upon decommissioning, all structures will be removed, the shaft will be filled and capped and the area will be recontoured as required. If required, the area will be seeded with a mixture of native seeds from the surrounding area. The power pole locations will be filled in, reseeded and a weed control program implemented.

The increase in traffic along Wolgan Road and the unnamed forestry track will be temporary and periodic. The noise levels associated with construction traffic along Wolgan Road will be well within the DEC's standard criteria. The forestry track will be used and maintained in accordance with the relevant Forests NSW Code of Practice. Additionally, an access protocol will be prepared in consultation with Forests NSW and may include automatic wet weather closures and temporary signage regarding increases in traffic volume and heavy vehicle usage. A construction traffic management plan will also be prepared in consultation with the Lithgow City Council.

The flora and fauna assessment did not locate any threatened flora or fauna species or populations that may be affected by the proposed development. The facilities have been designed to ensure minimal impact on the surrounding vegetation while at the same time ensuring that bushfire risk is minimised. Where vegetation is required to be removed or lopped, habitat trees will be removed appropriately and disturbance to the understorey and groundcover will be minimised.

The proposed aerial bundled cable is insulated and will create minimal bushfire risk. Vegetation will be cleared within a radius of two metres of the power poles, and a within a maximum radius of approximately 1 metre around the cable. The 50 x 50 metre disturbance zone required for the construction of the ventilation shaft will be maintained as an asset protection zone during the operational phase.

The visual impact assessment concluded that the ventilation shaft, fan and powerline would not be visible from surrounding tracks or elevated areas. There will be an impact in the immediate vicinity, although this will generally be screened by the relatively dense vegetation surrounding the area. The ventilation shaft will be able to be glimpsed through the trees along a small section of the adjacent forestry track which forms part of the Bicentennial National Trail. While this temporary impact cannot be avoided, the structures will be of a colour that blends with the surrounding landscape and so minimising the impact on the appearance of the natural landscape.

Overall, the project will have minimal environmental and community impact and provides significant benefits to the local and regional economy by establishing sufficient ventilation for Baal Bone Colliery to safely continue mining operations for a further three years.

9.0 References

Australian Greenhouse Office December 2006 *Factors and Methods Workbook* (AGO Workbook)

Australian Greenhouse Office 2005 *Australian Methodology for the Estimation of Greenhouse Gas Emissions and Sinks*

Baal Bone Colliery 2007 *Longwalls 29-31 Subsidence Management Plan Application*

Connell Wagner 2006. *Baal Bone Colliery Longwalls 29 to 31 SMP Hydrogeological Assessment*. Report to Xstrata Coal.

Department of Environment and Conservation 2005 *Approved Methods for the Modelling and Assessment of Air Pollutants in NSW.*

Department of Environment and Conservation 1999 *Environmental Criteria for Road Traffic Noise*

Department of Primary Industries (Forests NSW) *Forest Practices Code Part 4 – Forest Roads and Fire Trails*

Department of Primary Industries (Forests NSW) *Forests Practices - Miscellaneous*

Energy Australia 2002 *Tree Safety Management Plan*

Gibbons 2003 *Unpublished report to DEC Western Region*

Heggies Pty Ltd 2007a *Baal Bone Colliery Ventilation Shaft Installation and Operation Noise Impact Assessment*. Report to Umwelt (Australia) Pty Ltd on behalf of Baal Bone Colliery.

Heggies Pty Ltd 2007b *Baal Bone Colliery Ventilation Shaft Installation and Operation Air Quality Impact Assessment*. Report to Umwelt (Australia) Pty Ltd on behalf of Baal Bone Colliery.

Industry Safety Steering Committee 3 (ISSC3) 2005 *Guideline for Managing Vegetation Near Power Lines*

King, D.P. 1993 *Soil Landscapes of the Wallerawang 1:100 000 Sheet Report*, Department of Conservation and Land Management, NSW.

Landcom 2004 *Managing Urban Stormwater: Soils and Construction (Blue Book Volume 1)*. New South Wales Government.

New South Wales Rural Fire Service 2006 *Planning for Bushfire Protection*.

OzArk Environmental and Heritage Management Pty Ltd Ecological Assessment

OzArk Environmental and Heritage Management Pty Ltd 2007 *Indigenous Heritage Assessment for Proposed 1.7 KM, 11kV Electricity Easement & Ventilation Fan Compound*. Report to Umwelt (Australia) Pty Ltd on behalf of Baal Bone Colliery.

R.W. Corkery & Co Pty Limited 2005 *Review of Environmental Factors for Exploration Program for Proposed Longwall Panels 29 to 31*. Report to Baal Bone Colliery.

R.W. Corkery & Co Pty Limited 2006 *Addendum to Review of Environmental Factors for Exploration Program for Proposed Longwall Panels 29 to 31.* Report to Baal Bone Colliery.

Sustainable Energy Development Authority and Planning NSW 2002 NSW Energy and Greenhouse Guidelines (EIA Guidelines) for Environmental Impact Assessment (Draft).

Sydney Catchment Authority 2006 *Neutral or Beneficial Effect on Water Quality Assessment Guidelines.*

Sydney Catchment Authority 2006 *Drinking Water Catchments Regional Environmental Plan No. 1* (the REP)

Xstrata Coal NSW (XCN) *Social Involvement Strategy and Plan*

World Business Council for Sustainable Development and World Resources Institute 2004 *Greenhouse Gas Protocol* (GHG Protocol).

APPENDIX 1

EA Form and Project Application Area

Submission of
Environmental Assessment (EA)
under Section 75H of the Environmental Planning and Assessment Act 1979

EA prepared by	
Name:	Barbara Crossley
Qualifications:	B. Nat Res. (Hons)
Address:	Umwelt (Australia) Pty Limited PO Box 838 Toronto NSW 2283
in respect of	Proposed Ventilation Shaft and Powerline Easement, Baal Bone Colliery
Applicant Name Applicant Address	Baal Bone Colliery PO Box 13 LITHGOW NSW 2790
Land to be developed: lot no, DP/MPS, vol/fol etc	Part Ben Bullen and Wolgan State Forest
Proposed Development	Proposed Ventilation Shaft and Powerline Corridor
Environmental assessment	An environmental assessment (EA) is attached
Certification	I certify that I have prepared the contents of this environmental assessment and to the best of my knowledge • it is in accordance with Sections 75E and 75F of the *Environmental Planning and Assessment Act 1979*, and • it is true in all material particulars and does not, by its presentation or omission of information, materially mislead.
Signature: Name: Date:	____________________________ Barbara Crossley Date

Project Team

Umwelt (Australia) Pty Limited – Environmental Assessment Preparation

Barbara Crossley, Director B Nat Res (Hons)	Project Director
Katie Sachs, Environmental Scientist B Sc (Hons)	Project Manager
Travis Peake, Ecology Manager/Associate B Nat Res (Hons)	Ecological information
Tim Crosdale, Environmental Scientist B Nat Res / B Urb Reg Planning (in progress)	Planning information
Rebecca Abbott, Michael Ong	Drafting
Belinda McLeod, Frances Davies	Report editing, formatting and document control

Other Specialist Investigations

Heggies Pty Ltd	Noise, Air Quality and Greenhouse Gas Emission Assessments
OzArk Environmental and Heritage Management Pty Ltd	Aboriginal Heritage and Flora and Fauna Assessments

The Wallerawang Collieries Limited

The assistance of the following personnel during preparation of this EA is gratefully acknowledged. In addition, a number of personnel from The Wallerawang Collieries Limited and Xstrata Coal NSW provided details regarding the project.

Kevin Price	Project Manager
Tony King	Environment and Community Co-ordinator
Sarah Caruana	Environment and Community Graduate
Dave O'Brien	Xstrata Coal NSW - Environment Community Manager

Minter Ellison provided legal advice to Xstrata during the EA preparation process.

APPENDIX 2

Director-General's Requirements

Director-General's Requirements

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

Application number	07_0035
Project	Construction and operation of a ventilation shaft and power supply to the south eastern main headings of the existing long wall mining operation.
Location	Ben Bullen State Forest near Cullen Bullen, 25km northwest of Lithgow
Proponent	Baal Bone Colliery
Date of Issue	10 April 2007
Date of Expiration	10 April 2009
General Requirements	The Environmental Assessment must include • an executive summary; • a detailed description of the project including the: - need for the project; - various components and stages of the project; and - the likely inter-relationship between the proposed works and the existing or approved mining operations at Baal Bone Colliery; • consideration of any relevant statutory provisions; • a general overview of the 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; - an assessment of the potential impacts of the project including potential cumulative impacts (particularly on noise, surface water and groundwater) that may arise from the combined operation of the project, together with the other approved and mining operations in the region; • a description of the measures that would be implemented to avoid, minimise, mitigate, offset, manage and/or monitor the impacts of the project, and how the existing environmental monitoring and management programs/plans at Baal Bone Colliery would be revised to accommodate the proposed changes; • a draft Statement of Commitments, outlining environmental management, mitigation and monitoring measures; • a conclusion justifying the project, taking into consideration the environmental impacts of the project, the suitability of the site, and the benefits of the project; and • a signed statement from the author of the Environmental Assessment certifying that the information contained in the report is neither false nor misleading.
Key Issues	• **Water Quality** - particularly sediment/surface water control during and following construction; • **Flora and Fauna** – including impacts on native vegetation and the requirement for offsetting vegetation to be removed; • **Traffic** – particularly heavy traffic movements during construction; • **Energy and Greenhouse Gases** – a greenhouse gas assessment relating to construction and operation of the project; • **Aboriginal Cultural Heritage;** • **Bushfire Risk Management;** • **Noise**; and • **Rehabilitation of the site.**

References	The Environmental Assessment should take into account relevant State Government technical and policy guidelines. While not exhaustive, guidelines which may be relevant to the project are included in the attached list.
Consultation	During the preparation of the Environmental Assessment, you should consult with the relevant local, State or Commonwealth government authorities, service providers, community groups or affected landowners. The consultation process and the issues raised must be described in the Environmental Assessment. The consultation process and the issues raised must be described in the Environmental Assessment.
Deemed refusal period	30 days

Attachment 1

State Government Technical and Policy Guidelines - For Reference

Aspect	Policy /Methodology
Soil and Water	
	• *Managing Urban Stormwater: Soils & Construction* (Landcom); • *Guidelines for Fresh and Marine Water Quality* (ANZECC); • the various *State Groundwater Policy* documents (DNR); • *Approved Methods for the Sampling and Analysis of Water Pollutants in NSW* (DEC);
Flora and Fauna	
	• draft *Guidelines for Threatened Species Assessment* (DEC); • *Threatened Biodiversity Survey and Assessment: Guidelines for Development and Activities* (DEC);
Noise	
	• *NSW Industrial Noise Policy* (DEC); • *Environmental Noise Control Manual* (DEC);
Greenhouse Gases	
	• *AGO Factors and Methods Workbook* (Australian Greenhouse Office);
Heritage	
	• draft *Guidelines for Aboriginal Cultural Heritage Assessment and Community Consultation* (DEC);
EPBC	
	• *EPBC Act – Environmental Assessment Process – EPBC Act fact sheet,* (Commonwealth DEWR, February 2007).

APPENDIX 3

Assessment for Neutral or Beneficial Effect on Water Quality

Appendix 3 - Assessment for Neutral or Beneficial Effect on Water Quality (NorBE)

Assessment Item	**Response**
1. Name of project	Environmental Assessment – Ventilation Shaft and Powerline Corridor for South Eastern Mining Area, Baal Bone Colliery.
2. Proponent	Baal Bone Colliery (The Wallerawang Collieries Limited)
3. Location of project	Approximately 25 km northwest of Lithgow and 4 km north–northeast of Cullen Bullen in the Lithgow Local Government Area (LGA).
4. Name of Catchment/Subcatchment	Warragamba Catchment/Coxs River Subcatchment.
5. Description of activity	Refer to **Section 3.0** and **Figure 1.3** of this EA document.
6. Are there any identifiable potential impacts on water quality?	There is minor potential for the construction of the proposed ventilation shaft and powerline to affect water quality. Construction will involve minor clearing and earthworks. Raise boring of the ventilation shaft is likely to intersect water bearing strata..
7. Describe the site characteristics	Refer to **Sections 5.4** and **5.5** of this EA document.
8. Identify the likely pollutants of concern during construction/operation	There is very low potential for a minor increase in sediment if soil or dirty water is not contained on-site. There is very low potential for spills and leakages of fuel or oils.
9. Have any of the following been prepared as part of the environmental assessment: Water Cycle Management Study/Stormwater Management Plan/Erosion and Sediment Control Plan/Soil and Water Management Plan?	Erosion and sediment controls will be in place during construction and operation of the ventilation shaft and powerline (refer to **Section 6.2.5.1** of this EA document). Transport of fuel and refuelling of equipment will be done in a manner that prevents the potential for pollution of waters as a result of the escape of fuel. All waste will be stored in such a way that it does not pose a risk to waterways or contaminating land (refer to Sections 6.3.2 and 6.3.3).
10. List the on-ground water quality protection measures (based on SCA endorsed CRPs and Standards)	The erosion and sediment controls are described in **Section 6.2.5.1** and shown on **Figure 3.2**. These controls are consistent with the CRP *Managing Urban Stormwater: Soils and Construction* (Landcom 2004). The storage and handling of fuels will be undertaken in accordance with the relevant Australian Standard (refer to **Section 6.3.2**). All fuel tanks will be self-bunded and transport and refuelling will be done in a manner that prevents the potential for pollution of land or water.

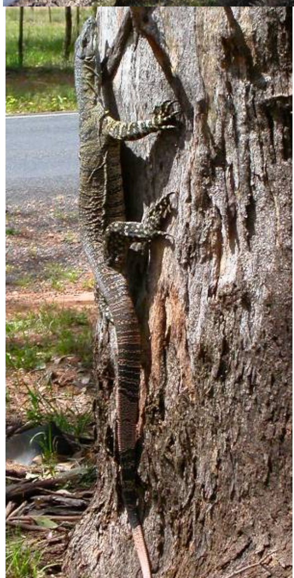
Assessment Item	Response
11. Are water quality protection measures or management practices other than the SCA endorsed CRPs and Standards proposed during construction	The erosion and sediment controls described in **Section 6.2.5.1** are also in accordance with the DPI (Forests NSW) *Forest Practices Code (Part 4 – Forest Roads and Fire Trails).* Any substantial water bearing strata that is intersected will be sealed as part of the ventilation shaft construction process. This will ensure that impacts to groundwater are minor and localised.
12. If so, list these measures or practices along with the performance criteria for each measure	Refer to **Section 6.2.5.1** and **6.2.5.3**..
13. List the on-ground water quality protection measures (based on SCA endorsed CRPs & Standards) proposed post construction and/or during operation along with the performance criteria designed for each measure	All disturbance areas will be rehabilitated once construction is complete (refer to **Section 6.2.5.1 and 6.2.9**). Once the operation phase of the ventilation shaft is complete (expected to be approximately three years), the ventilation fan, associated equipment, and the powerline will be dismantled and removed from the site. The site will be rehabilitated appropriately to ensure no detrimental impacts to water quality (refer to **Sections 3.8** and **6.2.9**).
14. Are water quality protection measures or management practices other than the SCA endorsed CRPs & Standards proposed post construction and/or during operation	See Assessment Item 13.
15. If so, list these measures or practices along with the performance criteria for each measure	Not applicable.
16. Are the water quality protection measures sustainable for the periods for which they are expected to be in place	Yes, the sediment and erosion controls, and controls to prevent fuel leaks will be in place throughout the construction period (refer to **Sections 6.2.5.1 and 6.3.2**). All disturbance areas will be rehabilitated following construction and also following site decommissioning.
17. For each pollutant of concern assess the post-activity condition in relation to the pre-activity condition in terms of load and concentration	The post-activity condition with regard to sediment load will be very similar, if not the same, as the pre-activity condition. The bunding of fuel tanks and other standard controls associated with refuelling and transportation fuels and oils will ensure that pollution of this kind will not occur. Any impacts to groundwater will be very minor and localised.
18. Is it likely that a NorBE on water quality will occur?	Yes. The construction and operation of the proposed ventilation shaft and powerline will have a negligible impact on water quality. Appropriate controls will be in place to ensure that sediment and water from the site will be contained on-site during construction. Appropriate rehabilitation will ensure that water quality will not be impacted during the operation and decommissioning stages.
19. NorBE statement	The NorBE assessment for the proposed ventilation shaft and powerline has concluded that the construction, operation and decommissioning of these

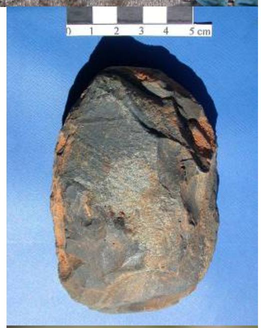
Assessment Item	Response
	facilities will result in a neutral effect on the water quality of the Warragamba and Coxs River Subcatchments.

APPENDIX 4

Flora and Fauna Assessment

Environmental & Heritage Management P/L





FLORA AND FAUNA ASSESSMENT:

PROPOSED 1.7 KM, 11 KV POWERLINE CORRIDOR AND VENTILATION COMPOUND.

Baal Bone Colliery - Ben Bullen State Forest, 4 km northeast of Cullen Bullen, NSW.

May 2007

REPORT PREPARED BY

OZARK ENVIRONMENTAL & HERITAGE MANAGEMENT P/L

FOR

BAAL BONE COLLIERY

OZARK ENVIRONMENTAL & HERITAGE MANAGEMENT P/L – PO Box 2069 / 145 Wingewarra St, Dubbo NSW 2830 Tel: 6882 0118; Fax: 6882 0630; Mob: 0403 763 504 / 0423 198 898;
E-mail: jodie@ozarkehm.com.au / phil@ozarkehm.com.au WEB: www.ozarkehm.com.au

Executive Summary

This study was commissioned by Baal Bone Colliery (operated by The Wallerawang Collieries Limited). It details the results of an ecological assessment of a proposed ventilation shaft and powerline corridor within Ben Bullen State Forest for Baal Bone Colliery. The ventilation shaft will allow for the mining of previously inaccessible coal reserves, continuation of the current annual coal production and extension of the lifespan of the Baal Bone Colliery.

The current survey recorded no threatened plants or animals within the assessed area, although three threatened microbats and two species of threatened birds were identified as having the potential to be affected by clearing associated with the proposed activity. Assessments of significance following State and National guidelines were undertaken and it was determined that populations of these species are unlikely to be impacted and, as such, no further ecological assessment is required.

Detailed recommendations are provided in Section 5 of this report.

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6. REFERENCES 61

FIGURES

TABLES

APPENDICES

1. INTRODUCTION

This report was commissioned by Baal Bone Colliery. It details the results of an ecological assessment within the Ben Bullen State Forest over an area for a proposed powerline corridor and ventilation shaft compound, approximately 4 km northeast of Cullen Bullen, NSW (**Figures 1** to **3**).

This study was originally undertaken to accompany an addendum to a Review of Environmental Factors (RW Corkery and Co 2006) originally completed for exploration work in an adjacent area of the State Forest (RW Corkery and Co 2005). The current version has been edited to incorporate updated design and environmental impact information that has become available during the Part 3A environmental assessment process.

1.1 Project scope

The consultant was briefed to undertake survey and assessment of ecological issues arising from the installation of a ventilation shaft and power supply infrastructure associated with the proposed extension to the Baal Bone Colliery underground mining area under the Ben Bullen State Forest, Cullen Bullen. The works will require clearing or lopping of native vegetation in two areas. An air ventilation shaft will require a 50 x 50 m compound and an 11kV electricity line will require a 1.7 km corridor with minimal vegetation clearance required. For the purposes of the current assessment, the term 'study area' refers only to the surveyed portion of land for this project, i.e. within the boundaries shown on **Figure 3.**

The exact size and extent of native vegetation to be removed by the proposed corridor and air ventilation compound had not been confirmed at the time of survey. Consequently a larger portion of land than is likely to be required was assessed to determine any opportunities or constraints related to ecology that may feed into determination of the final design. The area surveyed was approximately 200 m x 200 m for the ventilation shaft and 1.7 x 50 m for the corridor. The study area was delineated via maps provided to OzArk EHM and in the field by Mr Tony King, the Baal Bone Colliery Environment and Community Manager. This investigation included the following aspects:

- A search of the BioNet and DEC websites that encompasses the NSW DEC Wildlife Atlas for Threatened Flora and Fauna, NSW Fisheries, Australian Museum, NSW Royal Botanic Gardens and Forests NSW databases for the Lithgow Local Government Area (LGA). Threatened species of National significance that could occur in the area were identified from a search of the *Environment Protection and Biodiversity Conservation Act 1999* online data-base (2005);
- A review of current legislation including the *New South Wales National Parks & Wildlife Service Act 1974* (NPW Act 1974), *Threatened Species Conservation Act 1995* (TSC Act 1995), *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act 1999), *Fisheries Management Act 1994* (FM Act 1994), *Native Vegetation Conservation Act 1997* (NV Act 1997) and the *Environmental Planning and Assessment Amendment (Infrastructure and Other Planning Reform) Act 2005* (EP&A Act 2005);
- A review of available relevant literature including previous consulting reports, academic theses and articles and available works on the ecology, flora, fauna, history and ethnography of the Lithgow region. Two primary sources of information undertaken by

previous consultants in the immediate environs of the study area were reviewed. Denny (2005) undertook a flora assessment and Lembit (2005) undertook the flora assessment. Both studies were undertaken by highly experienced ecologists with extensive local knowledge and were focussed on the general environs of the current study area;

- Pedestrian field survey to identify and record all species of flora and fauna within the confines of the study area;
- Assessments of significance of recorded species, communities and habitats including identifying those species with the highest potential to require seven-part tests used to determine the significance of impacts to flora and fauna and the formulation of appropriate management strategies; and,
- Completion of documentary evidence (e.g. updates for the DEC Wildlife Atlas) for any threatened species located during the survey for the notification of the relevant authorities.

1.2 Proposed works

Baal Bone Colliery wishes to extend their underground mining area, in order to continue the current annual coal production. Predicted air flows into the new resource extraction area will be insufficient for the needs of the miners and as such a new air vent will be required. The electricity to power the ventilation fan will be sourced from an existing dewatering borehole circa (c.) 1.7 km to the west and a corridor plus infrastructure will be required to connect the proposed compound to the existing dewatering borehole power supply. The proposed air vent will be drilled from the underground mining area and as such will have less surface impacts than are normally associated with surface drill rigs. Although only 50 x 50 m is required for the compound 200 x 200 m area was assessed. Similarly, 50 m width for the corridor was assessed giving the Proponent flexibility in planning.

1.3 Project constraints and limitations

Survey was limited to the areas identified in **Figure 3**. The prevailing weather was clear and mild, ideal for fauna and flora observation. Rain had occurred within the previous week germinating many native groundcovers. Although many species of plants were in flower at the time of the survey, the cool temperatures limited a number of species ability to flower at the time of the survey, however on average the majority of the regions orchids and threatened species of plants are likely to be in flower at this time of the year. There is potential that other threatened species may not have germinated or been in flower at the time of the survey, however, as discussed below, the recent preparation of accurate species lists makes it unlikely that any species have been missed in the assessment.

Recent and extensive botanical and ecological assessment in the same environs has generated accurate species lists which were utilised to determine the potential affect on those species not observed but having the potential to occur in the locality. NSW State and Commonwealth agency records were reviewed for the Local Government Area to provide any additional information concerning the likelihood of flora and fauna species to occur within the project area.

1.4 Report authorship

This assessment was undertaken and written by Phillip Cameron Bsc, Ass. Dip. App. Sci (OzArk Environmental & Heritage Management P/L). This report was edited by Dr Jodie Benton (OzArk EHM).

2. THE STUDY AREA

The current study area is located entirely within the Ben Bullen State Forest and is managed by the Department of Primary Industries - Forests NSW (DPI-FNSW). The study area is comprised of two separate portions of land. The first, a 4 ha compound (200 x 200 m) has been earmarked for a ventilation facility whilst the second is for a proposed powerline corridor. Although 8.5 ha (1.7 km x 50 m) were assessed for the corridor it is likely that only 0.68 ha (1.7 km x 4 m) will be impacted. The 'study area' for the ecological assessment is detailed in **Figures 2** and **3** and is comprised of approximately 12.5 ha.

The subject land is located wholly within the Greater Lithgow Local Government Area (LGA) and is governed by the Greater Lithgow Local Environmental Plan (LEP) of 1994. The only alteration to the area assessed on **Figure 3** is that the author assessed all land up to the edge of the existing road (where it runs parallel to the proposed powerline) in the event that DPI-FNSW request the powerline to parallel the road in that portion of land.

2.1 Topography, hydrology and climate

According to the DEC website (2006), the study area lies within the South Eastern Highlands Bioregion which covers the dissected ranges and plateau of the Great Dividing Range.

The subject land is comprised primarily of an elevated plateau and a small portion of slope and creek line west of the existing Baal Bone Colliery. The powerline connects with an existing borehole at 960 m Australian Height Datum (AHD) near the creek line and ascends in elevation to 1030 AHD at the top of escarpment, where it remains at the same elevation as the proposed ventilation compound site. Some minor undulations characterise the ridgetop occur however these are minor in nature and do not influence the botanical or ecological composition of the study area.

In terms of hydrology, several ephemeral creek lines are present in the immediate environs of the assessed area, however only one that is near the existing borehole is actually within the assessed area. All local waterways drain south from higher elevations into Ben Bullen Creek which then flows to Jews Creek and eventually into the Turon and Macquarie Rivers. The ephemeral drainage line within the study area is currently dry but shows evidence of carrying water during high flow events.

Cullen Bullen, the nearest residential area (c. 1 km from the mines boundary) has a mild climate with a wet, late summer (average temperature is 16.5^{o} C with a maximum of 35.1^{o}) and cold, dry winters (average temperature 5.1^{o} C with a minimum of -9.4^{o}). Summer is the pronounced wet season, particularly from January to March, often accompanied by high intensity storms. Only intermittent rains are received during winter (Australian Bureau of Meteorology 2006).

2.2 Geology and soils

The South Eastern Highlands Bioregion comprises part of the Lachlan fold belt that runs through the eastern states as a complex series of metamorphosed Ordovician to Devonian sandstones, shales and volcanic rocks intruded by numerous granite bodies and deformed by four episodes of folding, faulting and uplift. The general structural trend in this bioregion is north-south and the topography strongly reflects this.

More specifically, the study area is situated near the edge of the Permo-Triassic Sydney Basin, in an area known as the Western Coalfields. This is comprised of an extensive plateau of erosion resistant Triassic sandstone dissected by steep-sided valleys. There is a remnant surface layer of weathered sandstone and shales of the Narrabeen Group overlying a complex stratigraphic sequence including the Lidsdale and Lithgow Seams, which are both sub-groups of the Illawarra Coal Measures (Appleton 2004: 12).

2.3 Existing levels of disturbance

Treed hills within the assessed area remain relatively undisturbed despite being subject to selective logging, vehicle access tracks, limited mineral exploration and grazing from domestic stock in former eras. Several shallow gullies between the hills and knolls showed signs of erosion due to changes in hydrology and the majority of trees showed evidence of bushfire (within 15 years).

Figure 1: Locality Map **(Source: International Environmental Consultants 2006).**

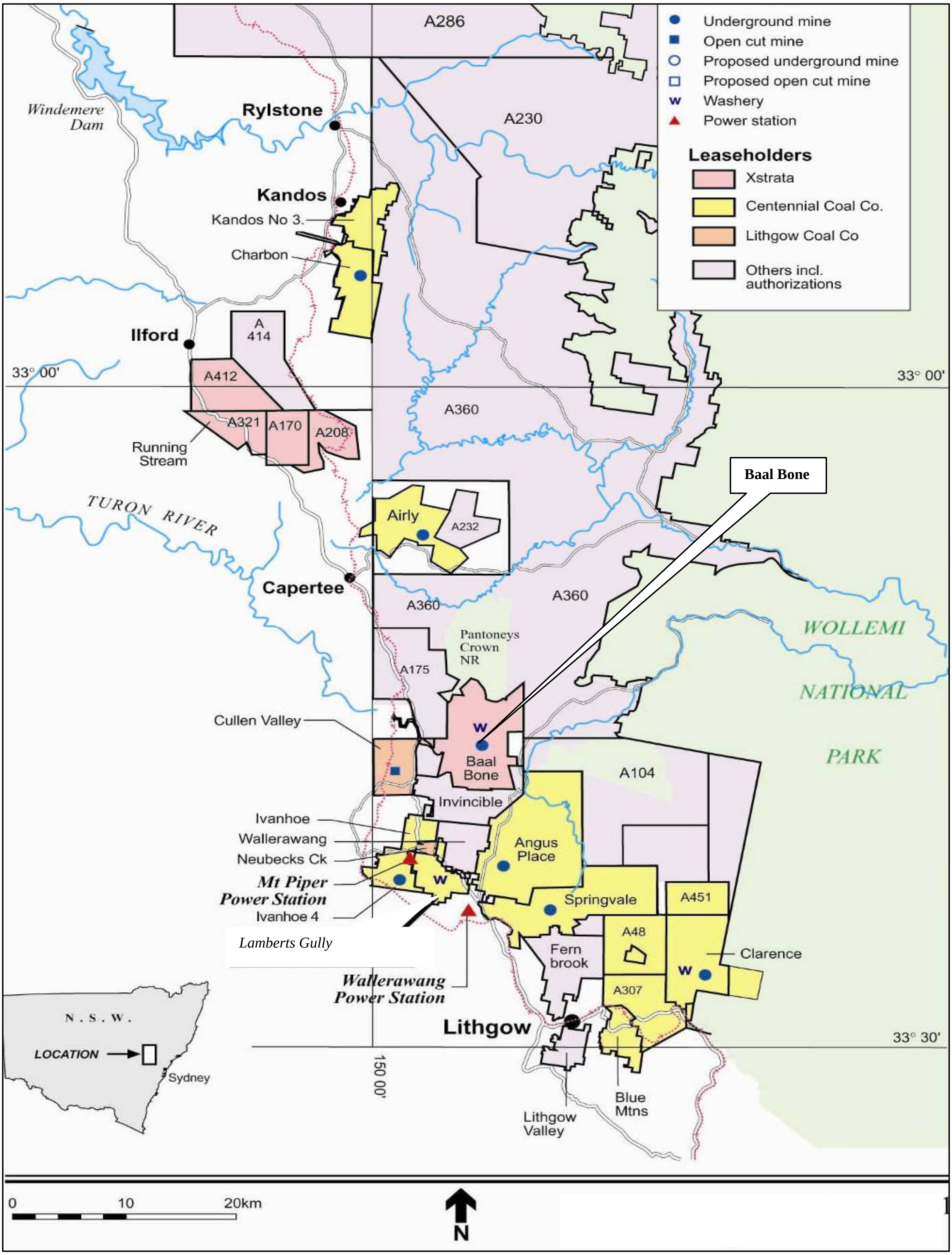


Figure 2: Topographic locality map and hydrology detail of the study area (Source: Cullen Bullen 8931-3-N).

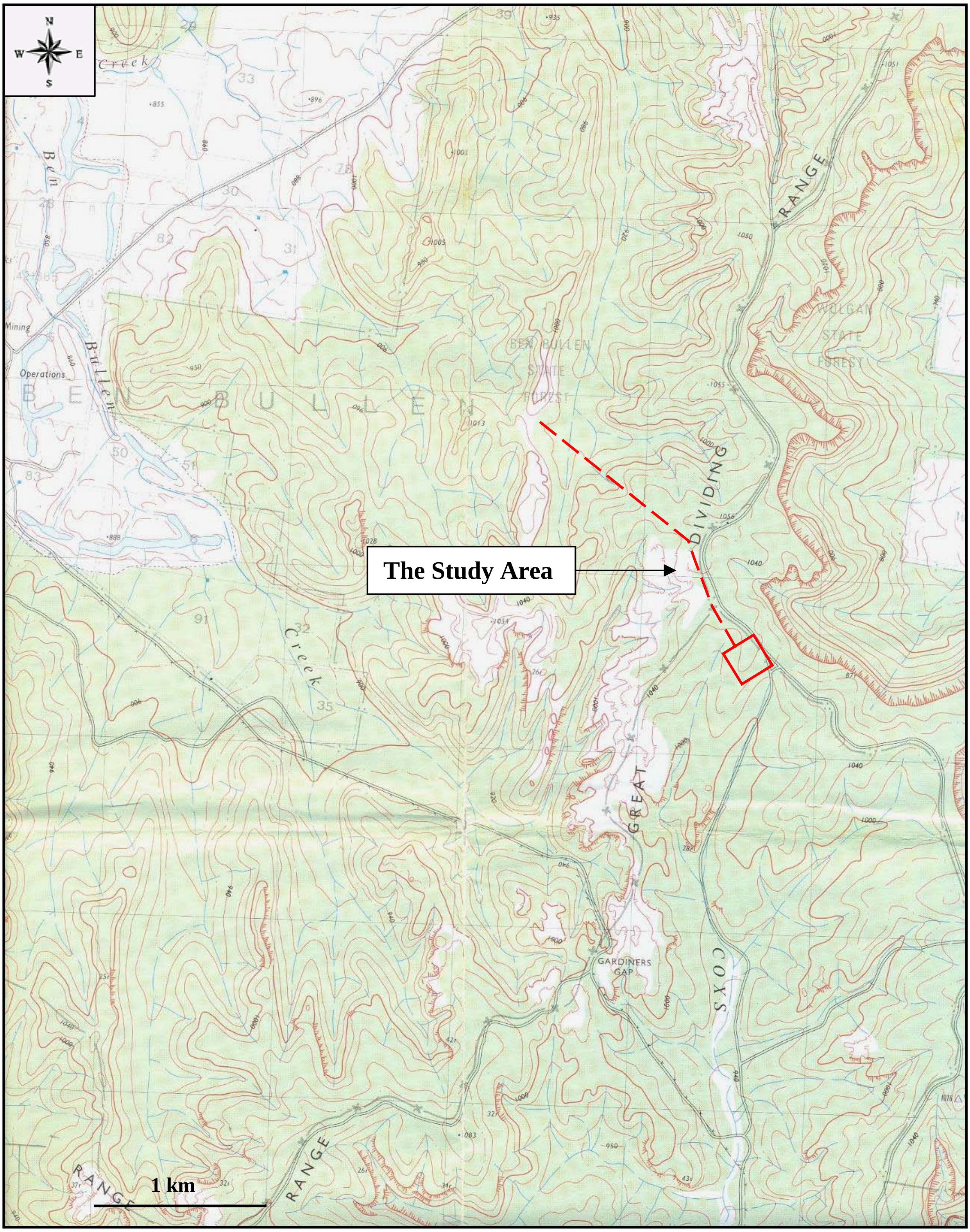
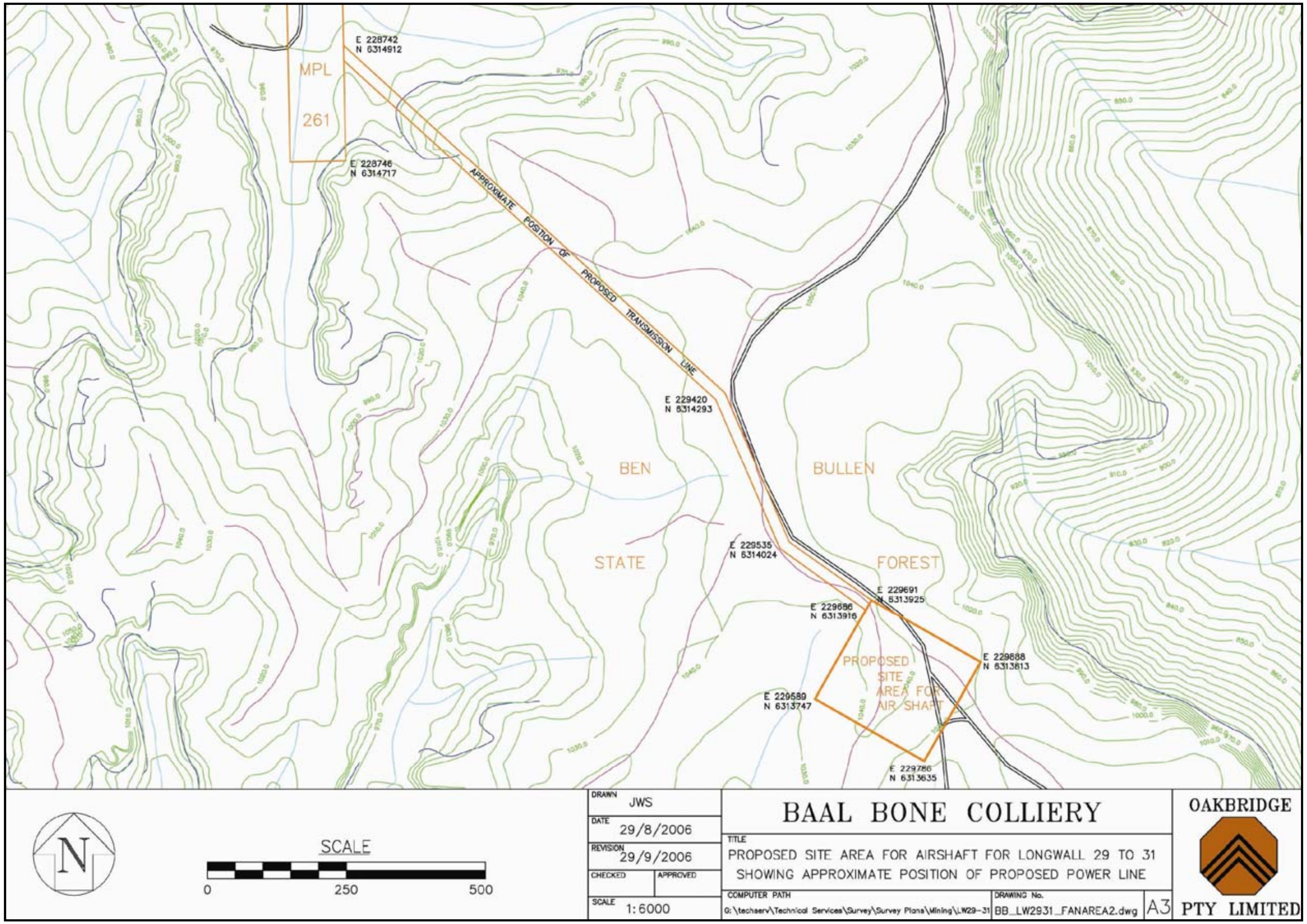


Figure 3: Design detail of the proposed impact footprint (Source: Baal Bone Colliery)



3. FLORA AND FAUNA ASSESSMENT

3.1 Background information collection

Prior to undertaking flora and fauna survey, a desktop review of the DEC threatened species and BioNet websites was undertaken. The BioNet database uses the combined resources of the NSW DEC Wildlife Atlas for Threatened Flora and Fauna, NSW Fisheries, Australian Museum, NSW Royal Botanic Gardens and Forests NSW and a search was undertaken of the Lithgow LGA. The DEC threatened species database was useful to determine species with the potential to occur in the study area that have not been previously recorded in the LGA. Threatened species of national significance that could occur in the area were identified from a search of the Department of Environment and Heritages (DEH) Protected Matters Report via an online database (2006). This information was combined with a review of past studies focused on the region more specifically those undertaken by Gingra (2005) and Mt King Ecology (2005). This process determined the diversity of plant and animal species of conservation significance that have been previously recorded or have the potential to occur within the current study area.

During recent years DEC has been conducting extensive mapping and research within the bioregion aimed at describing and recording many of its' natural assets. Information describing vegetation and significant flora / fauna within the bioregion has been summarised from the detailed DEC document. To source any of the references within the following section, follow the web link:

http://www.nationalparks.nsw.gov.au/npws.nsf/Content/Bioregion+overviews.

3.2 Bioregional overview

A bioregion is a complex land area composed of a cluster of interacting ecosystems that are repeated in similar form throughout, thus having attributes that are common or characteristic. Region descriptions seek to describe the dominant landscape scale attributes of climate, lithology, geology, landform and vegetation (Thackaway & Cresswell 1995). Reviewing a bioregion assists to contextualise the impact of a proposed development in relation to similar local and regional landforms, vegetation etc. and the fauna and flora that occupy it.

The study area is within the South Eastern Highlands Bioregion which covers the dissected ranges and plateau of the Great Dividing Range that are topographically lower than the Australian Alps. It extends to the Great Escarpment in the east and to the western slopes of the inland drainage basins and continues into Victoria. Both soils and vegetation vary across the study area in relation to altitude, temperature and rainfall. According to DEC (2005) diverse vegetation communities occur across the bioregion, with low altitude areas consisting of yellow box (*Eucalyptus melliodora*), red box (*E. polyanthemos*) and Blakely's red gum (*E. blakelyi*), with areas of white box (*E. albens*) on the more elevated portions. Red stringybark (*E. macrorhyncha*), broad-leaved peppermint (*E. dives*) and white gum (*E. rossii*) associations dominate hills in the west of the bioregion. Brown barrel (*E. fastigata*) communities are more common in the east. River oak (*Casuarina cunninghamiana*) is seen along main streams.

Grey gum (*E. punctata*) and Blaxland's stringybark (*E. blaxlandii*) are found on lower areas, and brown barrel, mountain gum (*E. dalrympleana*), narrow-leaved peppermint (*E. radiata*) and ribbon gum (*E. viminalis*) occur within the higher elevations. Small areas of Argyle apple (*E. cinerea*) can be found near Goulburn. Patches of snow gum (*E. pauciflora*) occur in the highest places in cold air pockets. Dwarf casuarina (*C. nana*), tea tree (*Leptospermu. lanigerum*) and *Calytrix tetragona* heath are present on the dry aspects of ranges at the head of the Shoalhaven River.

Within the bioregion high diversity swamps occur with *Carex appressa*, tea tree (*L. myrtifolium*) and sphagnum bogs in the streams. Extensive grasslands are common on the driest plains with characteristic species including snow grass (*Poa sieberiana*), spear grasses (*Stipa scabra* and *Stipa variabilis*), kangaroo grass (*Themeda australis*) and wallaby grass (*Danthonia* sp.).

The vegetation within the current study area is broadly characteristic of the red stringybark (*E. macrorhyncha*), broad-leaved peppermint (*E. dives*) and white gum (*E. rossii*) associations as noted in the west of the bioregion with intrusions of snow gum (*E. pauciflora*) found to occur in the highest places. A detailed vegetation community description and associations can be found in section 8.

The native vegetation within the assessed area has not been greatly altered by European settlement and associated land-use. The majority of land has been left as remnant forest however modified hydrology and fire regimes are evident. Despite it occurring within a state forest, the area does not appear to have been logged, possibly because of the thin skeletal soils not being able to support larger trees.

3.2.1 Significant flora and fauna

Flora species listed in the schedules of the *Threatened Species Conservation Act 1995* in the South Eastern Highlands Bioregion (Lithgow LGA) can be seen in Appendix 3. Of these two species: *Stemmacantha australis* and *Galium australe*, are considered extinct (DEC 2005). Similarly, Appendix 3 highlights bioregional fauna species likely to occur within the Lithgow LGA. There is a noticeable decline in the numbers of the endangered Regent Honeyeater (*Xanthomyza phrygia*) in the bioregion which is illustrative of a general decline in woodland bird species such as robins, treecreepers and many small honeyeaters. These declines have been attributed to fragmentation of the landscape, which in this bioregion tends to occur at the edges of largely intact remnants (DEC 2005).

3.2.2 Significant wetlands

There were no bioregionally significant wetlands recorded in the NSW part of the South Eastern Highlands Bioregion (Australian Terrestrial Biodiversity Assessment 2002). A number of wetlands in the bioregion are regarded as nationally important and listed in the Directory of Important Wetlands in Australia (ANCA 1996) which can be viewed on the DEH website (2006). These wetlands do not occur within proximity to the assessed area.

3.2.3 Bioregional-scale conservation

This section aims to detail the areas of land dedicated for conservation within the region. The ultimate net loss of habitat (and species dependant on it) within the proposed study area can be contextualised against what habitat is protected from development within the same bioregion.

Managed conservation tenures in the South Eastern Highlands Bioregion occupy about 726,530.55 ha or 14.86% and National parks and nature reserves make up an area of 596,638.58 ha or 12.22% of the bioregion and twelve wilderness areas (management under the Wilderness Act 1987) make up 177,381.15 ha or 3.63% of the national parks or nature reserves (Bimberi, Bogong Peaks, Brogo, Budawang, Byadbo, Ettrema, Goobarragandra, Jagungal, Kanangra-Boyd, Pilot, Woila Deua and Yowrie wilderness areas) in the bioregion. Other lands managed under the provisions of the NPW Act 1974 include karst conservation reserves, with 3,740.80 ha or 0.08% of the bioregion.

Hartley and Hill End historic sites occupy 119.04 ha or 0.002% and land managed as state recreation areas total 11,999.08 ha or 0.245% of the bioregion and there are no Aboriginal areas and no regional parks in the bioregion.

In 2001, there were twelve voluntary conservation agreements, which together occupied about 2,889.07 ha or 0.06% of the bioregion. Landholders on 96 properties also held wildlife refuges occupying 68,776.84 ha or 1.41% of the bioregion. Thirteen flora reserves managed under the provisions of the Forestry Act 1916 occupying 4,654.83 ha or 0.10% of the bioregion and contribute towards biodiversity conservation. In addition, State forests managed primarily for forestry activities under the Forestry Act 1916 occupy 357,262.24 ha or 7.31% of the bioregion.

A significant proportion of the bioregion receives supplementary management under the provisions of the Drinking Water Catchments Regional Environmental Plan No. 1. This area is 1,015,258.25 ha or 20.77% of the bioregion.

3.2.4 Regional conservation reserves

In relation to the current study area, the closest National Park or State Conservation Area is the Gardens of Stone and Wollemi NP’s. Several forests managed by DPI-FNSW are located in the immediate area such as the Ben Bullen, Cullen Bullen, Wolgan, Newnes Plateau and Lithgow State Forests. Much of the Lithgow area is dominated by remnant native vegetation.

There are several natural places listed in the Register of the National Estate in the Lithgow LGA:

- Blue Mountains National Park (1980 boundary);
- Coco Creek Geological Site;
- Evans Crown Nature Reserve (1977 boundary);
- Mudgee Overpass Road Cutting;
- Pantoneys Crown Nature Reserve;

- Tayan Pic Geological Site;
- Winburndale Nature Reserve (1977 boundary); and
- Wollemi National Park (1980 boundary).

None of these locations are within the assessed area. The Gardens of Stone National Park, NSW land within the Lower North East NSW Regional Forest Agreement whilst not on the RNE are also important local conservation reserves.

3.3 Flora survey

Survey of the study areas were conducted on the 18^{th} of September 2006 according to the Random Meander Method described by Cropper (1993: 31) with slight modification such that habitat for threatened species was targeted for intensive assessment. Particular care was taken to detect the potential presence of threatened species identified in the LGA during desk top review.

Vegetation was identified and their relationships to community composition, health, and age status were recorded. Habitat value for fauna and flora species and the overall conservation significance and structural or habitat importance of the vegetation present on the bordering land was also assessed.

Plant identification was made according to recent nomenclature in Harden (1990–2004), Cunningham *et al* (1981) and Wheeler, Jacobs and Norton (1984) and vegetation community descriptions were made in accordance with Keith (2004). The national conservation significance of flora was determined by referencing the Schedules associated with the *Threatened Species Conservation Act* 1995 and listings provided within the *Environmental Conservation and Biodiversity Protection Act* 1999. When required the NSW Threatened Species website (DEC 2006) and the Royal Botanic Gardens online herbarium (2006) were consulted.

3.4 Fauna survey

Survey concentrated on the study area and its immediate environs as detailed in **Figure 3**. Climatic conditions experienced during the survey were pleasant, from 15 to 20°C maximum without any breeze. Visibility across the majority of the study area was good **(Plates 1** to **3**). Survey was conducted on foot using the "Random Meander Method" described by Cropper (1993: 31) with slight modification for fauna surveys and using an adapted method of Gibbons (2003) targeted fauna searches. This method entails targeted searches for particular types of animals within a given time frame (i.e. a timed targeted reptile search). The benefits of this are that abundance of particular species can be drawn from different study areas within a similar landform or environment.

Habitat areas were assessed with the likely occurrence of threatened species in mind, particular care was taken to survey potential nesting or roosting sites, vegetative connectivity's, ground debris and any artificial habitats made by man (rubbish piles) or nature (rock piles). Features including potential feed trees, suitable aquatic environments, intact vegetation layers or any other important ecological niche of any species identified as "threatened" within the LGA were assessed.

Identification of species present and their diversity can indicate the habitat present on site. Subsequently, the inverse is true; the habitat value on site should indicate the potential for threatened species to be present or those likely to use the resource. Likely impacts and ramifications of the proposed development can be addressed through this process.

Fauna identification was achieved via:

- Identification of scats, diggings, tracks and other traces;
- Direct observation i.e. bird watching, frog searches;
- Ground, leaf litter and other refuge searches; and
- Call identification;

3.5. Results

3.5.1 The natural environment pre European contact

The study area occurs within the South Eastern Highlands Bioregion (**Figure 1**) and falls within the Greater Lithgow LGA. A broad brush stroke of the bioregion has been described in this report with its relevance to the current study area applied. The study area can be described more accurately by referencing the Wallarawang 1:100 K vegetation map sheet (Benson and Keith 1990).

Native vegetation within the study area is consistent with that recently described by Lembit[1] (2005) whom documented three vegetation sub-units:

1. Tablelands Sheltered Valley Forest

This community is dominated by Mountain Gum (*E. dalrympleana*) and Broad-leaved Peppermint (*E. dives*) and occurs in sheltered gullies with deeper soils. Tree height may exceed 20 m and the associated tree species include Red Stringybark (*E. macrorhyncha*), Apple Box (*E. bridgesiana*) and Narrow-leaved Peppermint (*E. radiata*).

A small tree layer of lower density is usually dominated by *Acacia falciformis*. The shrub layer is of medium density and ground layer of medium density is dominated by grasses and ferns. Common shrub species include Chinese Scrub (*Cassinia arcuata*), *Acacia buxifolia*, and Yellow Tea Tree (*Leptospermum polygalifolium)*. Common ground layer species include Wallaby Grass (*Austrodanthonia racemosa*), Snow Grass (*Poa sieberiana* ssp. *sieberiana*), Bracken Fern (*Pteridium esculentum*), *Viola betonicifolia*, Weeping Meadow Grass (*Microlaena stipoides*), *Lomandra filiformis* var. *coriacea*, *Senecio* sp. E, *Geranium solanderi* and *Veronica plebeia*.

Tablelands Sheltered Valley Forest falls within the Tablelands Grassy Woodland Complex of Benson & Keith (1990). According to Lembit (2005) examples of this community occur in the Gardens of Stone National Park.

[1] Roger Lembit is the principal of ‘Gingra Ecological Services’.

2. Sandstone Dry Ridgetop Woodland

This community is dominated by Inland Scribbly Gum (*Eucalyptus rossii*) and Narrow-leaved Stringybark (*E. sparsifolia*) and occurs on hills of Narrabeen Sandstone geology. It is found along the western fringes of the sandstone country of the Blue Mountains with extensive areas in Wollemi National Park. The community also occurs within Gardens of Stone National Park.

Other tree species may be locally frequent such as Silvertop Ash (*E. sieberi*), Blaxland's Stringybark (*E. blaxlandii*) and Sydney Peppermint (*E. pipertia*). The understorey includes a medium density shrub layer and a low density ground layer. Exposed, rocky areas support open heath vegetation, however these areas are relatively small in extent.

Common shrub species include prickly Moses wattle *(Acacia ulicifolia), Dillwynia phylicoides*, *Persoonia linearis*, Sunshine Wattle (*Acacia terminalis*), *Leucopogon muticus*, *Phyllanthus hirtellus* and *Monotoca scoparia*.

Ground layer species include Purple Flag Iris (*Patersonia longifolia*), Redanther Wallaby Grass (*Joycea pallida*), native parsnip *Platysace lanceolata*, Wiry Panic (*Entolasia stricta*), *Lomandra confertifolia* var. *rubiginosa* and Rock Fern (*Cheilanthes sieberi*).

3. Tablelands Dry Woodland

Broad-leaved Peppermint (*E. dives*), Red Stringybark (*E. macrorhyncha*), Inland Scribbly Gum (*E. rossii*) and Brittle Gum (*E. mannifera*) dominated this community.

Tablelands Dry Woodland occurs in areas underlain by Permian Illawarra Group geology with on more exposed aspects and drier, shallower soils than areas which support Tablelands Sheltered Valley Forest. Associated tree species may include Long-leaved Box (*E. goniocalyx*) and Silvertop Ash (*E. sieberi*).

The shrub layer is generally of low density, with medium density patches on sheltered slopes. The ground layer is grassy and of low to medium density.

Shrub species present include Silver Wattle (*Acacia dealbata*), *Persoonia linearis*, *Pultenaea microphylla*, *Hibbertia obtusifolia*, Mountain Holly (*Podolobium ilicifolium*), *Brachyloma daphnoides*, *Monotoca scoparia* and *Acacia buxifolia*.

Ground layer species include Wallaby Grass (*Austrodanthonia racemosa*), Redanther Wallaby Grass (*Joycea pallida*), Rock Fern (*Cheilanthes sieberi*), Blue-leaved Snow Grass (*Poa sieberiana* ssp. *cyanophylla*), *Goodenia hederacea*, *Gonocarpus tetragynus*, *Dianella revoluta* and Bluebell (*Wahlenbergia gracilis*).

Tablelands Dry Woodland falls within the Tablelands Grassy Woodland Complex of Benson & Keith 1990. Examples of this community occur in Gardens of Stone National Park, Winburndale Nature Reserve and Blue Mountains National Park.

This is the most widespread community in the general vicinity.

3.5.2 Observed flora in the study area

Proposed compound

Remnant vegetation within this area is consistent with that described in the Wallerawang 1:100 K map sheet for Sandstone Dry Ridgetop Woodland (see 3.5.1). Silvertop Ash (*E. sieberi*) and Blaxland's Stringybark (*E. blaxlandii*) is locally frequent (**Figure 4**).

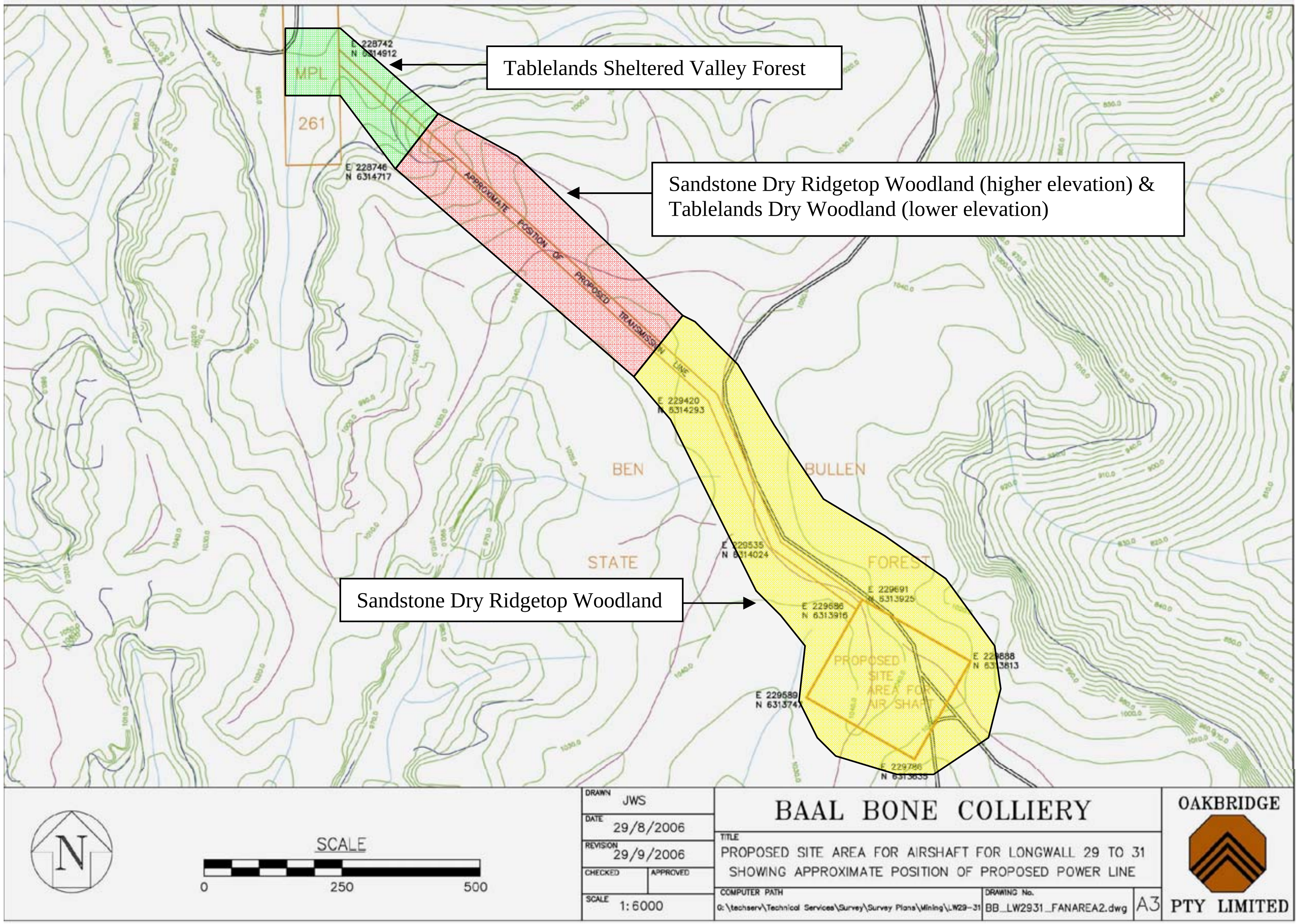
Common understorey species additional to those noted in section 3.5.1 include: *Acacia obtusifolia,* heath-leaved banksia (*Banksia ericifolia*), *Calytrix tetragona, Phyllota phylicoides,* native parsnip (*Platysace lanceolata*), *Boronia microphylla, Isopogon dawsonii, Allocasuarina distyla,* broad-leaved hakea (*Hakea dactyloides*) and *Leptospermum sphaerocarpum*

Additional ground cover species include *Lomandra multiflora, L. glauca, Dianella revoluta, Lepyrodia scariosa* and the grasses *Austrostipa pubescens,* silvertop wallaby grass (*Chionocholoa pallida*) and tussock (*Poa labillardieri*).

Proposed powerline corridor

Sandstone Dry Ridgetop Woodland continues north for approximately 500 m where the ground begins to slope towards the drainage feature. From (GDA) 229420 E / 6314293 N, (on the hill slope) the vegetation becomes interchangeable with Tablelands Dry Woodland as noted in section 3.5.1 above. As one moves westward (down slope) the physical attributes of Tablelands Dry Woodland become more prevalent until roughly 300 m east of the existing dewatering bore where Tablelands Sheltered Valley Forest occupies the bed and banks of the dominant drainage feature (**Figure 4**).

Figure 4: Vegetation communities within the assessed area (Source: Baal Bone Colliery).



3.5.3 Landscape description including flora and fauna key elements

Trees in the study area are 20 m in height when mature and have canopies that touch – slightly separated, which is consistent with the technical description of a tall open forest. The understory is comprised of plants that are generally less than 1 to 2 m in height at maturity and are separated (tall open shrubland) with an isolated to sparse grass layer that is less than 0.5 m height at maturity and ranging in foliage cover from 10 – 30%.

The useful available key habitats associated with this site are:

- Ephemeral waterways / drainage lines (niche habitat for plants requiring higher moisture);
- Tree hollows for small mammals such as microbats (c. 5 % of tress with suitable stags per ha);
- Tree hollows and stags for squirrel gliders (c. 3 – 5 % of trees suitable of those assessed in the study area);
- Isolated rocky outcrop / escarpment/ rock shelf (reptile habitat);
- Tree canopy cover with mistletoe and winter flowering species (avian and small mammal feeding sites);
- Dead and down timber and logs (terrestrial species habitat c. 5 % of ground cover per ha);
- Leaf litter (c. 70 % per ha);
- Decorating bark (reptile, insect and bat habitat); and
- Patches of shrub canopy (avian feeding and nesting sites).

Impacts associated with the proposed development on each of these identified key habitat elements will be discussed further (see Impacts section 3).

3.6 Threatened flora and fauna species and plant communities of conservation concern for the Lithgow LGA.

A threatened species is an animal or plant that is at risk of extinction if the threats to their survival continue to operate. The legal status assigned to the various plants and animals are characterised by either E – Endangered, V – Vulnerable or U – unprotected. Some minor variations occur i.e. P 13 (threatened plants having a degree of conditional protection) or species (birds) listed by the Commonwealth that are migratory and protected under international agreements (JAMBA or CAMBA). In NSW these categories are related to the *Threatened Species Conservation Act (1995)* and nationally they are related to the *Environment Protection and Biodiversity Conservation Act (1999)*. Endangered species have a greater risk of extinction than vulnerable species and any designated legal status has the potential to change from time to time as individual species or ecological communities move on and off the list.

According to the NSW BioNet database there are 26 threatened or endangered species of plants and 39 threatened or endangered species of animals recorded within the LGA (total of 65 Appendix 3). The DEH (National) lists 30 endangered or threatened species of plants and 21 threatened or endangered species of animals (total of 51, Appendix 3).

More specifically in relation to flora, of those species detailed in Table 1, Roger Lembit (Gingra Ecological Services) who has extensive experience in the region makes comment re: species recorded locally (5 km from the study area) that the habitat is sub-optional for Capertee Stringybark (aka Cannons stringybark *Eucalyptus cannonii*) and notes that the two isolated records of Clandulla Geebung (*Persoonia marginata*) and *Protanthera densa* on the NPWS database represent dubious records based upon known distribution and habitat preferences.

The current field survey did not locate any individual or populations of threatened flora species known or having the potential to occur within the Lithgow LGA.

In relation to fauna, of those species recorded or having the potential to occur within the Lithgow LGA (Table 3), Dr. Martin Denny (Principal of Mt. King Ecology) recorded the following threatened species in the Baal Bone Colliery study area:

- Gang-gang Cockatoo (*Callocephalon fimbriatum*); and
- Squirrel Glider (*Petaurus norfolcensis*).

Mt King Ecology (2005) undertook exhaustive fauna assessment in the immediate environs. This assessment included spotlighting, call playback, frog recording, reptile searches, mammal trapping bird watching and track / scat and hair identification and analysis undertaken over eight nights and ten days.

The current assessment did not record any threatened species of fauna and it was noted that habitat for threatened microbats was the most likely to be affected by the proposal. In respect to the occurrence of protected microbats no threatened microbats were recoded during the Mt King Ecology assessment.

3.6.1 Critically endangered, endangered and threatened ecological communities

There are nine endangered ecological communities (as described in the final determination of the Scientific Committee) within the Hawkesbury / Nepean > Wollemi Catchment Management Area (CMA) listed under Schedule 1 Part 3 of the *Threatened Species Conservation Act 1999.* These are the:

- Blue Mountains Shale Cap Forest in the Sydney Basin Bioregion;
- White Box Yellow Box Blakely's Red Gum Woodland;
- Montane Peatlands and Swamps of the New England Tableland, NSW North Coast, Sydney Basin, South East Corner, South Eastern Highlands and Australian Alps;
- Newnes Plateau Shrub Swamp in the Sydney Basin Bioregion;
- River-Flat Eucalypt Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions;
- Shale/Sandstone Transition Forest;
- Sun Valley Cabbage Gum Forest in the Sydney Basin Bioregion;
- Swamp oak floodplain forest of the NSW North Coast, Sydney Basin and South East Corner bioregions; and
- Sydney Turpentine-Ironbark Forest.

None of these endangered ecological ecosystems were recorded within the study area.

The Commonwealth Environment Protection Biodiversity Conservation Act 1999 lists two Threatened Ecological Community as occurring within the Lithgow LGA:

- White Box, Yellow Box, Blakely’s Red Gum grassy woodland and derived native grasslands; and
- Temperate Highland Peat Swamps on Sandstone.

These ecological communities were not recorded within the study area.

Table 1: Threatened flora species recorded within the Lithgow LGA.

Species	Cons'n status (ROTAP[2])	Growth form / habitat requirements	Likelihood to occur on site
Bynoe's wattle *Acacia bynoeana*	V (EPBC) V (TSC)	Decumbent shrub to 0.5 metres high. Grows mainly in heath and dry sclerophyll forest in sandy soils, south of Dora Creek-Morisset area to Berrima and Illawarra region, west to the Blue Mountains. It flowers mainly in summer (Harden 2002).	Low. This species was not recorded in the study area. <u>No further assessment is required</u>
Acacia flocktoniae Flockton Wattle	V (TSC) V (EPBC) ROTAP 2VC-	**Description** Flockton Wattle can be an erect or somewhat pendulous shrub 2 - 4 m tall, with somewhat winged branchlets. The wattle 'leaves' (phyllodes) are straight, between 5 - 10 cm long and 2 - 5 mm wide. Sprays of 5 - 10 golden-yellow globular flower-heads appear between June and August. **Distribution** The Flockton Wattle is found only in the Southern Blue Mountains (at Mt Victoria, Megalong Valley and Yerranderie). **Habitat and ecology** • Grows in dry sclerophyll forest on sandstone. (DEC threatened species website 2005)	Low. Not within known distribution area. This species was not observed during the assessment. <u>No further assessment is required</u>.
Deane's boronia *Boronia deanei*	V (TSC)	An erect shrub growing to 1.5 metres high. White to bright pink flowers are present from September – November. This species is found in wet heath, in a range from Lithgow to Nalbaugh NP (Weston & Duretto 2002).	Low. This species has the potential to occur within wet heath vegetation, however this does not occur within the assessed area. <u>No further assessment is required.</u>
Pultenaea sp. Genowlan Point –	E (TSC) CE (EPBC) No ROTAP code	**Description** A small shrub to 0.5 m with yellow and red pea flowers. Not yet formally described, and is considered part of the *Pultenaea glabra* species complex, which is the subject of ongoing research. Differs from *P. glabra* in: its smaller height; deep red keel petal vs. yellow to orange keel petal; and flowers growing on into a leafy shoot vs. flowers terminated in a dormant bud. **Distribution** Known from a single population at Genowlan Point in the Capertee Valley within the Rylstone Local Government Area. The population is restricted to a very small area of only 250 square metres on Crown Land. **Habitat and ecology**	Low. Not within known distribution area. This species was not observed during the assessment. <u>No further assessment is required.</u>

[2] Key to ROTAP codes can be seen on the page following this table.

Species	Cons'n status (ROTAP[2])	Growth form / habitat requirements	Likelihood to occur on site
		• Occurs on well drained stony soil near a cliff edge. • Likely to be fire sensitive, with recruitment occurring from a persistent soil stored seed bank following fire. (DEC threatened species website 2005)	
Pultenaea glabra smooth bush-pea	V (EPBC) V (TSC) ROTAP: 3VCa	**Description** An erect shrub to 1.5 m tall with smooth hairless stems and leaves. Leaves are alternate, narrow, concave, to 20mm x 2mm, with a pointed tip. The yellow/orange pea-like flowers are borne in dense subterminal or apparently terminal inflorescences. Fruit is a swollen pod to 5 mm long. The *Pultenaea glabra* species complex is the subject of ongoing research. Location and habitat **Distribution** Restricted to the higher Blue Mountains and has been recorded from the Katoomba-Hazelbrook and Mount Victoria areas, with unconfirmed sightings in the Mount Wilson and Mount Irvine areas. All known populations occur within the Blue Mountains Local Government Area. **Habitat and ecology** Grows in swamp margins, hillslopes, gullies and creekbanks and occurs within dry sclerophyll forest and tall damp heath on sandstone. Flowers September to November, fruit matures October to December. Fire sensitive, with adults killed by fire and recruitment occurring from a persistent soil stored seed bank. Seed germination will not occur in the absence of fire as the hard-coated seed requires heat to break seed dormancy, as is typical of species within Fabaceae. (DEC threatened species website 2005)	Low. Not within known distribution area. This species was not observed during the assessment. No further assessment is required.
Thesium australe Austral Toadflax	V (TSC) V (EPBC) ROTAP: 3VCi+	**Description** Austral Toadflax is a small, straggling herb to 40 cm tall. Leaves are pale green to yellow-green, somewhat succulent, 1 - 4 cm long and 0.5 - 1.5 mm wide. Flowers are minute and white, emerging where the leaves meet the stems and appearing in spring. The fruit is small and nut-like, developing in summer. This species is often hidden amongst grasses and herbs. Location and habitat **Distribution** Austral Toad-flax is found in very small populations scattered across eastern NSW, along the coast, and from the Northern to Southern Tablelands. It is also found in Tasmania and Queensland and in eastern Asia. **Habitat and ecology** Occurs in grassland or grassy woodland. Often found in damp sites in association with Kangaroo Grass (Themeda australis). A root parasite that takes water and some nutrient from other plants, especially Kangaroo Grass. (DEC threatened species website 2005).	Low. Wrong habitat present on site. This species was not observed during the assessment. No further assessment is required.
Derwentia blakelyi	V (TSC) ROTAP: 2K	**Description** A small hairless and bluish shrub to 50 cm high, with one to several erect, softly woody stems arising from a narrow rootstock; stems are mostly unbranched below the flower sprays, and die back after fruiting. The roundish leaves are usually V-shaped in cross section, and are mostly 2.5 - 5.5 cm long, 10 - 20 mm wide, with a point at the tip. Sprays of the small bright blue - violet flowers are 8 - 40 cm long and produced in summer.	Low. This species is often associated with steep hills within escarpments facing the morning sun adjoining

Species	Cons'n status (ROTAP[2])	Growth form / habitat requirements	Likelihood to occur on site
		The genus was renamed to *Parahebe* in 1994 however, this name change has not yet been recognised in the listing. **Distribution** Restricted to the western Blue Mountains, near Clarence, near Mt Horrible, on Nullo Mountain and in the Coricudgy Range. Occurs at fewer than 20 locations, none of which is in a conservation reserve. **Habitat and ecology** • Occurs in eucalypt forest, often in moist areas. • Known locations all have small population sizes. • Flowers in summer. (DEC threatened species website 2005).	drainage features with a reliable supply of water. Although potential exists for this species to occur it was not observed within the assessed area and deemed unlikely to occur. Note the author has recorded several populations of this species in the Lithgow area. <u>No further assessment is required.</u>
Cynanchum elegans White-flowered Wax Plant	E (TSC) E (EPBC) ROTAP: 3ECi	**Description** A climber or twiner with a highly variable form. Mature stems have a fissured corky bark and can grow to 10 metres long and 3.5 cm thick. The leaves are paired (or rarely in threes), ovate to broadly ovate in shape, 1.5 to 10.5 cm long, and 1.5 to 7.5 cm wide. The flowers are white, tubular, and up to 4 mm long and 12 mm wide. The fruit is a dry pointed pod to 8 cm long, which contains up to 45 seeds with long silky hairs attached to one end. **Distribution** Restricted to eastern NSW where it is distributed from Brunswick Heads on the north coast to Gerroa in the Illawarra region. The species has been recorded as far west as Merriwa in the upper Hunter River valley. **Habitat and ecology** • The White-flowered Wax Plant usually occurs on the edge of dry rainforest vegetation. Other associated vegetation types include littoral rainforest; Coastal Tea-tree *Leptospermum laevigatum* – Coastal Banksia *Banksia integrifolia* subsp. *integrifolia* coastal scrub; Forest Red Gum *Eucalyptus tereticornis* aligned open forest and woodland; Spotted Gum *Eucalyptus maculata* aligned open forest and woodland; and Bracelet Honeymyrtle *Melaleuca armillaris* scrub to open scrub. • Flowering occurs between August and May, with a peak in November. Flower abundance on individual plants varies from sparse to prolific. • The fruit can take up to six months to mature. • Seed production is variable and unreliable. Seeds are wind dispersed. It is considered to be unlikely that a soil seed bank for this species exists. • Plants are capable of suckering from rootstock in response to occasional slashing or grazing. The fire response of the species is unknown. (DEC threatened species website 2005)	Low. Wrong habitat present on site. This species was not observed during the assessment. <u>No further assessment is required.</u>
Pomaderris brunnea	V (TSC) V (EPBC)	**Description** Brown Pomaderris is a shrub to 3 m tall that has distinctively hairy stems. The stem-hairs are comprised of long brownish	Low. Not within known distribution and habitat

Species	Cons'n status (ROTAP[2])	Growth form / habitat requirements	Likelihood to occur on site
Brown Pomaderris	ROTAP: 2VC-	hairs above a thick white hairy under-coat. The leaves are to 4 cm long and 1.5 cm wide and have toothed margins. The upper leaf surface is hairless; the lower surface is densely hairy like the stem. The leaf veins extend to the margins. The small flowers have no petals, are yellowish and form dense clusters at the ends of the branches. Location and habitat **Distribution** Brown Pomaderris is found in a very limited area around the Nepean and Hawkesbury Rivers, including the Bargo area. It also occurs at Walcha on the New England tablelands and in far eastern Gippsland in Victoria. **Habitat and ecology** • Brown Pomaderris grows in moist woodland or forest on clay and alluvial soils of flood plains and creek lines. • Flowers appear in September and October. (DEC threatened species website 2005).	areas. This species was not observed during the assessment. No further assessment is required.
Leionema sympetalum Rylstone Bell Also formerly known as *Phebalium sympetalum*	V (TSC) V (EPBC) ROTAP: 2VC-	**Description** A shrub (formerly known as *Phebalium sympetalum*) 2 - 3 metres high, with angled stems which have star-shaped hairs. Leaves are 1.5 - 3.5 cm long and 4 - 8 mm wide. Tubular flowers occur in groups of 1 to 3 at the ends of branches and are greenish yellow in colour. Stamens are longer than petals. The fruit has erect lobes (cocci) about 4 mm in length. Location and habitat **Distribution** Restricted to a small area within Wollemi National Park, east of Rylstone on the Central Tablelands. Has only ever been recorded at four sites. All known sites are in the Rylstone Local Government Area. May also occur at previously unrecorded locations. **Habitat and ecology** • Restricted to exposed rocky sandstone formations known as pagodas. The species occurs in dry sclerophyll forest and probably also occurs in open or closed heathland communities. • The flowering period is recorded as winter to spring. The flower has a greenish yellow corolla that may be attractive to particular insect pollinators. • The fruit are in segments, known as cocci, which shatter when dry releasing seed. This seed generally lies dormant in the soil until fire or disturbance promotes germination. • Response of adults to fire is unknown. The sites that support the species are rocky and a fire would normally burn in a patchy manner through the habitat. (DEC threatened species website 2005).	No suitable habitat available on site. No further assessment is required.
Philotheca ericifolia	V (TSC) V (EPBC) ROTAP: 3RC-	**Description** Much-branched and wide spreading shrub, 1-2 m high, with sparsely warty branchlets. Leaves needle-like, 4-8 mm long and about 0.5 mm wide, sparsely warty and narrow-grooved above. Flowers 1-6 in stalkless clusters, petals about 9 mm long, possibly pink, glandular warty. Fruit composed of 5 small fruitlets, each about 5 mm long and abruptly narrowed into a beak. **Distribution** Known only from the upper Hunter Valley and Pilliga to Peak Hill districts of NSW. The records are scattered over a range of over 400 km between West Wyalong and the Pilliga Scrub. Site localities include Pilliga East SF, Goonoo SF, Hervey	Not observed during the assessment. Dubious suitable habitat available on site. No further assessment is required.

Species	Cons'n status (ROTAP[2])	Growth form / habitat requirements	Likelihood to occur on site
		Range, Wingen Maid NR, Toongi, Denman, Rylestone district and Kandos Weir. **Habitat and ecology** • Grows chiefly in dry sclerophyll forest and heath on damp sandy flats and gullies. It has been collected from a variety of habitats including heath, open woodland, dry sandy creek beds, and rocky ridge and cliff tops. • Associated species include *Melaleuca uncinata, Eucalyptus crebra, E. rossii, E. punctata, Corymbia trachyphloia, Acacia triptera, A. burrowii, Beyeria viscosa, Philotheca australis, Leucopogon muticus* and *Calytrix tetragona*. • Flowering time is in the spring. Fruits are produced from November to December. • Noted as being a "moisture-loving plant", with plants common on the sides of a particular spur of the Hervey Ranges where soakage from the high background provides sufficient moisture for the plants. • Also recorded growing in a recently burnt site (wildfire) and within a regeneration zone resulting from clearing. • Populations comprise from 3-12 adult plants to approx. 200 plants (mostly seedlings in one population). Also described as uncommon, scattered, common, locally occasional and locally frequent. Populations in Pilliga SF consist of hundreds or thousands of individuals. A very large population occurs in Lincoln SF near Gilgandra. (DEC threatened species website 2005).	
Persoonia acerosa	V (TSC) V (EPBC)	Erect to spreading shrub, with prominently channelled leaves. This species typically occurs in heath or dry sclerophyll forest on sandstone. The range extends from the central Blue Mountains south to Hill Top (Weston 2002).	This species was not recorded in the study area. <u>No further assessment is required.</u>
Persoonia hindii	E (TSC) ROTAP: 2V	**Description** A yellow flowered, multi-stemmed suckering shrub 0.3 - 1.0 m high, with shoots rising from extensive rhizomes (underground stems). Young stems are moderately hairy and dull red in colour. The succulent leaves are alternate, linear-oblong, to 2.7 cm long and 2.0 mm wide. Flower buds are yellow-green, with red base, prominently 4-angled. Fruit is an oval, fleshy drupe, dull green turning yellow, about 15 mm long. **Distribution** Restricted to the Newnes Plateau in the Blue Mountains, north of Lithgow. Was only discovered in 1989 and all known locations occur within Newnes State Forest. **Habitat and ecology** Occurs in dry sclerophyll forests and woodlands on sandy soils. Stoloniferous (has underground horizontal stems) and is thought to be clonal. Hence, each location may comprise only one to a few individuals. Flowers January to March, possibly with sporadic flowering in other months. (DEC threatened species website 2005).	Low. Restricted to the Newnes Plateau: Very distinctive in the field. This species was not observed during the floral survey. <u>No further assessment is required</u>.
Persoonia marginata Clandulla Geebung	V (TSC) V (EPBC) ROTAP: 2V	**Description** A spreading shrub that grows to 50 cm high and up to 1 m across. Young branches are hairy. Leaves are elliptic to obovate, 2 – 4 cm long and 6 – 23 mm wide, sparsely hairy when young and hairless when mature. Flowers are yellow with brownish hairs; have a densely hairy ovary; and occur on short stalks 2 – 7 mm long. **Distribution**	Low. Not within known distribution. This species was not observed during the floral survey. <u>No further assessment is</u>

Species	Cons'n status (ROTAP[2])	Growth form / habitat requirements	Likelihood to occur on site
		Known from only four disjunct locations on the Central Tablelands and Central Coast. Core of the species distribution is within Clandulla State Forest, west of Kandons. Disjunct populations occur; to the north at Dingo Creek and Mount Dangar within the Wollemi and Goulburn River National Parks; to the south within Ben Bullen State Forest, south-east of Capertee; and to the south-east at Devils Hole, north of Colo Heights within Parr State Recreation Area. **Habitat and ecology** • Grows in dry sclerophyll forest and woodland communities on sandstone. • Recorded flowering period varies and includes December and Winter. • Fruit is probably dispersed by large birds such as Currawongs and large mammals such as kangaroos and possums. • Fire response of adult plants varies with the species sometimes resprouting after fire and at other times killed by fire. • Has a persistent soil stored seed bank. • Appears to respond well to disturbance, with greater densities found along the edges of tracks and in areas disturbed by forestry activities. (DEC threatened species website 2005).	required.
Grevillea obtusiflora	E (TSC) No ROTAP code	**Description** Two subspecies are included under this taxon. Subspecies obtusiflora is a low, multi-stemmed shrub to half a metre tall, with narrow leaves and pink to pinkish red flowers. Subspecies fecunda is a low, dense shrub to one metre tall with narrow leaves, and profuse pale to deep pink to crimson flowers. **Distribution** Subspecies *obtusiflora* occurs near Rylstone, while subspecies fecunda occurs in the Capertee Valley, north-west of Lithgow, and in the Gardens of Stone National Park. Occurrences of both subspecies are within the Central Tablelands botanical subdivision. **Habitat and ecology** • Species growing in association with subspecies fecunda include Eucalyptus tenella, E. fibrosa, E. macrorhyncha, E. punctata, Callitris endlicheri, Acacia buxifolia, Leptospermum continentale, Monotoca elliptica, Persoonia linearis, Indigofera sp. and Pomax umbellata. • Subspecies obtusiflora occurs as scattered groups in the understorey of low open eucalypt forest at an altitude of 730 metres above sea level. • Subspecies fecunda occurs in clusters within low, open scrub beneath open, dry sclerophyll forest, on orange, sandy loam soils with sandstone boulders, at an altitude of 570 metres. • Species growing in association with subspecies obtusiflora include Eucalyptus crebra, E. dealbata, E. tenella, Callistemon linearis, Acacia buxifolia, Acacia elongata, Leucopogon sp., Caustis flexuosa, Dianella sp. and Patersonia sp. • Subspecies obtusiflora flowers sparsely in winter and spring with flowering peaking in October. Fruits, seeds and seedlings have not been recorded, indicating that it may be wholly dependent on root suckering for reproduction. The flower shape indicates it is mainly pollinated by birds, with bees being potential secondary pollinators. Subpopulation structure and isolation may affect pollination within and between sub-populations to cause lack of	Low. Known distribution is northwest of the study area and the altitude is too low according to the recorded ecology of the species. This species was not observed during the floral survey. No further assessment is required.

Species	Cons'n status (ROTAP[2])	Growth form / habitat requirements	Likelihood to occur on site
		fruit set. Other causes of failure to produce seed may be genetically influenced. • Subspecies fecunda flowers abundantly in spring and sets copious amounts of fruits. Due to the flower shape, subspecies fecunda is mainly pollinated by birds, with bees being potential secondary pollinators. Seed is most likely dispersed directly below the plant and is distributed by wind, water and ants. Seedlings have been recorded soon after seed is shed. • The high degree of clonality of subspecies obtusiflora makes it difficult to identify and count individual plants. The subpopulation sizes vary from a few isolated plants to several hundred plants covering up to 20 square metres. • Subpopulations of subspecies fecunda appear to be located in 'clusters'. No information on growth rate and longevity is available. It appears to respond favourably to mechanical soil disturbance and is known to quickly recolonise roadside scrapes. (DEC threatened species website 2005).	
Grevillea evansiana	V (TSC) V (EPBC) ROTAP: 2VC	**Description** A dense spreading shrub, rarely more than 0.5 m high, but can grow to 1.5 m, with white hairy stems. The leaves are grey-green, entire, to 40 mm x 8 mm, glossy green above, silver-grey underneath and with a small pointed tip. Flowers are dark red (and rarely white) and occur in round clusters. The fruit is a hairless and smooth follicle. Location and habitat **Distribution** Restricted to a small area east of Rylstone on the Central Tablelands. Known populations occur on the western side of Wollemi National Park and nearby private lands, within the Rylstone Local Government Area. **Habitat and ecology** • Grows in dry sclerophyll forest or woodland, occasionally in swampy heath, in sandy soils, usually over Hawkesbury sandstone. • Flowers August to December, with peak flowering in September. • Likely to be a fire sensitive obligate seeder with recruitment occurring from a soil stored seed bank following fire. Seedling recruitment can also occur in the absence of fire, but is promoted by physical disturbance or canopy gaps. (DEC threatened species website 2005)	Low. This species is very distinctive in the field and was not observed during the floral survey. <u>No further assessment is required.</u>
Prostanthera stricta	V (TSC) E (EPBC) ROTAP: 2V	**Description** An erect, bushy, aromatic shrub growing to 1-2m. Small (7-14 mm by 4-6 mm) leaves are lance-like with the upper surface covered by hairs. The leaf stalk is very short (approx. 0.5 mm). Flowers are pale mauve to deep purple, rarely white, 6-9 mm long, occurring in pairs on the ends of branches. Location and habitat **Distribution** Highly restricted, known only from Mt. Vincent and Genowlan Mountain in the Central Tablelands. **Habitat and ecology** • P. stricta occurs in the transition zone between fertile basalt caps and infertile sandstones. • This area is often characterised by steep rocky sideslopes, cliff lines, sandstone platforms or gentle slopes with	Low. The area is far from the known distribution of the species. No suitable habitat is available on site for the species. This species was not observed during the floral survey. <u>No further assessment is required.</u>

Species	Cons'n status (ROTAP[2])	Growth form / habitat requirements	Likelihood to occur on site
		exposed sandstone outcrops. Vegetation ranges from Tall Forest to Open Forest to Woodlands. • Often a dominant undershrub at Mount Vincent, in heath/scrub communities along cliff edges and sandstone outcroppings, downslope of Tall Open-Open Forest consisting of combinations of Eucalyptus blaxlandii, E. viminalis, E. sparsifolia, E. cannonii and E. punctata. • Forms extensive colonies at Genowlan Mountain in Open-forest/Woodlands of Eucalyptus sparsifolia, E. cannonii, E. polyanthemos, E. rossii and E. mannifera. Also extends into heath/scrub and Open-forest/heath communities in this locality. • Flowering usually occurs in winter and spring and pollination is likely to be by insects. • The species is likely to be killed by fire, with recruitment from the soil seed bank. (DEC Threatened species web page 2005)	
Prostanthera cryptandroides Wollemi Mint-bush	V (TSC) V (EPBC) No ROTAP code	**Description** A low-spreading shrub with a distinctive, pleasant aroma commonly growing 0.5 - 1 m tall and up to 1 m wide. The branches are moderately dense and are often black or obscured due to sooty mould. Leaves are light green, 5 - 9 mm long, 1 - 3 mm wide, and strongly aromatic. Flowers are lilac to mauve and occur from September to May. **Distribution** Occurs in restricted areas but over a fairly broad range from the Lithgow and Sandy Hollow Districts into the Border Rivers/Gwydir Catchment and up into Queensland. Occurs in the Wollemi National Park and is likely to also occur within the Goulburn River National Park. **Habitat and ecology** • At Glen Davis, occurs in open forest dominated by Eucalyptus fibrosa. Other eucalypt species may be present as sub-dominants. • In the Denman-Gungal and Widden-Baerami Valley areas, occurs on rocky ridgelines on Narrabeen Group Sandstones in association with a range of communities. • Associated communities include: Narrabeen Rocky Heath, Narrabeen Acacia Woodland, Narrabeen Exposed Woodland; Open Heath of Calytrix tetragona, Leptospermum parviflorum, Isopogon dawsonii; and Open Scrubland of Eucalyptus dwyeri, Baeckea densifolia, Dillwynia floribunda, Aotus ericoides and Hemigenia cunefolia. • It is thought that individuals have a lifespan of more than 15 years. • Flowers from September to May; however is likely to flower sporadically at any time of the year depending on seasonal conditions. • Flowers posses pollination guides, suggesting it is insect-pollinated. • The species is fire-sensitive, with recruitment occurring from the soil seed bank. • Reproductive maturity is likely to occur at three to five years; does not appear to reproduce vegetatively. (DEC Threatened species web page 2005)	Low. Distributions and preferred communities are not within the assessed area. This species was not observed during the floral survey. <u>No further assessment is required.</u>
Baeckea kandos	E (TSC) E (EPBC) ROTAP: 2RC-t	**Description** A shrub to 2 m high. Leaves are solitary at each node, and are linear to linear - lance-shaped, with smooth margins. The white flowers are up to 5 mm across.	Low. Only known from one population <u>No further assessment is</u>

Species	Cons'n status (ROTAP[2])	Growth form / habitat requirements	Likelihood to occur on site
		Distribution Occurs in the Kandos area, NSW. **Habitat and ecology** • Known from one population within Wollemi National Park. (DEC threatened species website 2005).	required
Eucalyptus cannonii Cannons Stringybark	E (TSC) E (EPBC) ROTAP: 2VCi	**Description** Usually occurs as a tree 10 – 15 m high with persistent, stringy bark. Leaves are lance-shaped, 9 – 15 cm long and 1. 5– 2.5 cm wide. Buds and bud stems are angular, and fruits are generally greater than 10 mm diameter, often with a distinct rim around the middle. Location and habitat **Distribution** Restricted to the western side of the Blue Mountains from Mount Piper in the south to the Mudgee area in the north. There are also populations to the west in Winburndale Nature Reserve and adjacent state forests. Occurs in several local government areas including Greater Lithgow City, Rylstone and Bathurst City. Occurs at more than 55 different locations. **Habitat and ecology** • Can be distinguished from E. macrorhyncha, a closely related species that may grow in similar habitat, by the angular buds and usually larger fruit with a medial rim and shorter pedicels. Hybrids between the two species are common in some places where they co-exist. Hybrids may be distinguished in the field on the basis of fruit diameter, lack of prominence of the medial rim and reduced angularity of buds. • Recorded from Tablelands Grassy Woodland Complex communities and Talus Slope Woodland, and in Winburndale Nature Reserve within woodland dominated by Red Stringybark (E. macrorhyncha) and Long-leaved Box (E. goniocalyx). • Occurs on a wide variety of geological types and soil substrates across a wide altitudinal range. Although also found in a variety of topographic locations, it is commonly found on footslopes. • Commonly found in ecotonal areas such as the boundaries of Tablelands Grassy Woodland Complex communities and Talus Slope Woodland vegetation. • Produces white flowers from January to April. The seed is spread by wind or gravity, generally in close proximity (within 30 m) to the parent plant. • Produces presumed hybrids with the closely related species E. macrorhyncha. In some populations the density of hybrid trees may reach 30%. • Mature trees survive hot fires, resprouting from epicormic buds. Frequent fires may kill seedlings and weaken mature trees. (DEC threatened species website 2005).	Possible but not recorded during the assessment. No further assessment is required.
silver-leaved mountain gum *Eucalyptus pulverulenta*	V (EPBC) V (TSC)	Small tree or mallee, growing to 10 metres. The smooth coppery/grey bark shreds in long ribbons (Brooker and Klinig 1999). This species occurs in the central and southern tablelands, from Bathurst to Bombala. *Eucalyptus pulverulenta* typically grows in the understorey of grassy woodland on relatively poor soil (Hill 2002).	This species was not recorded in the study area. No further assessment is required
Wollemia nobilis	E (TSC)	**Description**	Low, outside of known

Species	Cons'n status (ROTAP[2])	Growth form / habitat requirements	Likelihood to occur on site
Wollemi Pine	E (EPBC) No ROTAP code	A tree that grows up to 40 m tall, often multi-stemmed at the base. The crown is slender and column like. The bark is thin and fragile and in older trees becomes densely covered with soft and spongy nodules. Branches are arranged in successive whorls from the main stem. The side branches terminate in a male or female cone. Location and habitat **Distribution** Restricted to remote canyons in the Wollemi National Park, north-west of Sydney. **Habitat and ecology** • Little is known about the ecology of this recently-discovered species; ecological research is currently ongoing. • Occurs in warm temperate rainforest and rain forest margins in remote sandstone canyons. • Seed is persistent in the canopy and most probably matures in autumn. • Seeds are light and winged and most probably dispersed by wind. (DEC threatened species website 2005).	distribution, habitat is not suitable. This species was not observed during the floral assessment. <u>No further assessment is required.</u>
thick-lip spider orchid *Caladenia tessellata*	E (TSC) V (EPBC)	Terrestrial herb which grows on clay loam or sandy soils, south from Swansea. It flowers from September to November.	This species was not recorded in the study area. The area was assessed during the flowering period for this species. <u>No further assessment is required</u>
Cryptostylis hunteriana Leafless Tongue Orchid	V (TSC) V (EPBC) ROTAP: 3VC-	**Description** As its name implies, the Leafless Tongue Orchid has no leaf. It produces an upright flower-stem to 45 cm tall, bearing five to 10 flowers between November and February. It has small narrow green sepals and petals to 22 mm long, but is dominated by an erect narrow very hairy 'tongue' (the labellum). This is up to 33 mm long, maroon along the margins and at the widened tip, and with a black central band. All other tongue orchids have leaves; most have a downward pointing labellum. **Distribution** The Leafless Tongue Orchid has been recorded from as far north as Gibraltar Range National Park south into Victoria around the coast as far as Orbost. It is known historically from a number of localities on the NSW south coast and has been observed in recent years at many sites between Batemans Bay and Nowra (although it is uncommon at all sites). Also recorded at Nelson Bay, Wyee, Washpool National Park, Nowendoc State Forest, Ku-Ring-Gai Chase National Park, Ben Boyd National Park. **Habitat and ecology** • Does not appear to have well defined habitat preferences and is known from a range of communities, including swamp-heath and woodland. • The larger populations typically occur in woodland dominated by Scribbly Gum (*Eucalyptus sclerophylla*), Silvertop Ash (*E. sieberi*), Red Bloodwood (*Corymbia gummifera*) and Black Sheoak (*Allocasuarina littoralis*); appears to prefer open areas in the understorey of this community and is often found in association with the Large Tongue Orchid (*C. subulata*) and the Tartan Tongue Orchid (*C. erecta*).	Low. The study area does not provide suitable habitat. It is also outside of its known distribution. This species was not observed during the floral assessment. <u>No further assessment is required.</u>

Species	Cons'n status (ROTAP[2])	Growth form / habitat requirements	Likelihood to occur on site
		• Little is known about the ecology of the species; being leafless it is expected to have limited photosynthetic capability and probably depends upon a fungal associate to meet its nutritional requirements from either living or dead organic material. • In addition to reproducing from seed, it is also capable of vegetative reproduction and thus forms colonies which can become more or less permanent at a site.	
buttercup doubletail *Diuris aequalis*	E (TSC) V (EPBC)	This terrestrial herb grows among grass in sclerophyll forest, mainly in the ranges and tablelands, chiefly from Braidwood to Kanangra and Liverpool. Flowers in October through to December (Harden 1993).	This species was not recorded in the study area. No further assessment is required

V = vulnerable
E = endangered
EPBC = *Environment Protection and Biodiversity Conservation Act* 1999.
TSC = *Threatened Species Conservation Act 1995*
ROTAP – Rare or threatened Australian plant code (see following page)

Key to the Rare or Threatened Australian Plants (ROTAP) codes:

Example: *Rarus planticus* 3ECi+

3 Distribution Category for the species or taxon (can be 1,2 or 3).

1 = Known from one collection only.
2 = Geographic range <100 kilometres.
3 = Geographic range >100 kilometres.

E The Conservation Code (can be X, E, V, R, or K).

X = **Presumed Extinct.** The taxon has not been collected or otherwise verified over the past 50 years despite thorough searching, or all known wild populations have been destroyed more recently.

E = **Endangered.** The taxon is in serious risk of disappearing from the wild within 10-20 years if present landuse and other threats continue.

V = **Vulnerable.** The taxon is not presently endangered but is at risk of disappearing from the wild over a longer period (20-50 years) through continued depletion, or occurs on land whose future use is likely to change and threaten its survival.

R = **Rare.** A taxon which, while rare in Australia and hence usually the world is not currently threatened by ant identifiable factor.

K = **Poorly Known.** The taxon is suspected but not definitely known to belong to one of the above categories.

C = **Reserved.** The taxon has at least one population within a national park or other proclaimed conservation reserve.

i+ Size of Reserved Population (can be a, i, + or -)

a = indicates that 1,000 plants or more are known to occur within a conservation reserve(s).

i = indicates that less than 1,000 plants are known to occur within a conservation reserve(s).

+ = indicates that although recorded from within a reserve the population size is unknown.

- = indicates that the taxon also has a natural distribution outside Australia.

3.7 Threatened fauna species in the Lithgow Local Government Area and Populations of Conservation Concern.

According to the DEH and DEC online databases there are 28 species of bird, 9 species of mammals, 1 frog, 4 reptiles and one insect all listed as threatened and have been recorded or have the potential to occur within the study area. Ten species of birds with protection under international agreements are also recorded within the LGA. Five species of threatened fish are also recorded within the LGA however as no aquatic environments suitable for these species are located within the study area it is not necessary to provide further details. **Table 2** details key habit requirements for these species and whether full assessment under Section 5A of the EP&A Act 1979 or EPBC Act 1999 is required.

Table 2: Profile of threatened species identified within the Lithgow LGA (Source: DEC, BioNet and DEH online databases 2006)

Species	Status	Habitat Requirements (Source DEC: threatened species website)	Potential to Occur
Brown treecreeper *Climacteris picumnus*	V (TSC)	Found in the drier open forests and woodlands of eastern Australia. Stays in the same area all year round. **Habitat and ecology** It climbs up the trunks and branches of trees in search of food probing into cavities and under loose bark with its long downward curving bill searching for insects and their larvae. The most favoured insects are ants. Some feeding also takes place on the ground on fallen logs. Feeding normally takes place in pairs or small groups. The species breeds from June to January each year. The nest is a collection of grasses, feathers and other soft material, placed in a suitable tree hollow or similar site.	**Moderate.** This species has been recorded within 10 km of the current study area. This species has the potential to use the resources in the immediate environs Although unlikely to be affected by the proposal **further assessment has been provided**.
Gang-gang Cockatoo *Callocephalon fimbriatum*	V (TSC)	**Distribution** The Gang-gang Cockatoo is distributed from southern Victoria through south- and central-eastern New South Wales. In New South Wales, the Gang-gang Cockatoo is distributed from the south-east coast to the Hunter region, and inland to the Central Tablelands and south-west slopes. It occurs regularly in the Australian Capital Territory. It is rare at the extremities of its range, with isolated records known from as far north as Coffs Harbour and as far west as Mudgee. **Habitat and ecology** In summer, generally found in tall mountain forests and woodlands, particularly in heavily timbered and mature wet sclerophyll forests. In winter, may occur at lower altitudes in drier more open eucalypt forests and woodlands, and often found in urban areas. May also occur in sub-alpine Snow Gum *Eucalyptus pauciflora* woodland and occasionally in temperate rainforests. Move to lower altitudes in winter, preferring more open eucalypt forests and woodlands, particularly in box-ironbark assemblages, or in dry forest in coastal areas. Favours old growth attributes for nesting and roosting.	Previously recorded by Denny (2005) in the immediate locality. Although unlikely to be affected by the proposal **further assessment has been provided**.
swift parrot *Lathamus discolor*	E (EPBC) E (TSC) * #	Inhabits forests, woodlands, plantations, banksias and also street trees, parks and gardens. Breeds only in Tasmania in tree hollows six metres to twenty metres high. Most individuals migrate in March through to June to south eastern Australia and west to the Mt Lofty Ranges in South Australia. The species returns to Tasmania in August to October.	No winter flowering *Eucalyptus* spp. are present within the sites. As such, no suitable foraging resources for this migratory species are present. The swift parrot is not expected to occur, therefore further assessment is not required.

Species	Status	Habitat Requirements (Source DEC: threatened species website)	Potential to Occur
Australian painted snipe *Rostratula australis*	V (EPBC) E (TSC) * #	Inhabits well-vegetated shallows and margins of wetlands, dams, sewerage ponds and wet pastures; also marshy areas, irrigation systems, lignum, tea-tree scrub and open timber.	No significant impact will occur and no further assessment is required.
regent honeyeater *Xanthomyza phrygia*	E (EPBC) E (TSC) * #	Temperate eucalypt woodlands and open forests including forest edges. Associations of red ironbark, white box, yellow box, yellow gum and red box appear essential. Swamp mahogany and river oak may be used locally.	The *Eucalyptus* spp. Favoured by this species does not occur within the sites, therefore further assessment is not required.
glossy black cockatoo *Calyptorhynchus lathami*	V (TSC) *	The glossy black-cockatoo has a sparse distribution along the east coast of Australia and adjacent inland areas from western Victoria to Rockhampton in Queensland (NSW NPWS 1999). In New South Wales, this species has been recorded as far inland as Cobar and Griffith. Habitat for this species includes forests on low-nutrient soils, specifically those containing key *Allocasuarina* feed species (NSW NPWS 1999). This species can be highly selective in its choice of food trees, choosing casuarinas that produce seeds with a high nutrient value. A pair may visit a number of feed trees, before settling to harvest all mature cones within reach. They will also eat seeds from eucalypts, angophoras, acacias, cypress pine and hakeas, as well as eating insect larvae. Breeding occurs in autumn and winter, with large hollows required (NSW NPWS 1999).	No habitat is present for this species due to a lack of preferred habitat attributes (ie Allocasuarina species) , therefore further assessment is not required.
powerful owl *Ninox strenua*	V (TSC) *	The powerful owl occupies an extensive home range of up to 1000 hectares, generally within 200 kilometres of the coast in southeastern Australia. Habitat preferences include mountain forests; gullies and forest margins; sparser hilly woodlands; coastal forests, woodlands, scrubs; exotic pine plantations; and large trees in private/public gardens. The species breeds between June and September, nesting in a hollow trunk or limb 8 metres to 20 metres or more high in a tree.	Potential hunting habitat is present a, however roosting habitat is absent, therefore further assessment is not required.
barking owl *Ninox connivens*	V (TSC Act 1995) *	The barking owl is distributed sparsely throughout temperate and semi-arid areas of mainland Australia, however is most abundant in the tropical north (Kavanagh 2002a). Most records for this species occur west of the Great Dividing Range (Kavanagh 2004). Habitat for this species includes dry forests and woodlands (Kavanagh 2002a), often in association with hydrological features such as rivers and swamps (Taylor *et al.* 2002). Large hollows are required for breeding.	Hunting resources for this species are present within the site however the scale of the impact will not cause any affect to the species. Further assessment is not required.

Species	Status	Habitat Requirements (Source DEC: threatened species website)	Potential to Occur
masked owl *Tyto novaehollandiae*	V (TSC Act 1995) *	The masked owl occurs sparsely throughout the continent and nearby islands, including Tasmania and New Guinea (Kavanagh 2002a). This species is generally recorded from open forest habitat with sparse mid-storey but patches of dense, low ground cover. It is also recorded from ecotones between wet and dry eucalypt forest, along minor drainage lines and near boundaries between forest and cleared land (Kavanagh 2004). Masked owls nest (and roost) in large hollows of old trees and they also roost among dense foliage in variety of sub-canopy trees (Kavanagh 2004).	The masked owl has not previously been recorded within the local area, and is not considered likely to occur in the sites due to an absence of preferred habitat attributes. No further assessment for this species is required.
giant burrowing frog *Heleioporus australiacus*	V (EPBC) V (TSC) * #	A large frog to 90 mm restricted to Hawkesbury Sandstone (Robinson 1993). The range of this species extends from South East NSW to Victoria (NPWS 2001a). Prefers woodland and heath in sandstone ridgetop habitat and broader upland valleys. In particular it is found in small headwater creek lines and slow flowing/intermittent creek lines (NPWS 2001a). This species has a generalist diet, primarily feeding on invertebrates (NPWS 2001a).	The giant burrowing frog has not previously been recorded within the local area, and is not considered likely to occur in the sites as this species prefers upper catchment habitats on Hawkesbury sandstone . No further assessment for this species is required.
Littlejohn's tree frog *Litoria littlejohni*	V (EPBC) V (TSC) * #	Littlejohn's treefrog is generally a tree foraging species, however it is sometimes also found foraging on the ground. This species may shelter from heat under rocks on high ridges in summer. It prefers wet forest margins for breeding. This species occurs along the eastern slopes of the Great Dividing Range from Watagan State Forest near Wyong, south to Buchan in north-eastern Victoria. It has not been recorded in coastal habitats (NPWS 2000).	The wet forest margins required for this species to breed are not present within the study area. The impacts are of a scale will not to affect the life cycle of the species and as such additional assessment is not required.
stuttering frog *Mixophyes balbus*	V (EPBC)	A large stout frog that occurs in rainforest in the mountains of NSW, south-eastern Queensland and Victoria.	Due to a lack of rainforest attributes, no habitat is present for this species. Additional assessment is not required.
red-crowned toadlet *Pseudophryne australis*	V (TSC) *	The red-crowned toadlet has a restricted distribution, known from a relatively small area of mid-eastern NSW. It is known from isolated portions of the Sydney Basin, from Pokolbin State Forest, in the north to the Nowra district in the south, and Mt Victoria in the west. Known only from Triassic Sandstones of the Sydney Basin, red-crowned toadlets are found in steep escarpment areas and plateaus as well as low undulating ranges with benched outcroppings.	The red-crowned toadlet has not previously been recorded within the local area, and is not considered likely to be affected by the impact due to its very small scale. No further assessment for this species is required.
large-eared pied bat *Chalinolobus dwyeri*	V (EPBC) V (TSC) * #	This species typically roosts in caves, mine tunnels and the abandoned, bottle-shaped mud nests of fairy martins. It is found in a variety of drier habitats, including the dry sclerophyll forests to the east and west of the Great Dividing Range.	This species is not considered likely to be affected by the impact as it does not utilise tree hollows. Further assessment is not required.

Species	Status	Habitat Requirements (Source DEC: threatened species website)	Potential to Occur
eastern bent-wing bat *Miniopterus schreibersii oceanensis*	V (TSC) *	Wet and dry sclerophyll forests and rainforests. This species generally hunts above the forest canopy and roosts in caves, mine tunnels and buildings.	This species is not considered likely to be affected by the impact due to its very small scale however there is potential that individuals may be affected by vegetation clearing **further assessment has been provided**.
eastern long-eared bat *Nyctophilus timoriensis*	V (TSC) V (EPBC) * #	The eastern long-eared bat occurs across, Australia, south of the Tropic of Capricorn. Typically occurs in woodland and mallee across the arid and semi-arid regions (Strahan 1998). **Habitat and ecology** Inhabits a variety of vegetation types, including mallee, bulloke *Allocasuarina leuhmanni* and box eucalypt dominated communities, but it is distinctly more common in box/ironbark/cypress-pine vegetation that occurs in a north-south belt along the western slopes and plains of NSW and southern Queensland. Roosts in tree hollows, crevices, and under loose bark. Slow flying agile bat, utilising the understorey to hunt non-flying prey - especially caterpillars and beetles - and will even hunt on the ground. Mating takes place in autumn with one or two young born in late spring to early summer.	This species is not considered likely to be affected by the impact due to its very small scale however there is potential that individuals may be affected by vegetation clearing **further assessment has been provided**.
eastern false pipistrelle *Falsistrellus tasmaniensis*	V (TSC) *	The eastern false pipistrelle has a range from south eastern Queensland, south through New South Wales and Victoria, and into Tasmania (Churchill 1998). Habitat for this species includes sclerophyll forest from the Great Dividing Range running east to the coast, however it is thought to be more common at cool elevations (Phillips 2002). Eastern false pipistrelles appear to prefer wet habitats, with trees generally over 20 metres high (Churchill 1998). Pipistrelles generally roost in tree hollows or trunks, in groups of 6 – 36, and they are occasionally recorded from caves and buildings (Churchill 1998). This species appears to hibernate over winter in southern parts of its range (Phillips 1995). A single young is born in December (Churchill 1998). The eastern false pipistrelle feeds on various species of invertebrates (Churchill 1998).	This species is not considered likely to be affected by the impact due to its very small scale however there is potential that individuals may be affected by vegetation clearing **further assessment has been provided**.
grey-headed flying fox *Pteropus*	V (EPBC) V (TSC)	Roost sites (camps) are commonly formed in gullies, typically not far from water and usually in vegetation with a dense canopy cover. The species feeds on a wide variety of flowering and fruiting plants, including blossoms of	This species is not considered likely to be affected by the impact due to its very small scale. <u>No further assessment for this species is required.</u>

Species	Status	Habitat Requirements (Source DEC: threatened species website)	Potential to Occur
poliocephalus	* #	eucalypts, banksias, figs and palms.	
spotted-tailed quoll *Dasyurus maculatus maculatus*	E (EPBC) V (TSC) * #	This species is recorded from a wide range of habitats, including rainforest, open forest, woodland, coastal heathland and inland riparian forest. Suitable den sites include caves, rock crevices, hollow logs etc. This species is a carnivore, feeding on birds, reptiles and small mammals such as gliders, possums, rats and small macropods). Requires a large home range, estimated to be 800 hectares up to 20 km^2. This species breeds April – May, having an average litter of five offspring.	This species is not considered likely to be affected by the impact due to its very small scale. No further assessment for this species is required.
brush-tailed rock wallaby *Petrogale penicillata*	V (EPBC) V (TSC) * #	Populations of this species are scattered along the coast and ranges from the Queensland border to the south coast. They occur in rocky sites with a grassy understorey in sclerophyll forests, rainforest and open woodland. Prefers sites with a northerly aspect. This species tends to occur in small colonies, of 6-10 individuals. They shelter in caves, rocky crevices and dense stands of Lantana during the day. Feeds on grasses, forbs, seasonal fruits and seeds and the foliage of trees and shrubs.	The sites do not provide the preferred habitats of this species. <u>Further assessment is not required for this species.</u>
Koala *Phascolarctos cinereus*	V (TSC) *	Habitat consists of eucalypt forest and woodlands containing particular species including red gum, grey gum, manna gum, tallowwood, and swamp mahogany.	Assessment under SEPP 44 found that the project area provides no core or potential koala habitat. The sites do not contain a resident population of the species and <u>further assessment is not required.</u>
long-nosed potoroo *Potorous tridactylus* *tridactylus*	V (EPBC) V (TSC) * #	Occupies coastal heath or wet sclerophyll forest from southeast Queensland to Tasmania. Prefer areas with sandy soils and higher rainfalls. Feed on seeds, bulbs, roots, insects and their larvae however their main food is underground fungi.	The sites do not provide the preferred habitats of this species<u>. Further assessment is not required</u>.
yellow-bellied glider *Petaurus australis*	V (TSC) *	Prefers tall, mature forests in regions of high rainfall. Roosts in a den in a hollow branch, usually in a living, smooth-barked eucalypt. A variety of eucalypt species are required to provide year-round foraging resources in the species' large home range of between 30 and 65 hectares.	This species is not considered likely to be affected by the impact due to its very small scale. <u>No further assessment for this species is required.</u>
squirrel glider *Petaurus norfolcensis*	V (TSC) *	The squirrel glider occurs in wet and dry sclerophyll forests and woodlands, nests in tree hollows and feeds on insects, acacia gum and eucalypt sap released by incising the bark. The species has a home range of 20 to 30 hectares.	This species is not considered likely to be affected by the impact due to its very small scale however; **further assessment has been provided as it has been recorded in the immediate environs of the assessed area.**

Species	Status	Habitat Requirements (Source DEC: threatened species website)	Potential to Occur
spotted-tailed quoll *Dasyurus maculatus maculatus*	E (EPBC) V (TSC) * #	This species is recorded from a wide range of habitats, including rainforest, open forest, woodland, coastal heathland and inland riparian forest. Suitable den sites include caves, rock crevices, hollow logs etc. This species is a carnivore, feeding on birds, reptiles and small mammals such as gliders, possums, rats and small macropods). Requires a large home range, estimated to be 800 hectares up to 20 km^2. This species breeds April – May, having an average litter of five offspring.	This species is not considered likely to be affected by the impact due to its very small scale. <u>No further assessment for this species is required.</u>
Blue Mountains water skink *Eulamprus leuraensis*	E (TSC) E (EPBC) * #	Medium sized lizard, growing to 20 cm. This species is known only from restricted areas near the Blue Mountains and the Newnes Plateau. However, potential habitat occurs south and east of Hazelbrook and on the Newnes Plateau (NPWS 2002a). The preferred habitat for this species is in wet heath or hanging swamps. This species is also known to shelter in dense grass and tussocks or down holes.	Although having a high potential to occur in the vicinity this species is not considered likely to be affected by the impact due to its very small scale. <u>No further assessment for this species is required.</u>
broad-headed snake *Hoplocephalus bungaroides*	V (EPBC) E (TSC) * #	The distribution of this species is restricted to within a 200 kilometre radius of the Sydney basin. This extends from Wollemi National Park to the eastern edge of the Clyde River Catchment. It prefers sites where exposed sandstone outcrops and benches occur, particularly in woodland and heath vegetation. The species often hides under rock crevices and tree hollows.	The proposed disturbance areas lack exposed sandstone benches suitable for this species. <u>Further assessment is not required.</u>
Bathurst copper butterfly *Paralucia spinifera*	V (EPBC) E (TSC) * #	Small butterfly with 20-30 mm wingspan. Typically found in altitudes above 900 metres, commonly in open woodland or open forest with a sparse understorey (NPWS 2001b). Occurs in an area between Oberon, Hartly and Bathurst in the NSW Central Tablelands (NPWS 2001b). In this range it has been found in 29 locations.	This species requires *Bursaria spinosa* for foraging which was not recorded within the sites. The species is not expected to occur <u>and further assessment is not required.</u>
Giant Dragonfly *Petalura gigantea*	E (TSC)	The Giant Dragonfly is the second largest dragonfly in Australia and one of the largest dragonflies in the world. Males have an abdomen length of 6 - 7.5 cm, a wingspan up to 11 cm and petal-shaped claspers at the end of the abdomen. Females have an abdomen length of 8 - 9.5 cm and a wingspan up to 12.5 cm, and no claspers. Both sexes have widely-spaced eyes and have a predominantly brownish-black segmented body with light yellow markings along the back and sides. The larvae are also very large, up to 5 cm in length. When the dragonflies emerge from the larvae, they leave behind characteristics shells (exuviae). **Distribution** The Giant Dragonfly is found along the east coast of NSW from the Victorian border to northern NSW. It is not found west of the Great Dividing Range.	The proposed disturbance areas lack suitable habitat. <u>No further assessment for this species is required.</u>

Species	Status	Habitat Requirements (Source DEC: threatened species website)	Potential to Occur
		There are known occurrences in the Blue Mountains and Southern Highlands, in the Clarence River catchment, and on a few coastal swamps from north of Grafton to Nadgee in the south. **Habitat and ecology** Live in permanent swamps and bogs with some free water and open vegetation. Adults are short-lived surviving for one summer after emerging in October. Adults spend most of their time settled on low vegetation on or adjacent to the swamp Adults fly over the swamp and along its margins hunting for flying insects. Males sometimes congregate waiting for females to mate with. Females lay eggs into moss or other soft vegetation bordering swamps. Larvae dig long branching burrows under the swamp. Larvae leave their burrows at night and feed on insects and other invertebrates on the surface and also use underwater entrances to hunt for food in the aquatic vegetation. Larvae are slow growing and the larval stage may last up to 10 years. (DEC threatened species website 2005)	

3.8 Observed fauna

Assessment within the boundaries of the study area recorded 12 bird species, 1 mammal and 1 reptile (**Table 4**). None of the observed species were either abundant or listed as endangered or threatened in either state or national legislation. It would be also appropriate to review the species list recorded by Denny (2005: Appendix 2 in this report) to see a more exhaustive species compiled from a longer and more intensive survey.

Table 3: Observed fauna

Family	Common Name	Scientific Name	Comment
Aves			
Artamidae	Magpie	*Gymnorhina tibicen*	Using resources within the study area
Cacatuidae	Galah	*Eolophus roseicapillus*	As above
Corvidae	Australian Raven	*Corvus coronoides*	Overflying study area
Dicruridae	Magpie-lark	*Grallina cyanoleuca*	Using resources within the study area
	Restless Flycatcher	*Myiagra inquieta*	As above
	Willie Wagtail	*Rhipidura leucophrys*	As above
Hirundinidae	Welcome Swallow	*Hirundo neoxena*	As above
Maluridae	Blue Wren	*Malurus cyaneus*	Using resources within the study area
Meliphagidae	White-plumed Honeyeater	*Lichnostomus penicillatus*	As above
	Noisy Miner	*Manorina melanocephala*	As above
Pardalotidae	Yellow-rumped Thornbill	*Acanthiza apicalis*	As above
Psittacidae	Eastern Rosella	*Platycercus eximius*	Overflying study area
Mammalia			
Canidae	# Fox	*Vulpes vulpes*	Tracks observed in the study area.
Reptilia Elapidae	Eastern brownsnake	*Pseudonaja textilis*	Sloughed skin noted

3.9 State Environmental Planning Policy No. 44 - Koala Habitat Protection

The Lithgow City Local Government Area is not identified under Schedule 1 – Local Government Areas of *State Environmental Planning Policy No 44 (SEPP 44) – Koala Habitat Protection*. This policy seeks to protect the species by encouraging the proper conservation and management of areas that provide habitat for Koalas.

The study area does not support feed trees species listed under Schedule 2 of *State Environmental Planning Policy No 44 (SEPP 44) – Koala Habitat Protection.* As such, the proposed air vent and powerline corridor would not be considered to significantly affect any koala populations or their habitats, and therefore a Plan of Management for the conservation and management of areas of koala habitat is not required.

3.10 Fisheries issues

The immediate vicinity of the study area does not possess opportunities for fish species to occur, consequently no further discussion or assessment of impacts on fish species has been undertaken. The proponent will undertake appropriate erosion and sediment control during and post development to ensure mitigative measures are undertaken at all times to protect any local or connecting waterway from sediment or pollution.

3.11 Matters of National Environmental Significance

The proposed works do not impact on Commonwealth land.

The *Commonwealth Environment Protection and Biodiversity Conservation Act 1999* identifies six areas of National Significance that can trigger the Commonwealth Governments involvement in the environmental assessment and approval process. In relation to ecology[3] in the current study area:

- The locality is not part of any world heritage property;
- It is not part of, in the vicinity of, or immediately connected to any listed wetlands of international importance (Ramsar);
- The project will not affect any national heritage places;
- None of the Commonwealth listed vulnerable or endangered flora species observed is considered to inhabit the study area. No flora classified as "Extinct in the wild" or as "Critically Endangered" is listed for the locality of the study area;
- None of the Commonwealth listed vulnerable or endangered fauna species are considered to be in the study area, however regent honeyeater (*Xanthomyza phrygia*) has been previously recorded c. 30 km north of the study area. This species is unlikely to use the resources within the study area. No fauna species classified as "Extinct in the wild" or as "Critically endangered" are listed for the locality;
- No Commonwealth listed Critically Endangered Community or Endangered Ecological Community occurs within the study area. It is highly unlikely that the proposed works will impact on any critically endangered or endangered fauna, flora or community representative; and
- It is unlikely that impacts associated with the proposal will affect the life cycle or habitat of any internationally protected migratory species. The proposed development is unlikely to impact on the distribution, connectivity of known habitat, life cycle or availability of habitat of any of the species listed on the schedules under the *Environment Protection and Biodiversity Conservation Act 1999.*
- It is not near and will not have an effect on Commonwealth marine areas; and
- The project has no relationship to nuclear actions (including uranium mining).

[3] One additional NES issue deals with heritage issues which have been discussed in the appropriate part of this report.

3.12. Impacts

3.12.1 General

This assessment was undertaken assuming that all of the areas within the orange line on **Figure 4** have the potential to be affected. In a worst case scenario where all of the vegetation within the assessed area was to be impacted, approximately 12.5 ha of native woodland would be removed.

3.13 Assessment of significance

3.13.1 Introduction

The subject sites contains limited habitat that locally occurring threatened species could utilise.

There are two independent mechanisms used to determine assessments of significance and both directly relate to state or national legislative frameworks[4]:

1. The NSW Threatened Species Conservation Act 1995 (TSC Act) has been modified by the Threatened Species Conservation Act 2002. The NSW Environment Planning and Assessment Act 1979 (EP&A Act) incorporates these changes by including in section 5A seven factors which are to be considered when determining "whether there is likely to be a significant effect on threatened species, populations or ecological communities, or their habitats". These seven factors must be taken into account by consent or determining authorities when considering a development proposal or Development Application, particularly in administering Sections 78, 79 and 112 of the EP&A Act.

   While seven part tests are not required under Part 3A of the EP&A Act, the impact assessment requirements are similar. Consequently, seven part tests have been applied during the current assessment because it provides an appropriate benchmark and assessment process.

   Species or ecological communities requiring further assessment under the TSC Act at the current study area include:

   - Eastern Bent-wing Bat *(Miniopterus australis);*
   - Eastern False Pipistrelle (*Falsistrellus tasmaniensis);*
   - Eastern long-eared bat (*Nyctophilus timoriensis);*
   - Gang-gang Cockatoo (*Callocephalon fimbriatum*);
   - Brown treecreeper (*Climacteris picumnus);* and

[4] In some instances individual species may be listed in the schedules of both the TSC Act and the EPBC Act, however separate assessments of significance are required

- Squirrel Glider (*Petaurus norfolcensis*).

2. The DEH documents guidelines for determining the significance of an impact on nationally listed (EPBC Act 1999) threatened species and ecological communities, listed migratory species, wetlands of international importance, commonwealth marine environments, world heritage properties, national heritage places and nuclear actions. Criteria for each assessment of significance are specific for each matter of national environmental significance.

   Only one species the Eastern long-eared bat (*Nyctophilus timoriensis)* requires further assessment under this Act.

In relation to key threatening processes associated with this proposal, Schedule 3 of the TSC Act currently lists 30 key threatening processes, two pending (**Table 4**). Issues associated with longwall mining are not part of this proposal and therefore are not included in the current assessment.

Table 4: Schedule 3 of the TSC Act: Threatening Processes

Key threatening process listing - pending finalisation	**Does this apply to the current proposal?**
Invasion and establishment of Scotch Broom *Cytisus scoparius* - proposed key threatening process declaration	No
Loss of Hollow-bearing trees - proposed key threatening process declaration	Yes
Key threatening process listing - final	
Alteration of habitat following subsidence due to longwall mining	No
Alteration to the natural flow regimes of rivers, streams, floodplains & wetlands	No
Bushrock removal	No
Cane toad	No
Clearing of native vegetation	No
Competition and grazing by the feral European rabbit	No
Competition and habitat degradation by feral goats	No
Competition from feral honeybees	No
Death or injury to marine species following capture in shark control programs on ocean beaches	No
Ecological consequences of high frequency fires	No
Entanglement in or ingestion of anthropogenic debris in marine and estuarine environments	No
Exotic vines and scramblers	No
Feral pigs	No
Herbivory and environmental degradation caused by feral deer	No
Human-caused climate change	No
Importation of red imported fire ants into NSW	No
Infection by Psittacine circoviral (beak and feather) disease affecting endangered psittacine species and populations	No
Infection of frogs by amphibian chytrid causing the disease chytridiomycosis	No

Infection of native plants by Phytophthora cinnamomi	No
Introduction of the large earth bumblebee, Bombus terrestris	No
Invasion of native plant communities by bitou bush and boneseed	No
Invasion of native plant communities by exotic perennial grasses	No
Invasion of the yellow crazy ant	No
Lantana camara	No
Loss and/or degradation of sites used for hill-topping by butterflies	No
Predation by feral cats	No
Predation by the European red fox	No
Predation by the plague minnow (Gambusia holbrooki)	No
Predation by the ship rat on Lord Howe Island	No
Removal of dead wood and dead trees	No

Loss of hollow bearing trees and clearing of native vegetation are directly relevant to the current proposal.

3.13.2 Seven part tests

Table 5: Seven part tests - microbats

	Eastern Bentwing Bat (*Miniopterus australis)*	**Eastern False Pipistrelle (*Falsistrellus tasmaniensis)***	**Eastern long-eared bat (*Nyctophilus timoriensis)***
1) in the case of a threatened species, whether the life cycle of the species is likely to be disrupted such that a viable local population of the species is likely to be placed at risk of extinction.	The Eastern Bentwing Bat *(Miniopterus australis)* is an insectivorous, cave dwelling colony bat mainly occurring in well timbered areas (from sclerophyll woodland to rainforest and *Melaleuca* swamps). Due to the small amount of suitable habitat for this species being effected and volume of habitat in the immediate environs the project will not disrupt a viable local population such that it is likely to place the species at risk of local extinction.	The Eastern Falsistrelle *(Falsistrellus tasmaniensis)* is a large and robust insectivorous bat that roosts in hollow trunks of eucalypts in colonies of between 3 – 36 (generally in single sex groups). Most often found in sclerophyll forest from the Great Dividing Range to the coast in wetter habitats with trees more than 20 m in height (Churchill 1998:142). All comments in the left hand column are relevant for this species.	The eastern long-eared bat (*Nyctophilus timoriensis)* inhabits a variety of vegetation types, including mallee, bulloke *Allocasuarina leuhmanni* and box eucalypt dominated communities, but it is distinctly more common in box/ironbark/cypress-pine vegetation that occurs in a north-south belt along the western slopes and plains of NSW and southern Queensland. Roosts in tree hollows, crevices, and under loose bark. Slow flying agile bat, utilising the understorey to hunt non-flying prey - especially caterpillars and beetles - and will even hunt on the ground. Mating takes place in autumn with one or two young born in late spring to early summer (DEC 2006). All comments in the far left hand column are relevant for this species.
2) in the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the	Not relevant	Not relevant	Not relevant

	Eastern Bentwing Bat (*Miniopterus australis*)	**Eastern False Pipistrelle (*Falsistrellus tasmaniensis*)**	**Eastern long-eared bat (*Nyctophilus timoriensis*)**
endangered population such that a viable local population of the species is likely to be placed at risk of extinction.			
3) in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed: **(i) is likely to have an adverse effect on the extent of the ecological community such that its occurrence is likely to be placed at risk of extinction, or** **(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction,**	Not relevant	Not relevant	Not relevant
4) in relation to habitat of a threatened species, population or ecological community: **i) the extent to which habitat is likely to be removed or modified**	• 12.5 ha of habitat will be removed. • The impact will not cause fragmentation or isolation of the of the forest. • It is difficult to document importance of the loss of habitat other than stating that all habitats are important for native species. The accumulated area of habitat to be removed is	See all comments in the left hand column	See all comments in the far left hand column.

	Eastern Bentwing Bat (*Miniopterus australis*)	**Eastern False Pipistrelle (*Falsistrellus tasmaniensis*)**	**Eastern long-eared bat (*Nyctophilus timoriensis*)**
as a result of the action proposed, and **ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and** **iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality.**	small in comparison with that available. Thus this discrete proposal is unlikely to impact a local population of the species such that it is placed at risk of local extinction.		
5) whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly).	Critical habitat for this species has not been declared and at this date there are no habitat declared as critical in the immediate environs.	See all comments in the left hand column	See all comments in the far left hand column.
6) whether the actions proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan.	A recovery plan or threat abatement plan for this species has not been written. The only applicable recovery plans are detailed in the following table.	See all comments in the left hand column	See all comments in the far left hand column.

	Eastern Bentwing Bat (*Miniopterus australis)*	Eastern False Pipistrelle (*Falsistrellus tasmaniensis)*	Eastern long-eared bat (*Nyctophilus timoriensis)*
7) whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.	The proposal has relevance with clearing native vegetation and loss of tree hollows, both are key threatening process (Table 4).	See all comments in the left hand column	See all comments in the far left hand column.
Conclusion	The proposal is not likely to cause impact to a locally occurring population of this species such that it will be placed at risk of local extinction. A SIS is not warranted.	The proposal is not likely to cause impact to a locally occurring population of this species such that it will be placed at risk of local extinction. A SIS is not warranted.	The proposal is not likely to cause impact to a locally occurring population of this species such that it will be placed at risk of local extinction. A SIS is not warranted.

Table 6: Seven part tests - Brown tree creeper & Gang-gang Cockatoo

	Brown treecreeper (*Climacteris picumnus)*	Gang-gang Cockatoo (*Climacteris picumnus)*
1. **in the case of a threatened species, whether the life cycle of the species is likely to be disrupted such that a viable local population of the species is likely to be placed at risk of extinction.**	• Found in the drier open forests and woodlands of eastern Australia. Stays in the same area all year round. • It climbs up the trunks and branches of trees in search of food probing into cavities and under loose bark with its long downward curving bill searching for insects and their larvae. The most favoured insects are ants. Some feeding also takes place on the ground on fallen logs. Feeding normally takes place in pairs or small groups. • The species breeds from June to January each year. The nest is a collection of grasses, feathers and other soft material, placed in a suitable tree hollow or similar site. (DEC threatened species webpage 2005) • Although having the potential to occur in the study area it was not observed. Clearing of 12.5 ha of woodland within the study area is unlikely to affect the life cycle of the species such that a viable local population is likely to be placed at risk of extinction.	• According to DEC (2006) Gang-gang cockatoos are one of the more distinctive and charismatic members of Australia's avifauna. These birds are primarily slate-grey, with the males easily identified by their scarlet head and wispy crest, while females have a grey head and crest and feathers edged with salmon pink on the underbelly. They range in length from 32 to 37 cm, with a wingspan of 62 to 76 cm. The call has been likened to a creaking gate or cork being pulled from a bottle. • The Gang-gang Cockatoo is distributed from southern Victoria through south- and central-eastern New South Wales. In New South Wales, the Gang-gang Cockatoo is distributed from the south-east coast to the Hunter region, and inland to the Central Tablelands and south-west slopes. It occurs regularly in the Australian Capital Territory. It is rare at the extremities of its range, with isolated records known from as far north as Coffs Harbour and as far west as Mudgee. • In summer, generally found in tall mountain forests and woodlands, particularly in heavily timbered and mature wet sclerophyll forests. In winter, may occur at lower altitudes in

	Brown treecreeper (*Climacteris picumnus)*	Gang-gang Cockatoo (*Climacteris picumnus)*
		drier more open eucalypt forests and woodlands, and often found in urban areas. • May also occur in sub-alpine Snow Gum *Eucalyptus pauciflora* woodland and occasionally in temperate rainforests. • Move to lower altitudes in winter, preferring more open eucalypt forests and woodlands, particularly in box-ironbark assemblages, or in dry forest in coastal areas. Favours old growth attributes for nesting and roosting. Due to the small amount of suitable habitat for this species and volume of habitat in the immediate environs the project will not disrupt a viable local population such that it is likely to place the species at risk of local extinction.
2. **in the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction.**	Not relevant	Not relevant
3. **in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:** ▪ **is likely to have an adverse effect on the extent of the ecological community such that its occurrence is likely to**	Not relevant	Not relevant

	Brown treecreeper (*Climacteris picumnus)*	Gang-gang Cockatoo (*Climacteris picumnus)*
be placed at risk of extinction, or ▪ **is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction,**		
4. **in relation to habitat of a threatened species, population or ecological community:** • **the extent to which habitat is likely to be removed or modified as a result of the action proposed, and** • **whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and** • **the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality.**	• 12.5 ha of habitat will be removed. • The impact will not cause fragmentation or isolation of the of the forest. • It is difficult to document importance of the loss of habitat other than stating that all habitats are important for native species. The accumulated area of habitat to be removed is small in comparison with that available. Thus this discrete proposal is unlikely to impact a local population of the species such that it is placed at risk of local extinction.	• See comments (left).
5. **whether the action**	Critical habitat for this species has not been declared and at	Critical habitat for this species has not been declared and at present

	Brown treecreeper (*Climacteris picumnus)*	**Gang-gang Cockatoo (*Climacteris picumnus)***
proposed is likely to have an adverse effect on critical habitat (either directly or indirectly).	present there are no habitats listed as critical in the locality.	there are no habitats listed as critical in the locality.
6. **whether the actions proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan.**	A recovery plan or threat abatement plan for this species has not been written.	A recovery plan or threat abatement plan for this species has not been written.
7. **whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.**	The proposal has relevance with clearing native vegetation and loss of tree hollows, both are key threatening process (Table 4).	See the left hand column
Conclusion	This species was not observed during the current however is likely to occur. The proposal is not likely to cause impact to a locally occurring population of this species such that it will be placed at risk of local extinction. A SIS is not warranted.	This species was recorded in the immediate environs of the current study area. The proposal is not likely to cause impact to a locally occurring population of this species such that it will be placed at risk of local extinction. A SIS is not warranted.

Table 7: Seven part tests – Squirrel glider

	Squirrel Glider *Petaurus norfolkensis*
1. **in the case of a threatened species, whether the life cycle of the species is likely to be disrupted such that a viable local population of the species is likely to be placed at risk of extinction.**	The Squirrel Glider is found along the Great Dividing Range and the coastal plains in eastern Australia from Cape York to Victoria. Mainly found on inland slopes. There are three records within the locality of Baal Bone Colliery. The species is found in dry sclerophyll forest and woodlands which have mature or mixed-age stands of more than one eucalypt species. The stands usually include smooth-barked gums and high-nectar-producing species, such as *Acacia*, as a source of carbohydrate during winter (Menkhorst *et al*, 1988). The Squirrel Glider requires hollows in trees as den sites and utilises a range of hollows at various heights in living and dead trees and are known to travel up to 1 km from their foraging area to a preferred hollow (Menkhorst, 1995). Dead trees with hollows and iron-barked eucalypts are preferred nesting sites for this species (Rowston, 1998). The proposed action will remove habitat this species could utilise however on a local level habitat is abundant and as such the proposal would not place a viable local population of this species at risk of local extinction.
2. **in the case of an endangered population, whether the action**	Not relevant

	Squirrel Glider ***Petaurus norfolkensis***
proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction.	
3. **in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:** ▪ **is likely to have an adverse effect on the extent of the ecological community such that its occurrence is likely to be placed at risk of extinction, or** ▪ **is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction,**	Not relevant
4. **in relation to habitat of a threatened species, population or ecological community:**	• 12.5 ha of habitat will be removed. • The impact will not cause fragmentation or isolation of the forest. • It is difficult to document importance of the loss of habitat other than stating that all habitats are important for native species. The accumulated area of habitat to be removed is small in comparison with that available. Thus this discrete proposal is unlikely to

	Squirrel Glider *Petaurus norfolkensis*
• **the extent to which habitat is likely to be removed or modified as a result of the action proposed, and** • **whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and** • **the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality.**	impact a local population of the species such that it is placed at risk of local extinction.
5. **whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly).**	Critical habitat for this species has not been declared and at present there are no habitats listed as critical in the locality.
6. **whether the actions proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan.**	A recovery plan or threat abatement plan for this species has not been written.

	Squirrel Glider ***Petaurus norfolkensis***
7. **whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.**	The proposal has relevance with clearing native vegetation and loss of tree hollows, both are key threatening process (Table 4).
Conclusion	This species was not observed during the current however is likely to occur. The proposal is not likely to cause impact to a locally occurring population of this species such that it will be placed at risk of local extinction. A SIS is not warranted.

Table 8: Assessment of significance under the EPBC Act

An action is likely to have a significant impact on a threatened species if there is a real chance or possibility that it will:	**Eastern long-eared bat** (*Nyctophilus timoriensis)* (V) EPBC Act 1999.
➢ lead to a long-term decrease in the size of a *important population*, or	• An important local population of this species has not been recorded in the Lithgow region.
➢ reduce the area of occupancy of an *important population*, or	• The proposal is unlikely to reduce the area of occupancy for this species.
➢ fragment the existing *important population*[5] into two	• An important local population of this species has not been recorded in the Lithgow region however it is likely to occur. • If the species does exist within the study area the action will not cause a population to be fragmented.

[5] An *important* population is a population that is necessary for a species' long-term survival and recovery. This may include populations that are:

• key source populations either for breeding or dispersal,

• populations that are necessary for maintaining genetic diversity, and/or

An action is likely to have a significant impact on a threatened species if there is a real chance or possibility that it will:	**Eastern long-eared bat** (*Nyctophilus timoriensis)* (V) EPBC Act 1999.
or more populations, or	
➢ adversely affect *habitat critical*[6] to the survival of a species, or	• Habitat for this species does not appear on the register of critical habitat on the DEH online database. • The proposal will remove hollows and decorating bark suitable for this species to breed. • Availability of analogous habitat is available in the Wollemi and Gardens of Stone NP's and the Lithgow, Wolgan, Newnes, Ben Bullen and Cullen Bullen State Forests. in the road corridor for this species however, due to the availability of and abundance of habitat in the adjoining road corridor loss of roosting resources in the study area is considered manageable for the survival of the species. .
➢ disrupt the breeding cycle of a *population*, or	• The proposal is unlikely to disrupt the breeding cycle of a local population
➢ modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline, or	• As above
➢ result in *invasive species* that are	• Several areas within the regional stet forests have been cleared as a result of mining activities (small scale clearing). As yet no invasive species have been reported to invade the impacted areas.

• populations that are near the limit of the species range.

[6] Habitat critical to the survival of a species refers to:

habitat identified in a recovery plan for the species as habitat critical for those species or communities; and/or

i) habitat listed on the Register of Critical Habitat maintained by the Minister under the Act; and/or

ii) areas that are necessary:
- for activities such as foraging, breeding, roosting, or dispersal;
- for succession;
- to maintain genetic diversity and long term evolutionary development; or
- for the reintroduction of populations or recovery of the species.

An action is likely to have a significant impact on a threatened species if there is a real chance or possibility that it will:	**Eastern long-eared bat** (*Nyctophilus timoriensis)* (V) EPBC Act 1999.
harmful to a vulnerable species becoming established in the species habitat, or	
➢ interferes substantially with the recovery of the species.	• The proposal is unlikely to interfere with the recovery of the species.
Conclusion	• The proposed action is unlikely to affect a local population of this species and referred to the minister of the DEH is not warranted.

4. RELEVANT LEGISLATION

4.1 Vegetation

4.1.1 Native Vegetation Act 2003 *(NVA Act)*

The objects of this Act are:

> "(a) to provide for, encourage and promote the management of native vegetation on a regional basis in the social, economic and environmental interests of the State, and
>
> (b) to prevent broadscale clearing unless it improves or maintains environmental outcomes, and
>
> (c) to protect native vegetation of high conservation value having regard to its contribution to such matters as water quality, biodiversity, or the prevention of salinity or land degradation, and
>
> (d) to improve the condition of existing native vegetation, particularly where it has high conservation value, and
>
> (e) to encourage the revegetation of land, and the rehabilitation of land, with appropriate native vegetation, in accordance with the principles of ecologically sustainable development."

Excluded clearing

This Act does not apply to the following types of clearing of native vegetation:

> "(f) any clearing that is, or that is part of, designated development within the meaning of the EPA Act and for which development consent has been granted under that Act."

Relevance to the current proposal: As this proposal is being assessed under Part 3A of the EP&A Act, a Permit to clear native vegetation is not required under part (f) which is exempt under the excluded clearing section of the NVA Act.

4.1.2 Noxious Weeds Act 1993

The objectives of this Act are to:

"(a) to reduce the negative impact of weeds on the economy, community and environment of this State by establishing control mechanisms to:

- (i) prevent the establishment in this State of significant new weeds, and
- (ii) restrict the spread in this State of existing significant weeds, and
- (iii) reduce the area in this State of existing significant weeds,

(b) to provide for the monitoring of and reporting on the effectiveness of the management of weeds in this State."

Relevance to the current proposal: Although no noxious weeds were recorded as a result of this assessment, actions to reduce the risk of infestation have been detailed in the Recommendations section of this report.

4.1.2 Forestry Act 1916

The provisions of the Forestry Act apply to this proposal as the Project Area is on DPI (Forests) land. The objectives stated under Clause 8A of the Forestry Act are as follows.

"

(a) To conserve and utilise the timber on Crown-timber lands for building to the best advantage of the state.

(b) To provide adequate supplies of timber from Crown-timber lands for building, commercial, industrial, agricultural, mining and domestic purposes.

(c) To preserve and improve, in accordance with good forestry practice, the soil resources and water catchment capabilities of Crown-timber lands.

(d) To encourage the use of timber derived from trees grown in the State.

(e) Consistent with the use of DPI (Forests) for the purposes of forestry and of flora reserves for the preservation of the native flora thereon:

- to promote and encourage their use as a recreation area, and
- to conserve birds and animals thereon.

In the attainment of its object and the exercise and performance of its powers, authorities, duties and functions under the Forestry Act, DPI (Forests) shall take all practicable steps that it considers necessary or desirable to ensure the preservation and enhancement of the quality of the environment."

Relevance to the current proposal: A clearing licence is required from DPI (Forests) to clear any trees within its lands and the provisions of the *Nature Conservation Act 1997* do not apply.

4.2 Modification to water ways

4.2.1 Fisheries Management Act 1994

The objectives of the FM Act are to conserve, develop and share fishery resources of the State for the benefit of current and future generations. The Act is administered by NSW Fisheries through the Department of Primary Industries (DPI) and covers the following:

- "Declaration of aquatic reserves;
- Conserve fish stocks and key fish habitats;
- Protection of marine vegetation which is significant for fish habitat such as mangroves and sea grasses; a permit from NSW Fisheries is required for the removal, destruction or other alteration to such habitat;

- Conserve threatened species, populations and ecological communities of fish and marine vegetation;
- Promote ecologically sustainable development, including the conservation of biological diversity.
- Gazettal of fish habitat protection plans, which are intended to assist local Councils, developers and the community to determine which activates are appropriate in or near fish habitat".

The FM Act applies to all waters within the limits of the State. Part 7A of the Act deals with Threatened Species and allows for the listing of threatened species, population and endangered ecological communities under the Act. The Act also has provisions to allow the determination of whether an action will have a significant impact on threatened species, populations or endangered ecological communities. The FM Act incorporates the principles of the TSC Act in regard to aquatic species and therefore Assessments of Significance are required where Threatened Species have the potential to be impacted.

NSW Fisheries Policy and Guidelines for Aquatic Habitat Management and Fish Conservation 1999 where a 2:1 habitat compensation policy for any fish habitat loss associated with development exists.

<u>Relevance to the current project</u>: As fish habitat does not exist in the study area, application of this act is not required.

<u>4.2.2 Water Management Act 2000 (WM Act).</u>

This Act provides for the sustainable and integrated management of the State's waters, including those provisions previously included in the *Rivers and Foreshores Improvement Act 1948* (RFI Act). The main object of the WM Act is to enhance and restore water sources and their associated ecosystems, ecological processes and biodiversity. Most of the provisions of the WM Act commenced in 2001, yet matters relating to licences and approvals will continue to be dealt with by the RFI Act until further notice. The Act in its entirety was only adopted in Jan 2006.

Part 3A of the RFI Act controls activities potentially causing adverse impacts to protected waters. The RFI Act applies to land within 40 m of the top of a water body's banks (protected land) and natural and artificial water bodies (protected water). A permit from the Department of Natural Resources (formerly DLWC) is generally required for any excavation on, in or under protected land, removal of material from protected land, or for an action that might obstruct or detrimentally affect water flow.

<u>Relevance to the current proposal</u>: In accordance with Section 750 of the EP&A Act, the licensing and approval provisions of the WM Act are not required for Major Projects approved under Part 3A of the Act. However, all works must be undertaken in accordance with the relevant conditions of the development consent.

4.3 Impacts to threatened species and endangered ecological communities

4.3.1 State legislation

The *Threatened Species Conservation Act 1995* (TSC Act) commenced on 1 January 1996. This Act provides for the protection of all threatened plants and animals native to NSW and their habitats (including endangered populations and ecological communities, and their habitats). Threatened 'fish' and marine vegetation are specifically excluded as these are covered by the *Fisheries Management Act 1994*[7]. Under the EP&A Act, impacts on threatened species listed under the TSC Act are assessed by a Seven Part Test. Where a development is likely to have a significant impact on a threatened species, population or ecological community, the preparation of a Species Impact Statement is required.

Relevance to the current proposal: Under part 3A of the EP&A Act, Seven Part Tests and Species Impact Statements are not required. However, any impact must be undertaken in accordance with the conditions of development consent. Seven Part Tests have been undertaken as part of this assessment because, in the absence of specific guidelines, it provides an established benchmark that is well recognised by consultant ecologists and authority assessment officers.

4.3.2 Federal legislation

Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act) provides for the protection of the environment, especially those aspects of the environment that are matters of national environmental significance. These include:

a) World Heritage areas;

b) Ramsar Wetlands;

c) nationally listed threatened species and ecological communities;

d) internationally listed migratory species;

e) all nuclear actions; and

f) Commonwealth areas and Commonwealth marine areas.

Relevance to the current proposal: In relation to this Act, no items of national environmental significance were identified.

[7] The FM Act 1994 is not applicable for the current assessment as no fish habitat (as defined) was identified within the proposed easement footprint.

5. RECOMMENDATIONS

As a result of the current assessment, the following recommendations have been formulated:

1 Vegetation removal within the ventilation shaft site will be undertaken as follows:

When clearing mature trees:

- Habitat and non-habitat trees (less than 40cm in diameter, no hollow limbs or thick shaggy bark on the trunk under which small animals can hide) will be identified and clearly marked.
- All trees will be checked for the presence of birds or nestlings and arboreal mammals before felling or pushing. Tree removal will commence immediately after visual inspection.
- Non-habitat trees will be removed first to ensure that the associated disturbance will flush out any animals from within the habitat trees.
- Habitat trees will be felled 24 hours (or overnight) after all non-habitat trees have been removed. This will allow any animal occupying a habitat tree to vacate the area after the initial disturbance period.
- Hollows will be checked for injured animals and advice will be sought from Western Plains Zoo on 68811400 or the local WIRES group if injured wildlife is discovered. Bat species will not be handled due to dangers associated with the transmission of a virus that is detrimental to the health of humans.

2 The location of the powerline poles will be chosen so that the number of trees required to be removed is minimised. Impacts to the understorey and groundlayers will be minimised. Lopping and minimal vegetation removal will be undertaken where necessary along the alignment.

3 There will be no impact to the ground surface and ground cover within 20 metres of drainage lines.

4 There will be no impact on vegetation outside of the footprint of the powerline and ventilation shaft site.

5 A weed management program will be implemented to prevent the spread of weeds during construction, operation and decommissioning.

6 No vegetation will be burnt on site.

7 All disturbed areas will undergo rehabilitation upon completion of construction to restore the land to a condition at least similar to the condition existing before disturbance. Vegetation and topsoil removed during the course of the work will be stockpiled on site and spread within the ventilation shaft area after the completion of works to enhance the potential for endemic propagules.

Vegetation offsets are not considered necessary with regard to the proposed development due to the limited extent of vegetation clearance and the fact that the site will be completely rehabilitated following the approximate two year operational phase.

Soil and erosion control

Erosion and sediment control devices will be developed for the construction, operational and rehabilitation phases in accordance with *Managing Urban Stormwater – Soils and Construction* (Landcom 2004) and the Forest Practices Code (Part 4 – Forest Roads and Fire Trails) (DPI (Forests NSW)).

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Appendix 1 – Photographs

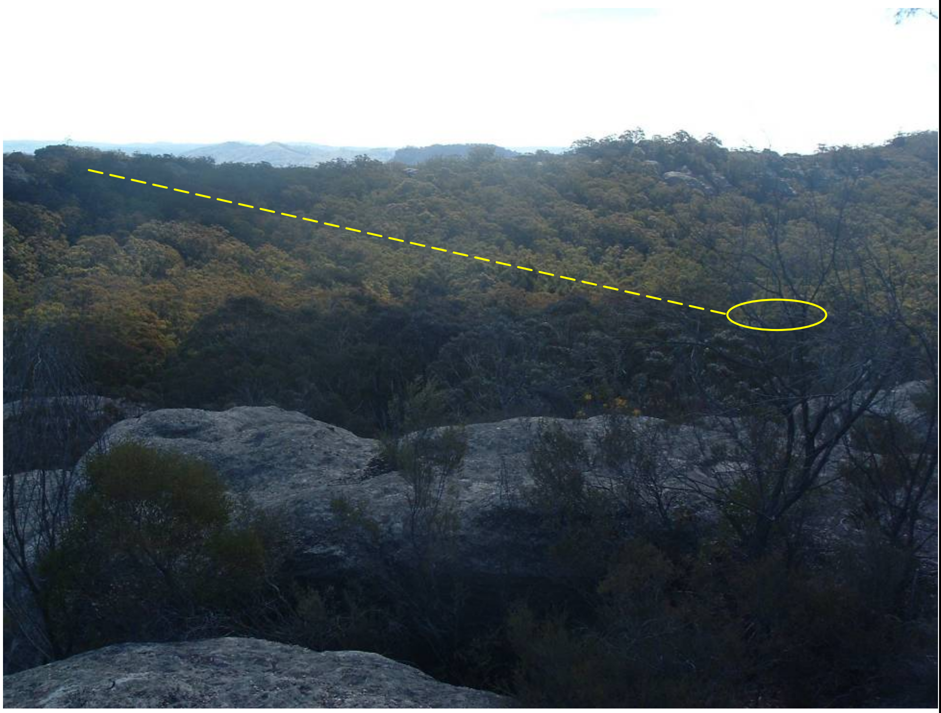

Plate 1

View west from the top of the escarpment along the proposed powerline route showing the location of the existing dewatering borehole in the valley below. The proposed powerline is likely to span from this point to the existing infrastructure.

Plate 2

View of a typical woodland habitat in the general vicinity of the proposed compound.

Plate 3

View east from the existing dewatering borehole toward the drainage feature.

Appendix 2 –

Observed species within the Baal Bone Colliery (Mt King Ecology 2005)

Scientific Name	Common Name	Status	Baal Bone	Drill Area	Longwall Area
a. Birds					
Anatidae					
Anas superciliosa	Pacific Black Duck	P	X	X	X
Chenonetta jubata	Australian Wood Duck	P	X	X	
Podicipedidae					
Tachybaptus novaehollandiae	Australasian Grebe	P	X	X	
Accipitridae					
Accipiter fasciatus	Brown Goshawk	P	X		
Aquila audax	Wedge-tailed Eagle	P	X	X	
Falconidae					
Falco berigora	Brown Falcon	P	X	X	
Columbidae					
Phaps elegans	Brush Bronzewing	P	X	X	
Cacatuidae					
Cacatua galerita	Sulphur-crested Cockatoo	P	X	X	
Callocephalon fimbriatum	Gang-gang Cockatoo	V	X	X	X
Calyptorhynchus funereus	Yellow-tailed Black-Cockatoo	P	X	X	X
Psittacidae					
Platycercus adscitus eximius	Eastern Rosella	P	X	X	
Platycercus elegans	Crimson Rosella	P	X	X	X
Strigidae					
Ninox novaeseelandiae	Southern Boobook	P	X	X	X
Halcyonidae					
Dacelo novaeguineae	Laughing Kookaburra	P	X	X	X
Todiramphus sanctus	Sacred Kingfisher	P	X		X
Menuridae					
Menura novaehollandiae	Superb Lyrebird	P	X	X	X
Climacteridae					
Climacteris erythrops	Red-browed Treecreeper	P	X	X	
Cormobates leucophaeus	White-throated Treecreeper	P	X	X	X
Maluridae					
Malurus cyaneus	Superb Fairy-wren	P	X	X	X
Pardalotidae					
Pardalotus striatus	Striated Pardalote	P	X	X	X
Origma solitaria	Rock Warbler	P	X		X
Acanthizidae					
Acanthiza nana	Yellow Thornbill	P	X		X
Acanthiza pusilla	Brown Thornbill	P	X	X	X
Acanthiza reguloides	Buff-rumped Thornbill	P	X		X
Sericornis frontalis	White-browed Scrubwren	P	X	X	X
Meliphagidae					
Anthochaera carunculata	Red Wattlebird	P	X	X	X
Lichenostomus leucotis	White-eared Honeyeater	P	X	X	X

Scientific Name	Common Name	Status	Baal Bone	Drill Area	Longwall Area
a. Birds					
Manorina melanocephala	Noisy Miner	P	X	X	
Melithreptus lunatus	White-naped Honeyeater	P	X		X
Phylidonyris novaehollandiae	New Holland Honeyeater	P	X	X	X
Petroicidae					
Microeca fascinans	Jacky Winter	P	X		X
Eupetidae					
Psophodes olivaceus	Eastern Whipbird	P	X	X	X
Pachycephalidae					
Colluricincla harmonica	Grey Shrike-thrush	P	X	X	X
Pachycephala pectoralis	Golden Whistler	P	X	X	X
Pachycephala rufiventris	Rufous Whistler	P	X		X
Dicruridae					
Rhipidura albiscapa	Grey Fantail	P	X	X	X
Rhipidura leucophrys	Willie Wagtail	P	X	X	
Artamidae					
Gymnorhina tibicen	Australian Magpie	P	X	X	X
Strepera graculina	Pied Currawong	P	X	X	X
Campephagidae					
Coracina novaehollandiae	Black-faced Cuckoo-shrike	P	X	X	
Corvidae					
Corvus coronoides	Australian Raven	P	X	X	X
Corvus mellori	Little Raven	P	X		X
Corcoracidae					
Corcorax melanorhamphos	White-winged Chough	P	X	X	
Sturnidae					
Sturnus vulgaris	Common Starling	U	X	X	
Hirundinae					
Hirundo neoxena	Welcome Swallow	P	X	X	
Zosteropidae					
Zosterops lateralis	Silvereye	P	X	X	
Fringillidae					
Carduelis carduelis	European Goldfinch	U	X	X	

b. Mammals					
Scientific Name	**Common Name**	**Status**	**Baal Bone**	**Drill Area**	**Longwall Area**
Tachyglossidae					
Tachyglossus aculeatus	Short-beaked Echidna	P	X	X	
Dasyuridae					
Antechinus agilis	Agile Antechinus	P	X		X
Petauridae					
Petaurus norfolcensis	Squirrel Glider	V	X		X
Pseudocheiridae					

b. Mammals					
Petauroides volans	Greater Glider	P	X	X	X
Pseudocheirus peregrinus	Common Ringtail Possum	P	X	X	X
Vombatidae					
Vombatus ursinus	Common Wombat	P	X		X
Macropodidae					
Macropus giganteus	Eastern Grey Kangaroo	P	X	X	X
Macropus robustus	Common Wallaroo	P	X		
Macropus rufogriseus	Red-necked Wallaby	P	X	X	
Muridae					
Rattus fuscipes	Southern Bush Rat	P	X	X	
Molossidae					
Tadarida australis	White-striped Mastiff Bat	P	X	X	
Vespertilionidae					
Vespadelus darlingtoni	Large Forest Bat	P	X	X	
Canidae					
Canis familiaris	Dog	U	X		
Vulpes vulpes	Red Fox	U	X	X	X
Felidae					
Felis catus	Cat	U	X		
Suidae					
Sus scrofa	Feral Pig	U	X		X
Leporidae					
Oryctolagus cuniculus	Rabbit	U	X	X	X
c. Reptiles					
Agamidae					
Amphibolurus muricatus	Jacky Lashtail	P	X	X	X
Pogona barbata	Eastern Bearded Dragon	P	X	X	
Scincidae					
Lampropholis delicata	Dark-flecked Garden Sunskink	P	X	X	X
Ctenotus taeniolatus	Copper-tailed Skink	P	X		X
Elapidae					
Pseudechis porphyriacus	Red-bellied Black Snake	P	X	X	
d. Amphibians					
Myobatrachidae					
Limnodynastes dumerilii	Eastern Banjo Frog	P	X		X
Limnodynastes tasmaniensis	Spotted Marsh Frog	P	X	X	
Crinea signifera	Common Eastern Toadlet	P	X	X	X

Appendix 3

BioNet, DEC and EPBC threatened species of fauna & flora search results

Combined geographic and habitat search results

Your search returned **115** results. You searched for the following information:

- geographic region: **Hawkesbury/Nepean > Wollemi**
- vegetation type: **all**
- type: **all**

Search Results

Scientific Name	Common Name	Level of Threat
Acacia baueri subsp. aspera	*Acacia baueri subsp. aspera*	Vulnerable
Acacia gordonii	*Acacia gordonii*	Endangered
Acrophyllum australe	*Acrophyllum australe*	Vulnerable
Archaeophya adamsi	Adam's emerald dragonfly	Vulnerable
Ancistrachne maidenii	*Ancistrachne maidenii*	Vulnerable
Apatophyllum constablei	*Apatophyllum constablei*	Endangered
Ninox connivens	Barking Owl	Vulnerable
Paralucia spinifera	Bathurst Copper Butterfly	Endangered
Ixobrychus flavicollis	Black Bittern	Vulnerable
Melithreptus gularis gularis	Black-chinned Honeyeater (eastern subspecies)	Vulnerable
Blue Mountains Shale Cap Forest in the Sydney Basin Bioregion	Blue Mountains Shale Cap Forest in the Sydney Basin Bioregion	Endangered Ecological Community
Eulamprus leuraensis	Blue Mountains Water Skink	Endangered
Litoria booroolongensis	Booroolong Frog	Endangered
White Box Yellow Box Blakely's Red Gum Woodland	Box-Gum Woodland	Endangered Ecological Community
Lastreopsis hispida	Bristly Shield Fern	Endangered
Hoplocephalus bungaroides	Broad-headed Snake	Endangered
Pomaderris brunnea	Brown Pomaderris	Vulnerable
Climacteris picumnus victoriae	Brown Treecreeper (eastern subspecies)	Vulnerable
Petrogale penicillata	Brush-tailed Rock-	Endangered

	wallaby	
Acacia bynoeana	Bynoe's Wattle	Endangered
Eucalyptus benthamii	Camden White Gum	Vulnerable
Eucalyptus cannonii	Capertee Stringybark	Vulnerable
Persoonia marginata	Clandulla Geebung	Vulnerable
Meridolum corneovirens	Cumberland Land Snail	Endangered
Darwinia peduncularis	*Darwinia peduncularis*	Vulnerable
Boronia deanei	Deane's Boronia	Vulnerable
Melaleuca deanei	Deane's Paperbark	Vulnerable
Derwentia blakelyi	*Derwentia blakelyi*	Vulnerable
Stagonopleura guttata	Diamond Firetail	Vulnerable
Dillwynia tenuifolia	*Dillwynia tenuifolia*	Vulnerable
Diuris aequalis	Doubletail Buttercup	Endangered
Acacia pubescens	Downy Wattle	Vulnerable
Microstrobos fitzgeraldii	Dwarf Mountain Pine	Endangered
Rhizanthella slateri	Eastern Australian Underground Orchid	Vulnerable
Miniopterus schreibersii oceanensis	Eastern Bentwing-bat	Vulnerable
Falsistrellus tasmaniensis	Eastern False Pipistrelle	Vulnerable
Mormopterus norfolkensis	Eastern Freetail-bat	Vulnerable
Cercartetus nanus	Eastern Pygmy-possum	Vulnerable
Epacris hamiltonii	*Epacris hamiltonii*	Endangered
Eucalyptus copulans	*Eucalyptus copulans*	Endangered
Eucalyptus sp. Howes Swamp Creek	*Eucalyptus* sp. Howes Swamp Creek	Endangered Ecological Community
Euphrasia bowdeniae	*Euphrasia bowdeniae*	Vulnerable
Grevillea evansiana	Evans Grevillea	Vulnerable
Lepidosperma evansianum	Evans Sedge	Vulnerable
Isopogon fletcheri	Fletcher's Drumstricks	Vulnerable
Acacia flocktoniae	Flockton Wattle	Vulnerable
Callocephalon fimbriatum	Gang-gang Cockatoo	Vulnerable
Mixophyes iteratus	Giant Barred Frog	Endangered
Heleioporus australiacus	Giant Burrowing Frog	Vulnerable

Petalura gigantea	Giant Dragonfly	Endangered
Calyptorhynchus lathami	Glossy Black-cockatoo	Vulnerable
Scoteanax rueppellii	Greater Broad-nosed Bat	Vulnerable
Litoria aurea	Green and Golden Bell Frog	Endangered
Pomatostomus temporalis temporalis	Grey-crowned Babbler (eastern subspecies)	Vulnerable
Pteropus poliocephalus	Grey-headed Flying-fox	Vulnerable
Melaleuca groveana	Grove's Paperbark	Vulnerable
Gyrostemon thesioides	*Gyrostemon thesioides*	Endangered
Persoonia hirsuta	Hairy Geebung	Endangered
Haloragodendron lucasii	Haloragodendron lucasii	Endangered
Melanodryas cucullata cucullata	Hooded Robin (south-eastern form)	Vulnerable
Hygrocybe anomala var. ianthinomarginata	*Hygrocybe anomala* var. *ianthinomarginata*	Vulnerable
Hygrocybe aurantipes	*Hygrocybe aurantipes*	Vulnerable
Hygrocybe reesiae	*Hygrocybe reesiae*	Vulnerable
Carex klaphakei	Klaphake's Sedge	Endangered
Phascolarctos cinereus	Koala	Vulnerable
Chalinolobus dwyeri	Large-eared Pied Bat	Vulnerable
Myotis adversus	Large-footed Myotis	Vulnerable
Leionema lachnaeoides	*Leionema lachnaeoides*	Endangered
Leucopogon fletcheri subsp. fletcheri	*Leucopogon fletcheri* subsp. *fletcheri*	Endangered
Litoria littlejohni	Littlejohn's Tree Frog	Vulnerable
Macquaria australasica	Macquarie perch	Vulnerable
Acacia bakeri	Marblewood	Vulnerable
Tyto novaehollandiae	Masked Owl	Vulnerable
Melaleuca sp. Megalong Valley	Megalong Valley Bottlebrush	Endangered
Montane Peatlands and Swamps of the New England Tableland, NSW North Coast, Sydney Basin, South East Corner, South Eastern Highlands and Australian Alps	Montane Peatlands and Swamps	Endangered Ecological Community

Grammitis stenophylla	Narrow-leaf Finger Fern	Endangered
Persoonia acerosa	Needle Geebung	Vulnerable
Newnes Plateau Shrub Swamp in the Sydney Basin Bioregion	Newnes Plateau Shrub Swamp in the Sydney Basin Bioregion	Endangered Ecological Community
Olearia cordata	*Olearia cordata*	Vulnerable
Macropus parma	Parma Wallaby	Vulnerable
Persoonia hindii	*Persoonia hindii*	Endangered
Ninox strenua	Powerful Owl	Vulnerable
Pultenaea sp. Genowlan Point	*Pultenaea* sp. Genowlan Point	Endangered
Pultenaea villifera - endangered population	*Pultenaea villifera* population in the Blue Mountains LGA	Endangered Population
Pseudophryne australis	Red-crowned Toadlet	Vulnerable
Xanthomyza phrygia	Regent Honeyeater	Endangered
River-Flat Eucalypt Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions	River-Flat Eucalypt Forest on Coastal Floodplains	Endangered Ecological Community
Varanus rosenbergi	Rosenberg's Goanna	Vulnerable
Leionema sympetalum	Rylstone Bell	Vulnerable
Shale/Sandstone Transition Forest	Shale/Sandstone Transition Forest	Endangered Ecological Community
Eucalyptus pulverulenta	Silver-leafed Gum	Vulnerable
Prasophyllum fuscum	Slaty Leek Orchid	Vulnerable
Caesia parviflora var. minor	Small Pale Grass-lily	Endangered
Pultenaea glabra	Smooth Bush-Pea	Vulnerable
Tyto tenebricosa	Sooty Owl	Vulnerable
Isoodon obesulus obesulus	Southern Brown Bandicoot (eastern)	Endangered
Epacris sparsa	Sparse Heath	Vulnerable
Pyrrholaemus sagittatus	Speckled Warbler	Vulnerable
Dasyurus maculatus	Spotted-tailed Quoll	Vulnerable
Lophoictinia isura	Square-tailed Kite	Vulnerable
Petaurus norfolcensis	Squirrel Glider	Vulnerable
Mixophyes balbus	Stuttering Barrred	Endangered

	Frog	
Sun Valley Cabbage Gum Forest in the Sydney Basin Bioregion	Sun Valley Cabbage Gum Forest in the Sydney Basin Bioregion	Endangered Ecological Community
Swamp oak floodplain forest of the NSW North Coast, Sydney Basin and South East Corner bioregions	Swamp oak floodplain forest	Endangered Ecological Community
Lathamus discolor	Swift Parrot	Endangered
Sydney Turpentine-Ironbark Forest	Sydney Turpentine-Ironbark Forest	Endangered Ecological Community
Astrotricha crassifolia	Thick-leaf Star-hair	Vulnerable
Maccullochella macquariensis	Trout cod	Endangered
Neophema pulchella	Turquoise Parrot	Vulnerable
Velleia perfoliata	*Velleia perfoliata*	Vulnerable
Zieria murphyi	Velvet Zieria	Vulnerable
Cynanchum elegans	White-flowered Wax Plant	Endangered
Xanthosia scopulicola	*Xanthosia scopulicola*	Vulnerable
Petaurus australis	Yellow-bellied Glider	Vulnerable
Zieria involucrata	*Zieria involucrata*	Endangered

BioNet search results Lithgow LGA (fauna)

Order	Family	Sci Name	Common Name	Agency	Threat	Count
Anura						
	Hylidae		Tree frogs			
		Litoria booroolongensis	Booroolong Frog	NP	E1	11
	Myobatrachidae		Terrestrial frogs			
		Pseudophryne australis	Red-Crowned Toadlet	NP	V	6
Falconiformes						
	Accipitridae					
		Lophoictinia isura	Square-tailed Kite	NP	V	5
Passeriformes						
	Climacteridae					
		Climacteris picumnus	Brown Treecreeper	NP	V	55
	Meliphagidae					
		Grantiella picta	Painted Honeyeater	NP	V	2
		Melithreptus gularis gularis		NP	V	11
		Xanthomyza phrygia	Regent Honeyeater	NP	E1	206
	Pardalotidae					
		Pyrrholaemus sagittatus		NP	V	5

Order	Family	Sci Name	Common Name	Agency	Threat	Count
	Passeridae					
		Stagonopleura guttata	Diamond Firetail	NP	V	42
	Petroicidae					
		Melanodryas cucullata	Hooded Robin	NP	V	27
	Pomatostomidae					
		Pomatostomus temporalis temporalis		NP	V	3
Psittaciformes						
	Cacatuidae					
		Calyptorhynchus lathami		NP	V	27
	Psittacidae					
		Lathamus discolor	Swift Parrot	AM	E1	5
		Lathamus discolor	Swift Parrot	NP	E1	29
		Neophema pulchella		AM	V	3
		Neophema pulchella		NP	V	16
Strigiformes						
	Strigidae					
		Ninox strenua		StateF	V	1
		Ninox connivens		NP	V	10
		Ninox strenua		NP	V	14
Perciformes						
	Percichthyidae		Australian Freshwater Basses, Australian Freshwater			
		Macquaria australasica	Macquarie Perch	AM	FV	1
		Macquaria australasica	Macquarie Perch	Fish	FV	6
Lepidoptera						
	Lycaenidae					
		Paralucia spinifera	Bathurst Copper Butterfly	NP	E1	38
Odonata						
	Petaluridae					
		Petalura gigantea		NP	E1	18
Chiroptera						
	Emballonuridae		Sheath-tail bats			
		Saccolaimus flaviventris	Yellow-bellied Sheathtail-bat	NP	V	2
	Molossidae		Mastiff bats			
		Mormopterus norfolkensis	Eastern Little Mastiff-bat	NP	V	3
	Pteropodidae		Fruit bats and Flying Foxes			
		Pteropus poliocephalus	Grey-headed Flying-fox	AM	V	1
	Vespertilionidae		Long-eared, Broad-nosed and other bats			
		Chalinolobus dwyeri	Large Pied Bat	NP	V	10
		Falsistrellus tasmaniensis	Great Pipistrelle	NP	V	20
		Miniopterus australis	Little Bent-wing Bat	NP	V	1
		Miniopterus schreibersii oceanensis		NP	V	11
		Scoteanax rueppellii	Greater Broad-nosed Bat	AM	V	3

Order	Family	Sci Name	Common Name	Agency	Threat	Count
		Scoteanax rueppellii	Greater Broad-nosed Bat	NP	V	5
Dasyuromorphia						
	Dasyuridae		Antechinus', Dunnarts and Quolls			
		Dasyurus maculatus	Tiger Quoll	AM	V	1
		Dasyurus viverrinus	Eastern Quoll	AM	E1	2
		Dasyurus maculatus	Tiger Quoll	NP	V	5
Diprotodonta						
	Macropodidae		Kangaroos and Wallabies			
		Petrogale penicillata	Brush-tailed Rock-wallaby	AM	E1	4
		Petrogale penicillata	Brush-tailed Rock-wallaby	NP	E1	10
	Petauridae		Possums, Gliders			
		Petaurus australis	Yellow-bellied Glider	NP	V	6
		Petaurus norfolcensis	Squirrel Glider	NP	V	6
	Phascolarctidae		Koala			
		Phascolarctos cinereus	Koala	AM	V	2
		Phascolarctos cinereus	Koala	NP	V	18
	Potoroidae		Bettongs, Potoroos			
		Aepyprymnus rufescens	Rufous Bettong	AM	V	1
		Bettongia penicillata	Brush-tailed Bettong	AM	E4	1
		Bettongia gaimardi	Tasmanian Bettong	NP	E4	1
Squamata						
	Elapidae		Front-fanged snakes			
		Hoplocephalus bungaroides	Broad-headed Snake	NP	E1	3
	Scincidae		Skinks			
		Eulamprus leuraensis		AM	E1	3
		Eulamprus leuraensis		NP	E1	14
	Varanidae		Monitors and Varanids			
		Varanus rosenbergi		NP	V	2

BioNet search results Lithgow LGA - flora

Order	Family	Sci Name	Common Name	Agency	Threat	Count
	Asteraceae					
		Calotis glandulosa		RBG	V	1
		Olearia cordata		RBG	V	1
		Olearia cordata		NP	V	1
	Celastraceae					
		Apatophyllum constablei		RBG	E1	7
		Apatophyllum constablei		NP	E1	9
	Dryopteridaceae					
		Lastreopsis hispida	Bristly Shield Fern	RBG	E1	1
	Fabaceae (Faboideae)					
		Pultenaea glabra		RBG	V	1
		Pultenaea glabra		NP	V	2

	Pulteneaea sp. 'Genowlan Point'		NP	E1	2
Fabaceae (Mimosoideae)					
	Acacia bynoeana	Bynoe's Wattle	RBG	E1	2
	Acacia clunies-rossiae	Kowmung Wattle	RBG	V	1
	Acacia flocktoniae		RBG	V	2
	Acacia bynoeana		NP	E1	1
	Acacia flocktoniae		NP	V	2
Haloragaceae					
	Haloragodendron lucasii		RBG	E1	5
	Haloragodendron lucasii		NP	E1	1
Lamiaceae					
	Prostanthera stricta		RBG	V	6
	Prostanthera cryptandroides		NP	V	11
	Prostanthera stricta		NP	V	13
Myrtaceae					
	Darwinia peduncularis		RBG	V	2
	Darwinia peduncularis		NP	V	2
	Eucalyptus cannonii		RBG	V	24
	Eucalyptus pulverulenta	Silver-leaved Gum	RBG	V	27
	Eucalyptus cannonii		NP	V	58
	Eucalyptus pulverulenta		NP	V	17
Orchidaceae					
	Prasophyllum fuscum	Slaty Leek Orchid	RBG	V	2
Proteaceae					
	Grevillea evansiana		RBG	V	1
	Grevillea obtusiflora		RBG	E1	4
	Grevillea evansiana		NP	V	8
	Persoonia acerosa		RBG	V	8
	Persoonia hindii		StateF	E1	11
	Persoonia hindii		RBG	E1	15
	Persoonia marginata		RBG	V	10
	Persoonia acerosa		NP	V	2
	Persoonia hindii		NP	E1	16
	Persoonia marginata		NP	V	10
Rutaceae					
	Asterolasia buxifolia		RBG	E1	2
	Asterolasia buxifolia		NP	E1	1
	Boronia deanei		RBG	V	3
	Boronia ruppii		RBG	E1	2
	Boronia deanei		NP	V	8
	Leionema sympetalum		NP	V	6
	Philotheca ericifolia		NP	V	1
Scrophulariaceae					
	Derwentia blakelyi		StateF	V	12

	Derwentia blakelyi		RBG	V	22
	Derwentia blakelyi		NP	V	2

DEH (EPBC) search result – Protected Matters Report for the Lithgow LGA.

Summary

Matters of National Environmental Significance

This part of the report summarises the matters of national environmental significance that may occur in, or may relate to, the area you nominated. Further information is available in the detail part of the report, which can be accessed by scrolling or following the links below. If you are proposing to undertake an activity that may have a significant impact on one or more matters of national environmental significance then you should consider the Administrative Guidelines on Significance - see http://www.deh.gov.au/epbc/assessmentsapprovals/guidelines/index.html.

World Heritage Properties:	1
National Heritage Places:	None
Wetlands of International Significance: **(Ramsar Sites)**	1
Commonwealth Marine Areas:	None
Threatened Ecological Communities:	2
Threatened Species:	48
Migratory Species:	8

Other Matters Protected by the EPBC Act

This part of the report summarises other matters protected under the Act that may relate to the area you nominated. Approval may be required for a proposed activity that significantly affects the environment on Commonwealth land, when the action is outside the Commonwealth land, or the environment anywhere when the action is taken on Commonwealth land. Approval may also be required for the Commonwealth or Commonwealth agencies proposing to take an action that is likely to have a significant impact on the environment anywhere.

The EPBC Act protects the environment on Commonwealth land, the environment from the actions taken on Commonwealth land, and the environment from actions taken by Commonwealth agencies. As heritage values of a place are part of the 'environment', these aspects of the EPBC Act protect the Commonwealth Heritage values of a Commonwealth Heritage place and the heritage values of a place on the Register of the National Estate. Information on the new heritage laws can be found at http://www.deh.gov.au/heritage/index.html.

Please note that the current dataset on Commonwealth land is not complete. Further information on Commonwealth land would need to be obtained from relevant sources including Commonwealth agencies, local agencies, and land tenure maps.

A permit may be required for activities in or on a Commonwealth area that may affect a member of a listed threatened species or ecological community, a member of a listed migratory species, whales and other cetaceans, or a member of a listed marine species. Information on EPBC Act permit requirements and application forms can be found at http://www.deh.gov.au/epbc/permits/index.html.

Commonwealth Lands:	6
Commonwealth Heritage Places:	None
Places on the RNE:	29
Listed Marine Species:	12
Whales and Other Cetaceans:	None
Critical Habitats:	None

Commonwealth Reserves:	None

Extra Information
This part of the report provides information that may also be relevant to the area you have nominated.

State and Territory Reserves:	5
Other Commonwealth Reserves:	None
Regional Forest Agreements:	1

World Heritage Properties [Dataset Information]	
The Greater Blue Mountains Area NSW	

Wetlands of International Significance [Dataset Information] (Ramsar Sites)	
MACQUARIE MARSHES NATURE RESERVE	Within same catchment as Ramsar site

Threatened Ecological Communities [Dataset Information]	Status	Type of Presence
Grassy White Box Woodlands	Endangered	Community may occur within area
Temperate Highland Peat Swamps on Sandstone	Endangered	Community known to occur within area

Threatened Species [Dataset Information]	Status	Type of Presence
Birds (highlighted species represent those not recorded within the State registries)		
Lathamus discolor Swift Parrot	Endangered	Species or species habitat may occur within area
Polytelis swainsonii Superb Parrot	Vulnerable	Species or species habitat may occur within area
Rostratula australis Australian Painted Snipe	Vulnerable	Species or species habitat may occur within area
Xanthomyza phrygia Regent Honeyeater	Endangered	Species or species habitat known to occur within area
Fishes		
*Maccullochella peelii peelii**** Murray Cod, Cod, Goodoo	Vulnerable	Species or species habitat may occur within area
Macquaria australasica * Macquarie Perch	Endangered	Species or species habitat may occur within area
Prototroctes maraena * Australian Grayling	Vulnerable	Species or species habitat likely to occur within area
Frogs		
Heleioporus australiacus * Giant Burrowing Frog	Vulnerable	Species or species habitat likely to occur within area
Litoria littlejohni * Littlejohn's Tree Frog, Heath Frog	Vulnerable	Species or species habitat likely to occur within area
Mixophyes balbus * Stuttering Frog, Southern Barred Frog (in Victoria)	Vulnerable	Species or species habitat likely to occur within area
Mixophyes iteratus * Southern Barred Frog, Giant Barred Frog	Endangered	Species or species habitat likely to occur within area
Insects		
Paralucia spinifera Bathurst Copper Butterfly, Purple Copper Butterfly,	Vulnerable	Species or species habitat likely to occur within area

Bathurst Copper, Bathurst Copper Wing, Bathurst-Lithgow Copper, Purple Copper		
Mammals		
Chalinolobus dwyeri Large-eared Pied Bat, Large Pied Bat	Vulnerable	Species or species habitat may occur within area
Dasyurus maculatus maculatus (SE mainland population) Spot-tailed Quoll, Spotted-tail Quoll, Tiger Quoll (southeastern mainland population)	Endangered	Species or species habitat likely to occur within area
Nyctophilus timoriensis (South-eastern form) Eastern Long-eared Bat	Vulnerable	Species or species habitat may occur within area
Petrogale penicillata Brush-tailed Rock-wallaby	Vulnerable	Species or species habitat may occur within area
Potorous tridactylus tridactylus Long-nosed Potoroo (SE mainland)	Vulnerable	Species or species habitat may occur within area
Pteropus poliocephalus Grey-headed Flying-fox	Vulnerable	Species or species habitat likely to occur within area
Reptiles		
Eulamprus leuraensis ***** Blue Mountains Water Skink	Endangered	Species or species habitat likely to occur within area
Hoplocephalus bungaroides ***** Broad-headed Snake	Vulnerable	Species or species habitat likely to occur within area
Plants (highlighted plants represent species not recorded within the State registries)		
Acacia bynoeana ***** Bynoe's Wattle, Tiny Wattle	Vulnerable	Species or species habitat likely to occur within area
Acacia flocktoniae *****	Vulnerable	Species or species habitat likely to occur within area
Acacia gordonii *****	Endangered	Species or species habitat likely to occur within area
Apatophyllum constablei	Endangered	Species or species habitat likely to occur within area
Boronia deanei ***** Deane's Boronia	Vulnerable	Species or species habitat likely to occur within area
Caladenia tessellata Thick-lipped Spider-orchid, Daddy Long-legs	Vulnerable	Species or species habitat likely to occur within area
Cryptostylis hunteriana Leafless Tongue-orchid	Vulnerable	Species or species habitat may occur within area
Cynanchum elegans White-flowered Wax Plant	Endangered	Species or species habitat likely to occur within area
Diuris aequalis Buttercup Doubletail	Vulnerable	Species or species habitat likely to occur within area
Eucalyptus cannonii Cannons / Capertee Stringybark	Vulnerable	Species or species habitat likely to occur within area
Eucalyptus pulverulenta Silver-leaved Mountain Gum, Silver-leaved Gum	Vulnerable	Species or species habitat likely to occur within area
Grevillea evansiana	Vulnerable	Species or species habitat likely to occur within area

Haloragodendron lucasii Hal	Endangered	Species or species habitat likely to occur within area
Isopogon fletcheri	Vulnerable	Species or species habitat likely to occur within area
Leionema lachnaeoides	Endangered	Species or species habitat likely to occur within area
Leionema sympetalum Rylstone Bell	Vulnerable	Species or species habitat likely to occur within area
Microtis angusii	Endangered	Species or species habitat likely to occur within area
Olearia cordata	Vulnerable	Species or species habitat likely to occur within area
Persoonia acerosa *****	Vulnerable	Species or species habitat likely to occur within area
Philotheca ericifolia *****	Vulnerable	Species or species habitat likely to occur within area
Pomaderris brunnea ***** Rufous Pomaderris	Vulnerable	Species or species habitat likely to occur within area
Prostanthera cryptandroides	Vulnerable	Species or species habitat likely to occur within area
Prostanthera stricta Mount Vincent Mintbush	Vulnerable	Species or species habitat likely to occur within area
Pultenaea campbellii New England Bush-pea	Vulnerable	Species or species habitat likely to occur within area
Pultenaea glabra Smooth Bush-pea, Swamp Bush-pea	Vulnerable	Species or species habitat likely to occur within area
Pultenaea sp. Genowlan Point Genowlan Point Pultenaea	Critically Endangered	Species or species habitat known to occur within area
Thesium australe Austral Toadflax, Toadflax	Vulnerable	Species or species habitat likely to occur within area
Wollemia nobilis ***** Wollemi Pine	Endangered	Species or species habitat likely to occur within area

Migratory Species [Dataset Information]	Status	Type of Presence
Migratory Terrestrial Species		
Birds		
Haliaeetus leucogaster White-bellied Sea-Eagle	Migratory	Species or species habitat likely to occur within area
Hirundapus caudacutus White-throated Needletail	Migratory	Species or species habitat may occur within area
Monarcha melanopsis Black-faced Monarch	Migratory	Breeding may occur within area
Myiagra cyanoleuca Satin Flycatcher	Migratory	Breeding likely to occur within area
Rhipidura rufifrons Rufous Fantail	Migratory	Breeding may occur within area
Xanthomyza phrygia Regent Honeyeater	Migratory	Species or species habitat known to occur within area

Migratory Wetland Species

Birds		
Gallinago hardwickii Latham's Snipe, Japanese Snipe	Migratory	Species or species habitat may occur within area
Rostratula benghalensis s. lat. Painted Snipe	Migratory	Species or species habitat may occur within area

Other Matters Protected by the EPBC Act

Listed Marine Species [Dataset Information]	Status	Type of Presence
Birds		
Apus pacificus Fork-tailed Swift	Listed - overfly marine area	Species or species habitat may occur within area
Ardea alba Great Egret, White Egret	Listed - overfly marine area	Species or species habitat may occur within area
Ardea ibis Cattle Egret	Listed - overfly marine area	Species or species habitat may occur within area
Gallinago hardwickii Latham's Snipe, Japanese Snipe	Listed - overfly marine area	Species or species habitat may occur within area
Haliaeetus leucogaster White-bellied Sea-Eagle	Listed	Species or species habitat likely to occur within area
Hirundapus caudacutus White-throated Needletail	Listed - overfly marine area	Species or species habitat may occur within area
Lathamus discolor Swift Parrot	Listed - overfly marine area	Species or species habitat may occur within area
Merops ornatus Rainbow Bee-eater	Listed - overfly marine area	Species or species habitat may occur within area
Monarcha melanopsis Black-faced Monarch	Listed - overfly marine area	Breeding may occur within area
Myiagra cyanoleuca Satin Flycatcher	Listed - overfly marine area	Breeding likely to occur within area
Rhipidura rufifrons Rufous Fantail	Listed - overfly marine area	Breeding may occur within area
Rostratula benghalensis s. lat. Painted Snipe	Listed - overfly marine area	Species or species habitat may occur within area

Commonwealth Lands [Dataset Information]

Commonwealth Bank of Australia

Commonwealth Trading Bank of Australia

Communications, Information Technology and the Arts - Telstra Corporation Limited

Defence

Defence - Defence Housing Authority

Unknown

Places on the RNE [Dataset Information]
Note that not all Indigenous sites may be listed.

Historic

Australian Arms Inn (former) Group NSW

Ben Avon NSW

Coke Ovens at Newnes Shale Oil Plant NSW

Collits Cemetery NSW

Collits Inn NSW

Coxs River Rail Bridge at Wallerawang (former) NSW

Great Zig Zag Railway NSW

Hartley Courthouse (former) NSW

Hartley Historic Site NSW

Lithgow Small Arms Factory NSW

Middle River Rail Bridge at Marrangaroo NSW

Newnes Shale Mine Site NSW

Presbyterian Church Group NSW

Royal Hotel (former) NSW

Rydal Railway Station NSW

Somerset House NSW

St Bernards Catholic Church Group NSW

St Bernards Presbytery NSW

St John the Evangelist Church NSW

Tarana Schoolhouse (former) NSW

Indigenous

Capertee Area NSW

Waratah Ridge Area NSW

Natural

Blue Mountains National Park (1980 boundary) NSW

Coco Creek Geological Site NSW

Evans Crown Nature Reserve (1977 boundary) NSW

Mudgee Overpass Road Cutting NSW

Pantoneys Crown Nature Reserve NSW

Winburndale Nature Reserve (1977 boundary) NSW

Wollemi National Park (1980 boundary) NSW

Extra Information

State and Territory Reserves [Dataset Information]

Blue Mountains National Park, NSW

Evans Crown Nature Reserve, NSW

Gardens of Stone National Park, NSW

Winburndale Nature Reserve, NSW

Wollemi National Park, NSW

Regional Forest Agreements [Dataset Information]
Note that all RFA areas including those still under consideration have been included.

Lower North East NSW RFA, New South Wales

APPENDIX 5

Air Quality and Greenhouse Gas Emission Assessment

HEGGIES

REPORT 10-5070-R1
Revision 3

Baal Bone Colliery
Ventilation Shaft Installation and Operation
Air Quality Impact Assessment

PREPARED FOR
Umwelt (Australia) Pty Ltd
2/20 The Boulevard
TORONTO NSW 2238

4 JUNE 2007

Baal Bone Colliery
Ventilation Shaft Installation and Operation
Air Quality Impact Assessment

PREPARED BY:

Heggies Pty Ltd
ABN 29 001 584 612
2 Lincoln Street Lane Cove NSW 2066 Australia
(PO Box 176 Lane Cove NSW 1595 Australia)
Telephone 61 2 9427 8100 Facsimile 61 2 9427 8200
Email sydney@heggies.com Web www.heggies.com

DOCUMENT CONTROL

Reference	Status	Date	Prepared	Checked	Authorised
10-5070-R1	Revision 3	4 June 2007	Scott Fishwick	Damon Roddis	Damon Roddis
10-5070-R1	Revision 2	30 May 2007	Scott Fishwick	Damon Roddis	Damon Roddis
10-5070-R1	Revision 1	17 April 2007	Scott Fishwick	Damon Roddis	Damon Roddis
10-5070-R1	Revision 0	10 April 2007	Scott Fishwick	Damon Roddis	Damon Roddis

EXECUTIVE SUMMARY

Heggies Pty Ltd has been commissioned by Umwelt (Australia) Pty Ltd on behalf of The Wallerawang Collieries Limited to conduct an assessment of the air quality impacts in relation to the construction and operation of a proposed ventilation shaft at the Baal Bone Colliery. The siting of the ventilation shaft is approximately 25 km north of Lithgow in the Central Tablelands of NSW. The shaft will provide ventilation for the extraction of the southeastern reserves (Longwalls 29-31).

For the purposes of assessing the potential air quality impacts of the proposed project, an estimate of background air quality parameters is required. Based on a range of available data**,** site-specific ambient air quality levels adopted for assessment purposes are as follows.

- Dust: An annual average ambient dust deposition level of the order of 1.7 g/m^2/month.
- TSP: An annual average concentration of the order of 29 $\mu g/m^3$.
- PM_{10}: A daily varying 24-hour average concentration and an annual average concentration of the order of 18 $\mu g/m^3$.
- Odour: Negligible.

Air quality goals consistent with the NSW Department of the Environment and Climate Change (DECC) document *Approved Methods for the Modelling and Assessment of Air Pollutants in NSW*, (DECC, 2005) have been applied to the project.

Meteorological observations have been sourced from the Mt Piper Power Station Automatic Weather Station. Additionally, the Air Pollution Model (TAPM) software was used to simulate indirect meteorological observations, while retaining direct wind speed and direction observations from Mt Piper Power Station.

A review has been carried out of activities with potential to generate significant emissions to atmosphere expected in the construction and operation of the ventilation shaft. Two scenarios were derived for modelling to reflect the construction and operational phases of the Project. The two scenarios aim to be representative of worst case conditions present during these phases and are as follows:

- Ventilation Shaft Construction - incorporates the establishment and construction of the ventilation shaft including excavation of collar and any pre-sink collar, stockpiling of excavated materials and drilling of ventilation shaft by a raised borer.
- Mining Operations – incorporates emissions from the operational ventilation shaft.

Atmospheric dispersion model predictions of atmospheric emissions (PM_{10}, dust deposition, and Odour) associated with the installation and operation of the ventilation shaft were undertaken using the Ausplume Gaussian Plume Dispersion Model software developed by EPA (Victoria). All modelling predictions indicate that particulate matter, dust deposition and odour attributable to the Project would be within the current DECC (and National Environmental Protection Measure) air quality goals at all surrounding residences.

A Greenhouse Gas Assessment of the Project predicts that the total annual emissions of CO_2-Equivalent as a result of the project are likely to be of the order of 16,489 t of CO_2-Equivalent per annum. A comparison of the predicted maximum emissions from the project with the 1990 estimate indicates that Project-related operations would represent an increase of approximately 0.0029% on the total baseline Australian emissions.

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1 INTRODUCTION

The Wallerawang Collieries Limited (hereafter, “the Proponent”) intends to continue their current underground mining operations at the Baal Bone Colliery, into the southeastern section of their lease area, to maintain their annual coal production capacity and prolong the life of their underground longwall mine by approximately three years.

To provide sufficient quantities of air to mine in this area, the Proponent plans to install a ventilation shaft approximately 4 km to the west of the Run-of-Mine (ROM) area of the mine.

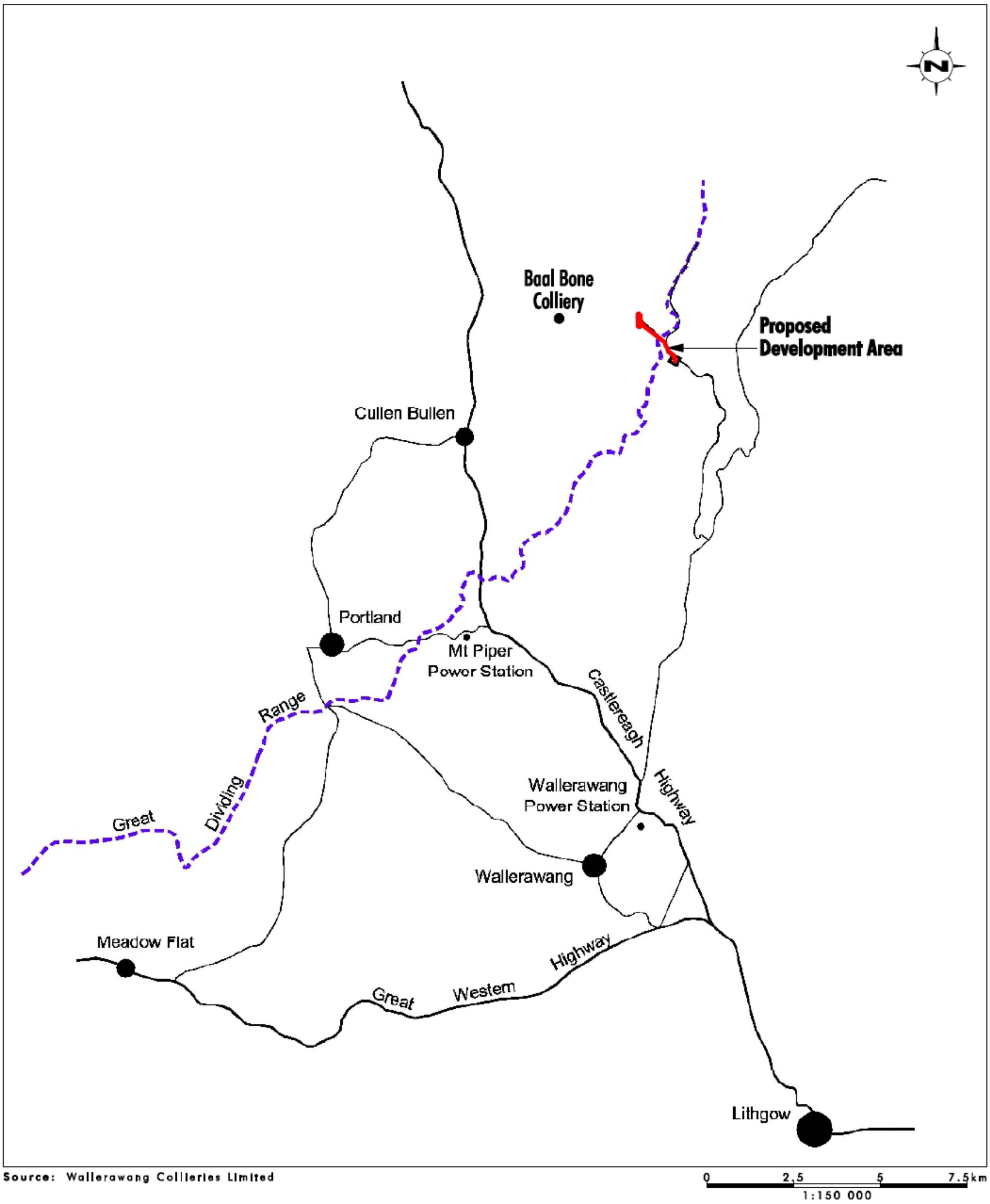
Heggies Pty Ltd (Heggies) has been commissioned by Umwelt (Australia) Pty Ltd (Umwelt) on behalf of the Proponent to conduct an assessment of the air quality impacts in relation to the construction and operation of the proposed ventilation shaft (hereafter, “the Project”).

The Project Site is located within the Ben Bullen State Forest, approximately 25 km north of Lithgow and 7 km east of Cullen Bullen, in the Central Tablelands region of NSW. **Figure 1** illustrates the regional setting of the Project Site (marked “Proposed Development Area”).

The Proponent commenced underground longwall mining at the Mine in 1985, while open cut mining on the site recommenced in February 2005. Approximately 2.4 million tonnes of saleable thermal and PCI quality coal is produced annually.

The continuation of the Mine’s underground operations to access the previously unmined southeastern reserves, known as Longwalls 29-31, will provide about 5 Mt of ROM coal over an anticipated period of approximately three years.

Figure 1 Regional Setting of the Project Site



2 PROJECT OVERVIEW

2.1 Project Description

The Project Site comprises two areas – a 50 x 50 metre within which the ventilation shaft and associated equipment will be located; and an approximate 1.7 km corridor for the purposes of power supply.

The Project is planned to comprise the following components:

- Topsoil clearing of a maximum 50 m x 50 m zone within the ventilation shaft area in order to account for both the shaft construction and subsequent fan installation;
- Excavation of a shaft collar and any pre-sink collar to a maximum depth of 11 m;
- Stockpiling of all cleared topsoil and spread of excavated material from the collar excavation on site;
- Construction of a 3.15 m diameter shaft to the required depth (approximately 220 m) by the raise bore method;
- Installation of a ventilation fan on the shaft;
- Installation of a power line from an existing source to the new shaft position. The method of power supply is expected to be one of aerial bundled cable (insulated cable) with minimal clearing and the possibility of limited underground cabling;
- Installation of a range of amenity facilities, including temporary office block, bunded diesel tanks, onsite power generator, workshop container and chemical toilet. These facilities will be removed at the completion of the ventilation shaft construction;
- Operation of ventilation shaft during underground mining campaign at Longwall 29-31 of the mine (approximately three years); and
- Following completion of mining campaign, dismantling and removal of the ventilation fan and power line corridor, and filling and sealing of the shaft. Both areas will then be rehabilitated.

2.2 Project Timing

The following timing for a range of components of the Project has been provided by the Proponent, as follows:

- Site Construction (All components expected to run 24 hours a day, 7 days a week);
  - Establishment and set up – 2 to 3 weeks;
  - Pilot hole and raise bore setup – 1.5 to 3 weeks;
  - Raise bore operations – 5 to 8 weeks;
  - Demobilisation – 1 week.
- Power line construction – concurrent with shaft construction;
- Fan installation and commissioning – 4 weeks; and
- Ventilation Shaft Operation – approximately three years.

Duration of the construction phase from preliminary site works to fan commissioning is expected to be approximately 20 weeks, subject to site conditions.

2.3 Local Setting and Nearby Receptors

As discussed in **Section 1**, the Project Site is located within the Ben Bullen State Forest, approximately 25 km north of Lithgow and 7 km east of Cullen Bullen, in the Central Tablelands region of NSW. While the surrounding area is dominated by dense bushland, there are some residences located to the east of the Project Site. **Figure 2** displays the local setting of the Project Site, illustrating the proximity of nearest residences and the township of Cullen Bullen.

It can be seen that the nearest potentially affected residence is R1, which is located 1,860 m from the Project Site. The locations of the three potentially affected residences are summarised in **Table 1**.

Figure 2 Local Setting of Project Site

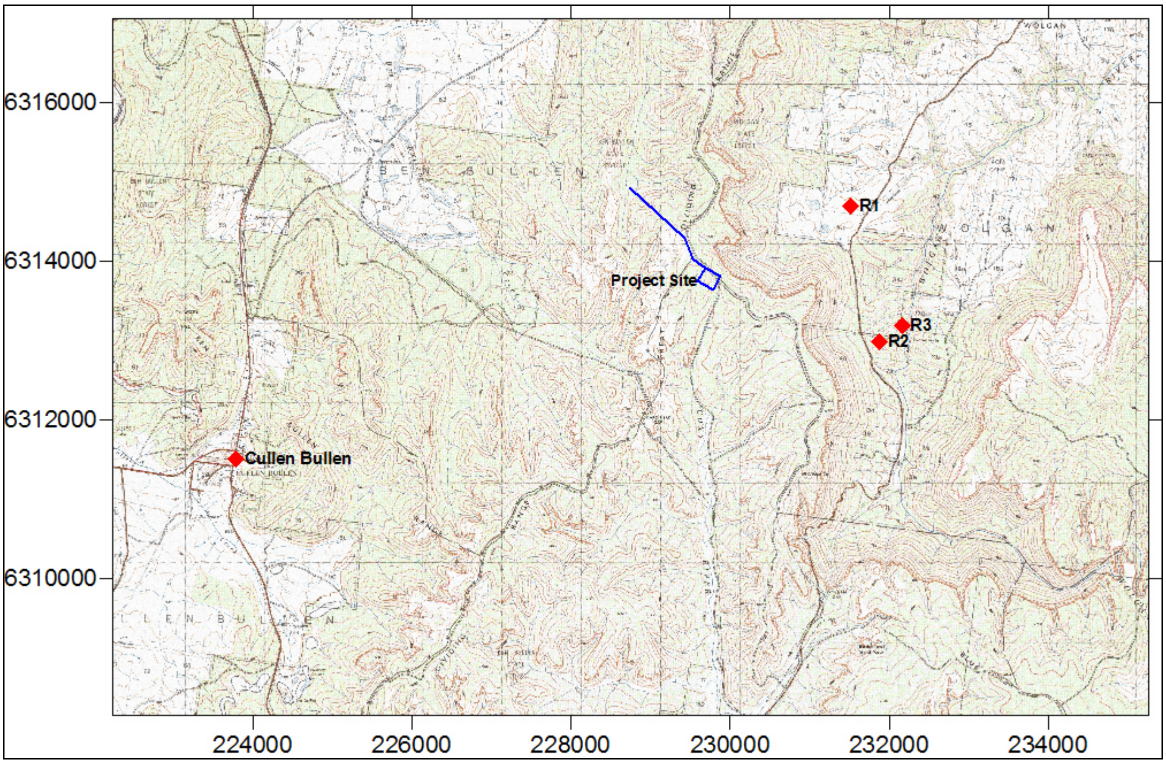


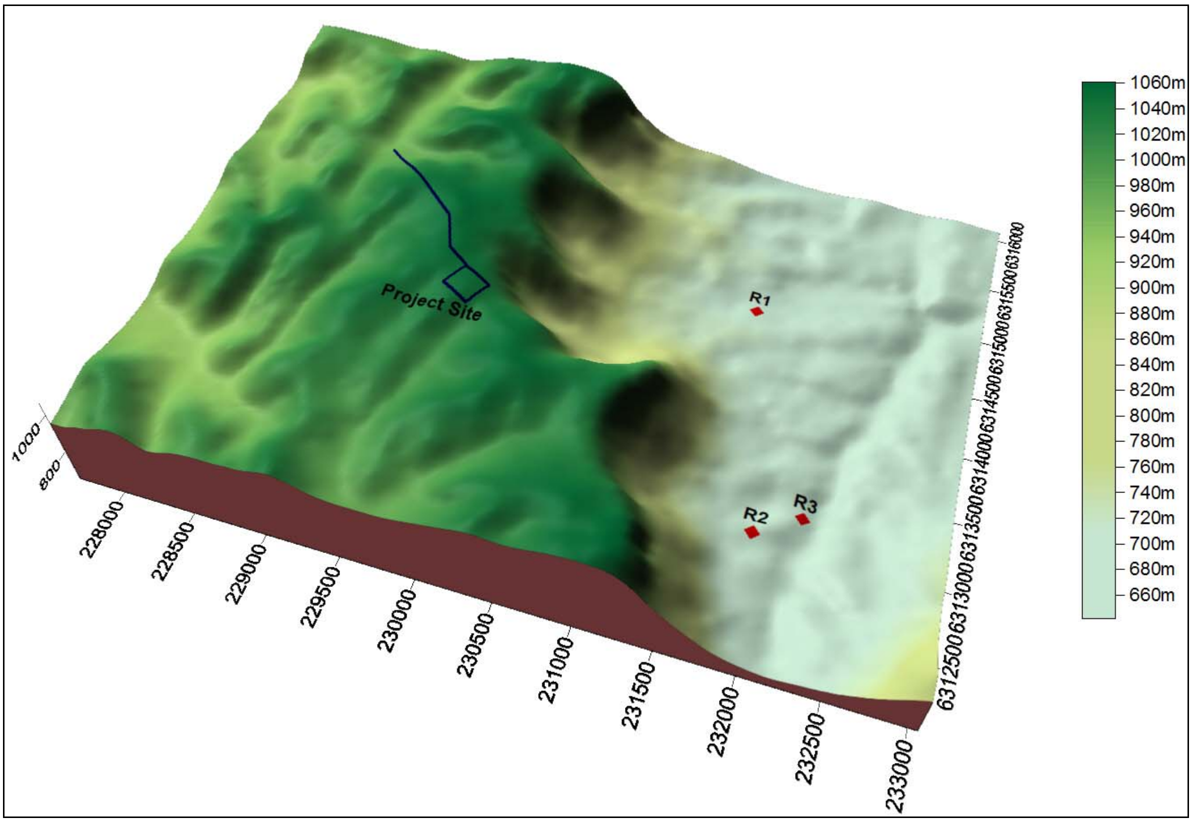
Table 1 Nearest Potentially Affected Residential Dwellings

Property ID	Distance and Direction to Project Site (m) from Residence	Location (MGA)		Elevation (m AHD)
		Easting (m)	Northing (m)	
R1	1,860 - SW	231519	6314698	705
R2	2,170 - WNW	231881	6312983	700
R3	2,370 - WNW	232160	6313187	680

2.4 Project Site Topography

The topography surrounding the Project Site is quite complicated, located atop of a north-south oriented ridgeline of the Great Dividing Range. The Project Site sits at an elevation of between 1,040 m and 1,050 m AHD. To the east of the site, the topography decreases significantly to an elevation of approximately 700 m AHD. It is at this elevation that the three nearby residences are located. **Figure 3** represents a 3-dimensional view of the Project Site and surrounding topography.

Figure 3 3-Dimensional Representation of Local Topography



Note: Topography has Vertical Exaggeration of 2

3 EXISTING AIR QUALITY ENVIRONMENT

3.1 Background Dust Deposition Environment

Dust deposition monitoring has been conducted at four locations in the area surrounding the Baal Bone Colliery. Monthly dust deposition data for the period between January 2006 and December 2006 are presented in **Table 2.**

Table 2 Ambient Dust Deposition Monitoring Data, 2006 – Baal Bone Colliery

Month	Insoluble Solids ($g/m^2/month$)				Ash Residue ($g/m^2/month$)			
	DM1	**DM2**	**DM3**	**DM4**	**DM1**	**DM2**	**DM3**	**DM4**
January	N/D	3.9	1.6	1.5	N/D	2.4	0.9	0.9
February	N/D	0.7	1.5	0.3	N/D	0.5	0.8	0.2
March	N/D	1.2	0.9	0.8	N/D	0.7	0.5	0.4
April	1.5	1.7	0.7	1.5	0.8	1.1	0.5	0.7
May	0.6	1.3	1.2	1.0	0.3	0.8	0.7	0.6
June	0.7	1.7	4.5	1.4	0.5	1.3	1.3	1.1
July	0.2	0.9	0.4	0.5	0.2	0.8	0.4	0.5
August	0.5	0.5	0.7	0.5	0.2	0.3	0.4	0.3
September	0.3	0.8	0.8	0.8	0.2	0.5	0.5	0.6
October	0.3	0.8	0.8	0.8	0.2	0.5	0.5	0.6
November	0.5	0.6	0.6	0.6	0.3	0.4	0.4	0.4
December	0.8	3.4	3.0	1.3	0.7	1.6	1.3	0.9
Average	**1.0**	**1.7**	**1.4**	**0.9**	**0.5**	**1.0**	**0.7**	**0.6**

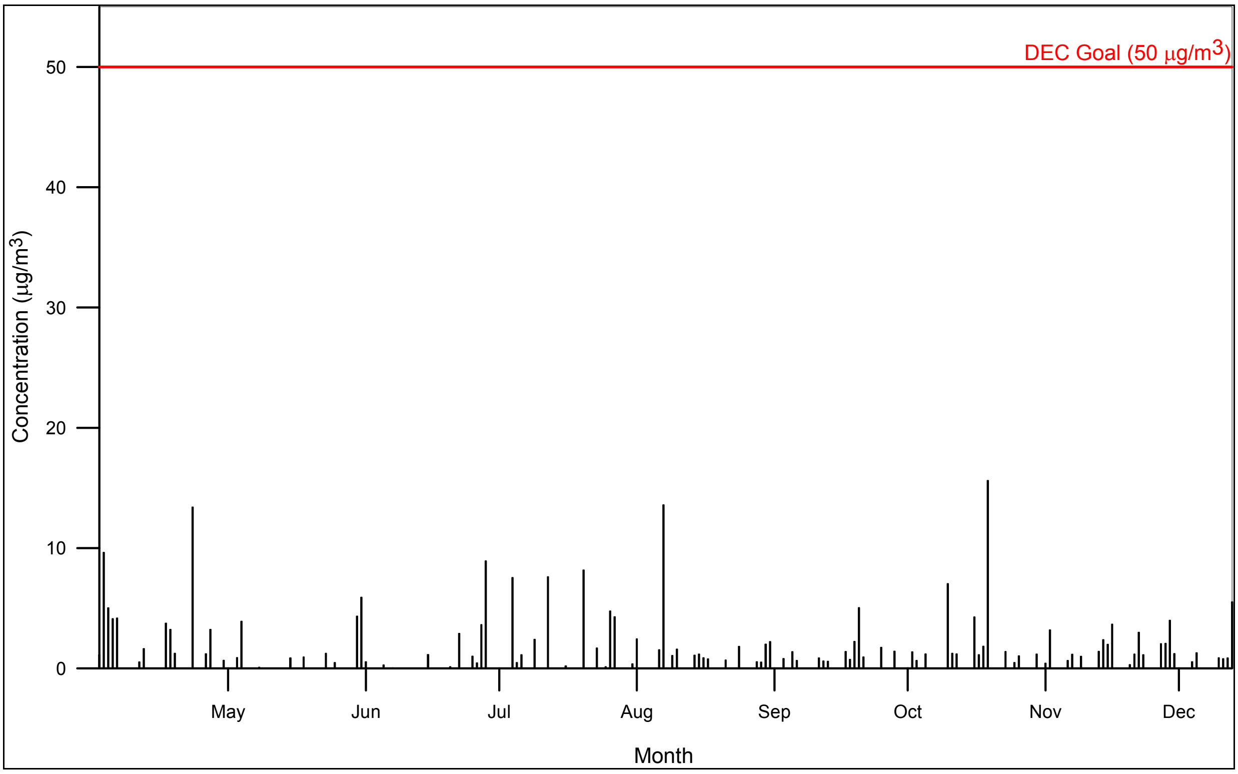
A conservatively high estimation of the ambient dust deposition rate at the Project Site for assessment purposes may therefore be assumed to be of the order of 1.7 $g/m^2/month$ expressed as an annual average. This is the maximum of all the annual average deposition rates from the four sites.

3.2 Ambient Particulate Matter Environment

The term *"particulate matter"* refers to a category of airborne particles typically less than 50 microns (μm) in diameter and ranging down to 0.1 μm in size. Particles less than 10 μm and 2.5 μm are referred to in this report as PM_{10} and $PM_{2.5}$ respectively.

PM_{10} monitoring has historically been undertaken by Connell Wagner, on behalf of Delta Electricity, in the area surrounding the Mt Piper Power Station, located approximately 10 km south of the Project Site (using a Low Volume Air Sampler (LVAS)). Data for the period 2 April 2001 to 31 December 2001 is presented in **Figure 4**.

Figure 4 Mount Piper Power Station LVAS 24 hour PM_{10} results (µg/m³), 2001.



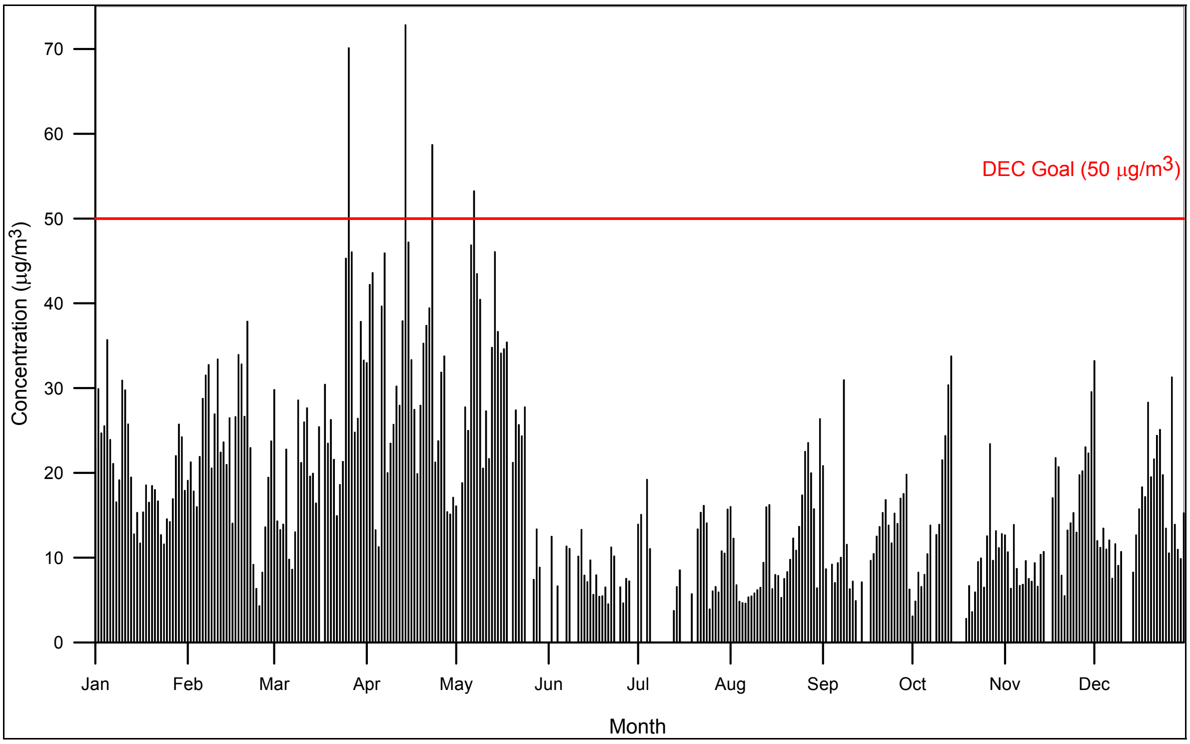
The above graph indicates that PM_{10} monitoring at Mt Piper Power Station yielded 24-hour average PM_{10} concentrations below the NSW Department of Environment and Climate Change (DECC) criterion of 50 µg/m³ expressed as a 24-hour average. The maximum 24-hour average was 16 µg/m³ on 19 October 2001. The annual average PM_{10} was determined to be 2 µg/m³, compared to the DECC goal of 30 µg/m³.

While the results provide an indication of the background concentration of PM_{10} in the area surrounding the Project Site, Section 5.1.1 of the DECC document *Approved Methods for the Modelling and Assessment of Air Pollutants in NSW* (DECC, 2005) (hereafter, "the AMMAAP") states that for Level 2 assessments, ambient monitoring data for at least one year of continuous measurements should be used in dispersion modelling. For this reason, and given the low level of data capture presented in **Figure 4**, the results have been compared with monitoring conducted at an alternative, similar location.

Data is available from the DECC's Tapered Element Oscillating Microbalance (TEOM) monitoring location in the Central West at Bathurst. This air quality monitoring site is located at the Sewage Treatment Plant, off Morrisset Street, Bathurst, located approximately 50 km west of the Project Site. It is noted that although Bathurst is the closest DECC monitoring site to the Project Site, it is considerably more built up than the area surrounding the Project Site. However, it is considered that the Bathurst monitoring data will provide a conservatively high estimate of background PM_{10} concentrations in the vicinity of the Project Site.

The 24-hour average PM_{10} concentrations for the period 1 January 2004 to 31 December 2004 are presented in **Figure 5**. This dataset is concurrent with the meteorological data set used in the atmospheric dispersion modelling conducted for this assessment.

Figure 5 NSW DECC PM_{10} (24-Hour Average) Monitoring Results for Bathurst, 2004



The results indicate that the highest 24-hour average PM_{10} concentration recorded at the DECC's Bathurst monitoring site was 73 µg/m^3, recorded on 14 April 2004. This is above the DECC goal of 50 µg/m^3. In addition to this exceedance, there were three further exceedances during this period, one in March, a further exceedance in April and one in May.

It is likely that these exceedances were as a result of an anomalous local event such as a dust storm or bushfire. However, in accordance with the AMMAAP, these values have been included in the assessment as it is appropriate to demonstrate that no additional exceedances of the impact assessment criteria will occur as a result of the proposed activity.

The annual average PM_{10} concentration for 2004, recorded at the DECC's Bathurst monitoring site was 18 µg/m^3. Comparing this to the annual average PM_{10} concentration of 2 µg/m^3 recorded at Mt Piper Power Station indicates that use of the Bathurst monitoring data in this assessment is highly conservative.

Total Suspended Particulate (TSP) monitoring data has been measured using a Tapered Element Oscillating Monitoring (TEOM) conducted by Connell Wagner PPI between April 2002 and December 2002. The unit was located at the Mt Piper Ash Disposal Area. Annual average TSP was determined to be 29 µg/m^3, compared with the National Health and Medical Research Council goal of 90 µg/m^3.

It is noted that the PM_{10} sub-set is typically 50% of total suspended particulate (TSP) in the ambient air of regions where road traffic is not the dominant particulate source, such as rural environments (USEPA, 2001). This is disparate from the Mt Piper Power Station recorded annual average PM_{10} concentration of 2 µg/m^3, however, is more comparable to the Bathurst PM_{10} annual average of 18 µg/m^3.

3.3 Odour Impacts

Underground mining of coal has the potential to generate odorous emissions within the exhaust flow from ventilation shafts. Odorous emissions are typically generated as a result of release of a combination of gases including coal bed methane during underground mining activities. Given the rural location of the project site, significant background odour has been assumed to be negligible.

3.4 Ambient Air Quality Environment for Assessment Purposes

For the purposes of assessing the potential air quality impacts from the Project, an estimation of ambient air quality levels is required. There is considerable discrepancy between PM_{10} monitoring in Bathurst and PM_{10} monitoring at Mt Piper Power Station. However, given the significantly low levels recorded at Mt Piper Power Station, the use of Bathurst monitoring data is considered a conservative estimate of background air quality surrounding the Project Site.

The site-specific ambient air quality levels adopted for this assessment are summarised in **Table 3**.

Table 3 Ambient Air Quality Environment for Assessment Purposes

Air Quality Parameter	Averaging Period	Assumed Background Ambient Level
TSP	Annual	29 µg/m^3
PM_{10}	24-Hour	Daily Varying
	Annual	18 µg/m^3
Dust Deposition	Annual	1.7 g/m^2/month
Odour	1-second (Nose Response)	Negligible

4 AIR QUALITY CRITERIA

4.1 Criteria Applicable to Particulate Matter Less than 10 Microns (PM_{10})

Emissions of PM_{10} and $PM_{2.5}$ are considered important pollutants in terms of impact due to their ability to penetrate into the respiratory system. In the case of the $PM_{2.5}$ category, recent health research has shown that this penetration can occur deep into the lungs. Potential adverse health impacts associated with exposure to PM_{10} and $PM_{2.5}$ include increased mortality from cardiovascular and respiratory diseases, chronic obstructive pulmonary disease and heart disease, and reduced lung capacity in asthmatic children.

One of the difficulties in dealing with air quality goals governing fine particles such as PM_{10} is that the medical community has not been able to establish a threshold value below which there are no adverse health impacts.

The DECC PM_{10} impact assessment goals, as expressed in the AMMAAP, are:

- a 24-hour maximum of 50 $\mu g/m^3$; and
- an annual average of 30 $\mu g/m^3$.

The 24-hour PM_{10} reporting standard of 50 $\mu g/m^3$ is numerically identical to the equivalent National Environment Protection Measure (NEPM) reporting standard except that the NEPM reporting standard allows for five exceedances per year. These NEPM goals were developed by the National Environmental Protection Council (NEPC) in 1998 to be achieved within 10 years of commencement.

4.2 Criteria Applicable to Total Suspended Particulate (TSP)

The annual goal for Total Suspended Particulate (or TSP) is given as 90 $\mu g/m^3$, as recommended by the National Health and Medical Research Council (NHMRC) at their 92nd session in October 1981. It was developed before the more recent results of epidemiological studies suggested a relationship between health impacts and exposure to PM_{10} concentrations.

It is noted that the PM_{10} sub-set is typically 50% of total suspended particulate (TSP) in the ambient air of regions where road traffic is not the dominant particulate source, such as the Project Site (USEPA, 2001). The TSP goal would therefore be consistent with an annual PM_{10} goal of approximately 45 $\mu g/m^3$ under these circumstances. Thus, the historical NHMRC goal may be regarded as less stringent than the newer DECC PM_{10} goal of 30$\mu g/m^3$ expressed as an annual average.

Therefore, as the annual TSP goal is seen to be achieved if the annual PM_{10} goal is satisfied, TSP has not been considered further in this report.

4.3 Nuisance Impacts of Fugitive Emissions

The preceding sections are concerned in large part with the health impacts of particulate matter. Nuisance impacts need also to be considered, mainly in relation to dust. In NSW, accepted practice regarding the nuisance impact of dust is that dust-related nuisance can be expected to impact on residential areas when annual average dust deposition levels exceed 4 g/m^2/month.

Table 4 presents the DECC impact assessment goals for dust fallout, showing the allowable increase in dust deposition level over the ambient (background) level which would be acceptable so that dust nuisance could be avoided.

Table 4 DECC Goals for Allowable Dust Deposition

Averaging Period	Maximum Increase in Deposited Dust Level	Maximum Total Deposited Dust Level
Annual	2g/m^2/month	4g/m^2/month

Source: AMMAAP, DECC 2005.

4.4 Goals Applicable to Odour Emissions

Impacts from odorous air contaminants are often nuisance-related rather than health-related. Odour performance criteria guide decisions on odour management, but are not specifically intended to achieve “no odour”. The detectability of an odour is a sensory property that refers to the theoretical minimum concentration that produces an olfactory response or sensation. This point is called the odour threshold and defines one odour unit per cubic metre (OU/m^3). Therefore, an odour criterion of less than 1 OU/m^3 would theoretically result in no odour impact being experienced.

In practice, the character of a particular odour can only be judged by the receiver’s reaction to it, and preferably only compared to another odour under similar social and regional conditions. Based on the literature available, the level at which an odour is perceived to be a nuisance can range from 2 OU/m^3 to 10 OU/m^3.

Odour performance criteria need to be designed to take into account the range in sensitivities to odours within the community, and provide additional protection for individuals with a heightened response to odours, using a statistical approach which depends on the size of the affected population. A summary of odour performance criteria for various population densities is shown in **Table 5**.

Table 5 DECC Odour Performance Criteria vs. Population Density

Population of Affected Community	Impact Assessment Criteria for complex mixtures of odorous air pollutants (OU)
Urban area ($\geq$~ 2000)	2.0
~500	3.0
~125	4.0
~30	5.0
~10	6.0
Single residence ($\leq$~2)	7.0

Source: AMMAAP, DECC 2005

The area surrounding the Project Site is primarily rural. It is assumed that the population that may potentially be affected by odour emissions associated with coal seam gases is between 10 and 30 people. Consequently, the project odour performance goal adopted for this assessment is:

- A maximum of 6.0 odour units per cubic metre (OU/m^3) expressed as a nose response average (1-second) value.

4.5 Project Air Quality Goals

In view of the foregoing, the air quality goals adopted for this assessment, which conform to current DECC air quality goals and other relevant air quality criteria, are summarised in **Table 6**.

Table 6 Project Air Quality Goals

Pollutant	Averaging Time	Maximum Concentration	Reference
PM_{10}	24 hours Annual	50 µg/m³ 30 µg/m³	DECC/NEPM
Dust Deposition	Annual	Incremental increase of 2 g/m^2/month	DECC
Odour	1-Second	6 OU/m^3	DECC

5 ATMOSPHERIC DISPERSION MODELLING

5.1 Methodology

The atmospheric dispersion modelling carried out in the present assessment utilises the Ausplume Gaussian Plume Dispersion Model software (Version 6.0) developed by the EPA, Victoria.

Ausplume is the approved dispersion model for use in the majority of applications in New South Wales. Default options specified in the Technical Users Manual (EPA Victoria, 2000) have been used, as per the AMMAAP.

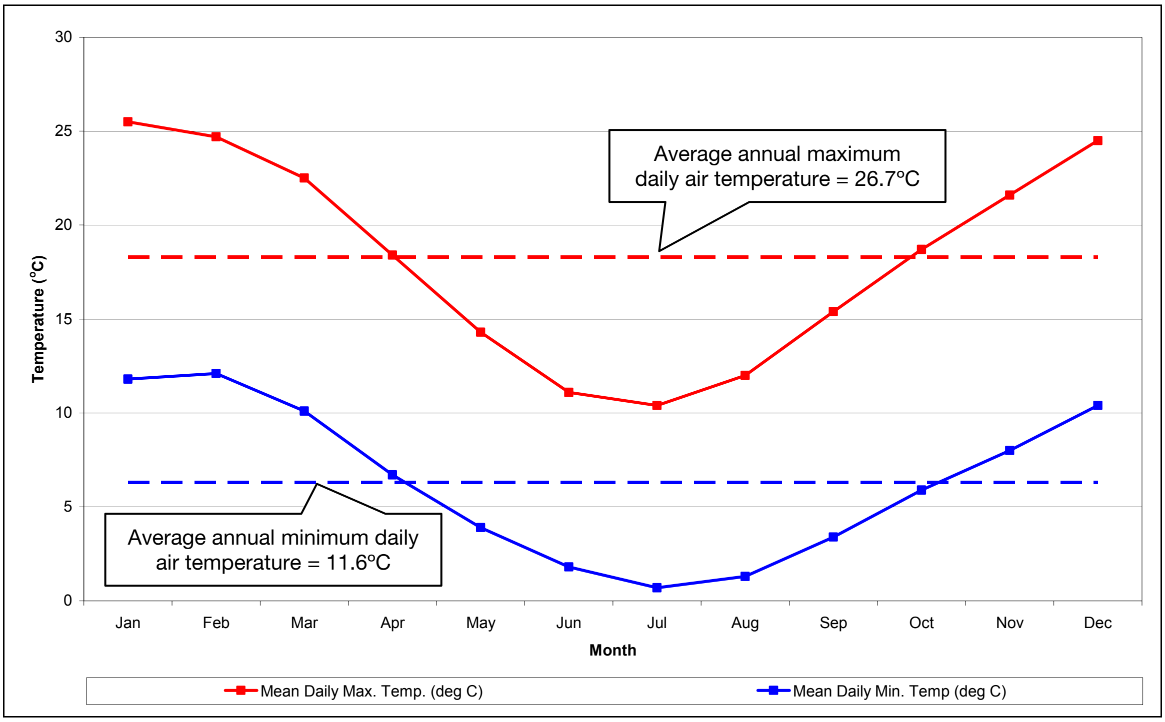
5.2 Regional Climate Averages

The nearest current Bureau of Meteorology (BoM) Automatic Weather Station (AWS) to the Project site is located at Birdwood Street, Lithgow, approximately 25 km to the southeast of the site. Climatic averages are available since records began in 1889. Full details of the climate averages for Birdwood Street are given in **Appendix A**.

5.2.1 Air Temperature

The monthly fluctuations in mean daily minimum and mean daily maximum temperatures at Birdwood Street AWS are shown in **Figure 6**.

Figure 6 Monthly Temperature Averages at Birdwood Street, Lithgow.



It can be seen **Figure 6** that the temperature in Lithgow may be described as mild in nature.

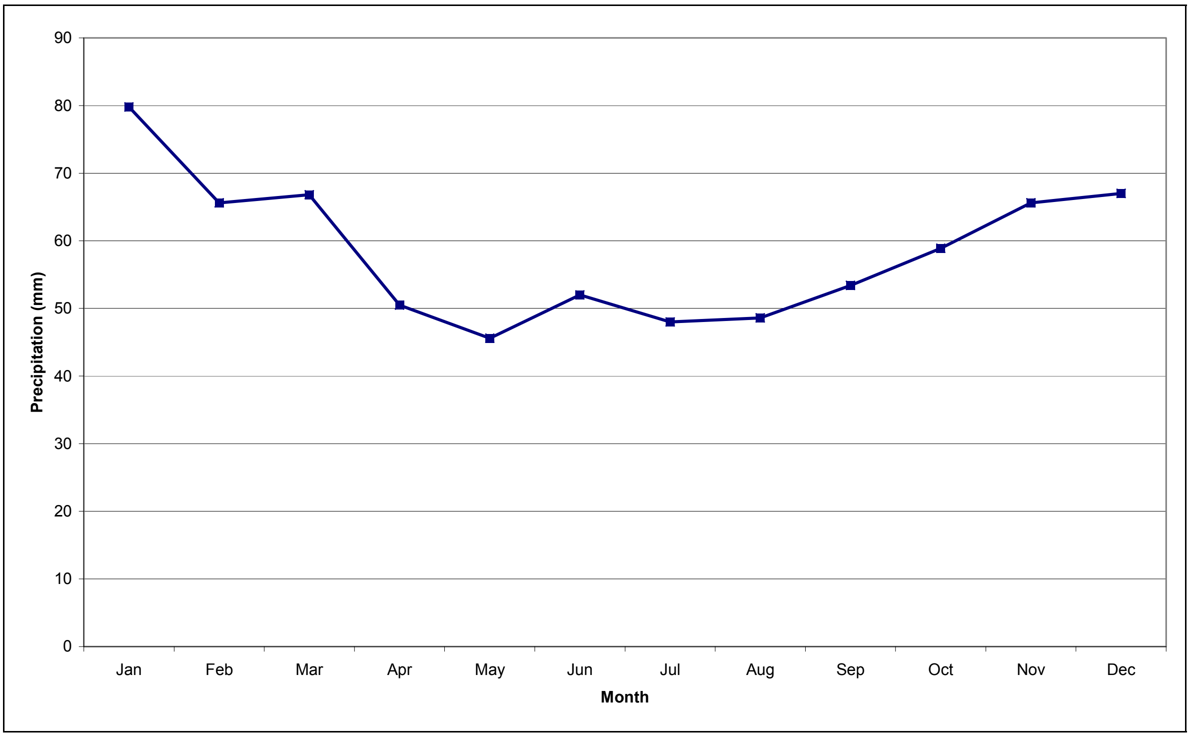
Air temperatures during the day tend to be mild to warm, varying from 11°C - 12°C in winter, to 24°C – 25°C in summer. Air temperatures during the night tend to be cool to mild, varying from 0°C – 1°C in winter to 10°C - 12°C in summer.

The average annual maximum daily air temperature is 18°C, and the average annual minimum daily air temperature is 6°C.

5.2.2 Rainfall

A graph displaying the median (5th decile) monthly rainfall at the Birdwood Street AWS is shown in **Figure 7**.

Figure 7 Median (5th decile) Monthly Rainfall Measurements, Birdwood Street, Lithgow



The rainfall experienced at the Lithgow can be described as moderate to light, with the area receiving, on average, approximately 860 mm per annum. Rainfall at Lithgow is relatively uniform in nature, with a decrease in rainfall during winter.

Rainfall has a significant effect on the way in which particles behave in the atmosphere, and hence the way in which pollution is dispersed. When rainfall occurs, pollutants are flushed out of the atmosphere quickly, thus reducing potential nuisance impacts, as well as those on health and visibility.

5.2.3 Relative Humidity

The relative humidity of Lithgow can be described as medium to high. The mean 9 am and 3 pm relative humidity is 70% and 55% respectively, with little variation occurring between seasons.

5.3 Dispersion Meteorology

5.3.1 Wind

Delta Electricity manages an AWS at their Mt Piper Power Station, located approximately 10 km south-southwest of the Project Site (the suitability of this site for meteorological data is discussed in **Section 5.3.2**). Data is available dating back to December 1993.

A comparison of the Annual Wind Roses for Mt Piper Power Station for 2000 to 2004 is given in **Appendix B**. These wind roses display occurrences of winds from all quadrants. Comparison of these wind roses indicates that light to moderate (between 1.5 m/s and 8 m/s) west to southwest winds are predominant at the Mt Piper Power Station across all five years.

A summary of the seasonal wind behaviour for 2004 at Mt Piper Power Station is given in **Appendix B**. The seasonal wind roses indicate that:

- In summer, light to moderate winds are experienced from the northeast and west to southwest quadrant.
- In autumn, light to moderate winds are experienced predominately from southwest and west-southwest.
- In winter, light to moderate winds are experienced from predominately from west to southwest quadrant.
- In spring, light (between 1.5 m/s and 5.5 m/s) are experienced from the west to southwest quadrant.

Following a review of the complete meteorological dataset, hourly observations collected between 1 January 2004 and 31 December 2004 have been utilised in this assessment. This data set is consistent with the background air quality data compiled for the assessment, and, based on the comparison of annual wind roses for the site, is considered to be representative of the meteorology likely to be experienced at the Mt Piper Power Station .

TAPM (The Air Pollution Model) developed by the Commonwealth Scientific and Industrial Research Organisation (CSIRO), is a prognostic model which may be used to predict three-dimensional meteorological data, with no local data inputs required.

The program allows the user to generate synthetic observations by referencing databases (covering terrain, vegetation and soil type, temperature and synoptic scale meteorological analyses) which are subsequently used in the model input to generate site-specific hourly meteorological observations. TAPM is often used where insufficient on-site meteorological data is available, and as such is considered suitable to predict indirect meteorological parameters in this assessment.

Thus, direct measurements obtained by the Mt Piper Power Station AWS (hourly average wind speed, wind direction and temperature) have been used in creating a meteorological input file for modelling purposes. Parameters not recorded by the AWS (atmospheric stability class, mixing height and sigma theta) but required by the meteorological input file have thus been synthetically generated using TAPM.

5.3.2 Suitability of Meteorological Data based on Regional Topography

As discussed in **Section 2.4**, the topography surrounding the Project Site is relatively complex due to the presence of the Great Dividing Range.

Figure 8 details a 3-dimensional view of the regional topography surrounding the Project Site, in particular highlighting the location of the Mt Piper Power Station AWS. It can be seen that a disparity in altitude exists between the two sites. The Mt Piper Power Station and the Project Site are at approximately 950 m AHD and 1040 m AHD respectively. Additionally, it can be seen in **Figure 8** that the topography between the two sites is relatively complex, making up a section of the Great Dividing Range. It could therefore be expected that variance in meteorology at the Mt Piper Power Station AWS and the Project Site may exist.

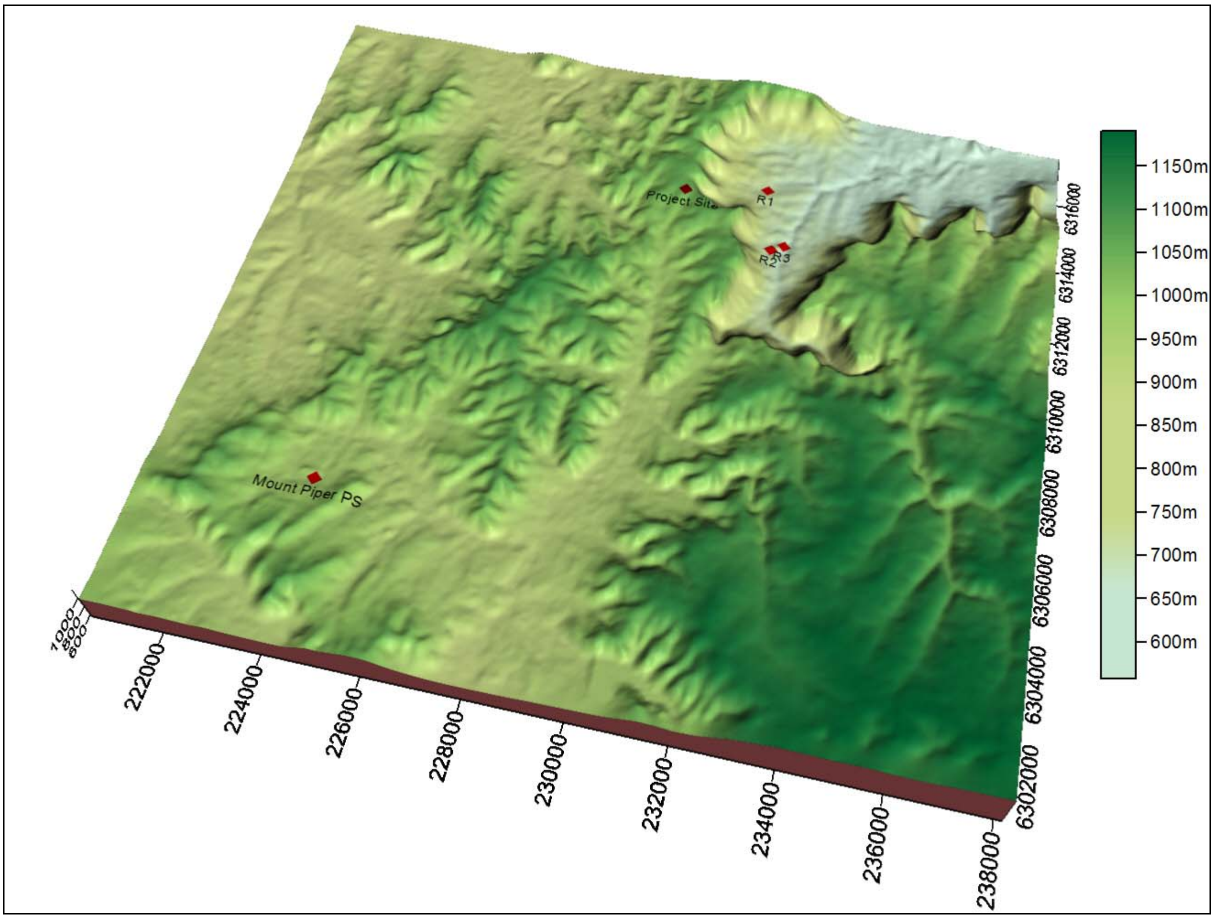
Despite these factors, the meteorological dataset recorded at the Mt Piper Power Station AWS is deemed to be the most suitable dataset available for the purpose of representing meteorological conditions present at the Project Site for a number of reasons.

Firstly, the Mt Piper Power Station AWS is the closest weather station to the Project Site, at a distance of 10 km. The nearest BoM AWS that records hourly meteorological observations is situated at Bathurst, approximately 45 km to the southwest of the Project Site.

Secondly, the predominant wind direction within the Mt Piper Power Station data set is favourable for predicting conservative worst case pollutant impacts at the nearest receptors. As discussed in **Section 5.3.1**, the predominant wind direction throughout the year at the Mt Piper Power Station AWS is from the west to south quadrant. Winds from this direction would present the most adverse conditions from an air quality perspective at the nearby residences, in particular at Receptor R1.

Finally, this predominant wind direction would help account for any geographically-forced winds that may be present at the Project Site. As detailed in **Section 2.4**, a significant difference in altitude exists between the Project Site and the nearby residences. This may result in the generation of phenomena such as night-time katabatic winds which may assist in the transfer of pollutants from the Project Site to the valley below. The predominant wind direction of the Mt Piper Power Station AWS data set (from the west to south quadrant) would incorporate any such winds at the Project Site.

Figure 8 3-Dimensional Regional Topography Surrounding Project Site



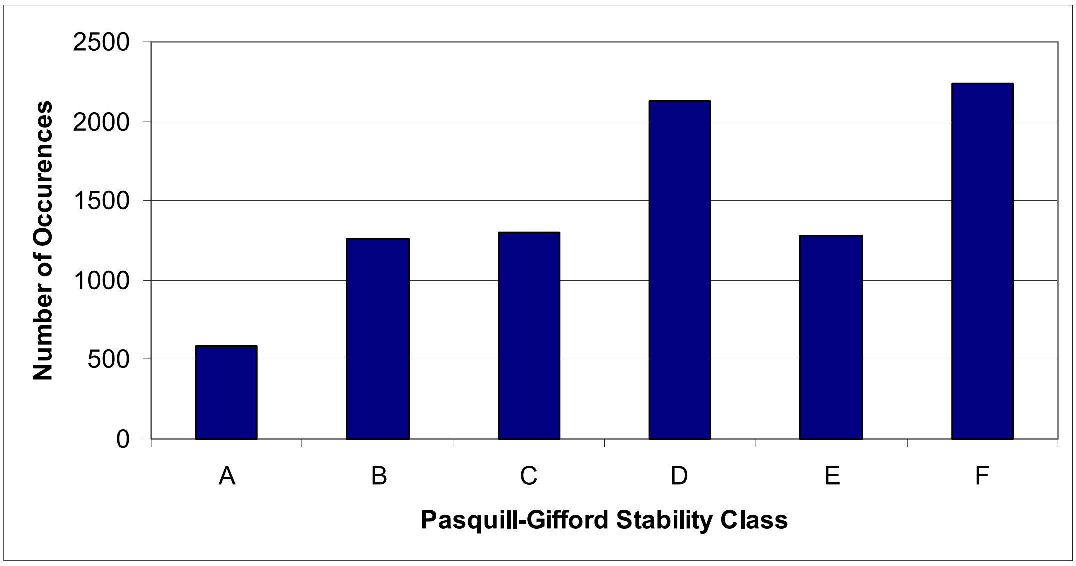
5.3.3 Atmospheric Stability

Atmospheric stability refers to the tendency of the atmosphere to resist or enhance vertical motion. The Pasquill-Gifford assignment scheme identifies six Stability Classes, “A” to “F”, to categorise the degree of atmospheric stability. These classes indicate the characteristics of the prevailing meteorological conditions.

Stability Class “A” represents highly unstable conditions that are typically found during summer, categorised by strong winds and convective conditions. Conversely, Stability Class “F” relates to highly stable conditions, typically associated with clear skies, light winds and the presence of a temperature inversion. Classes “B” through to “E” represent conditions intermediate to these extremes.

The frequency of occurrence of each Stability Class for the year 2004, as predicted by TAPM, is presented in **Figure 9**.

Figure 9 Annual Stability Class Distribution for the Project Site



The results indicate a high frequency of conditions typical to Stability Class “D” and “F”. Stability Class “D” is indicative of neutral conditions, which will neither enhance nor impede atmospheric pollutant dispersion. Stability Class “F” is indicative of stable conditions which represent very little turbulent mixing in the vertical. Under stable atmospheric conditions, pollutant plumes can extend for long distances downwind of the source but are diluted very little.

Appendix C illustrates the seasonal variation in atmospheric stability class at Mt Piper Power Station. This indicates that there is little variation in stability class distribution with season.

5.4 Regional and Project Site Topography

As discussed in **Section 2.4** and **Section 5.3.2**, the topography surrounding the Project Site is quite complicated due to the presence of the Great Dividing Range. It can be expected that this topography will have an influence on the dispersion of pollutants from the Project Site. Consequently, a terrain file incorporating these local topographical features has been included in the modelling

5.5 Modelling Scenarios

Two scenarios have been modelled to reflect the construction and operational phases of the Project. The two scenarios aim to be representative of worst case conditions present during these phases and are as follows:

- Ventilation Shaft Construction - incorporates the establishment and construction of the ventilation shaft including excavation of shaft collar and any pre-sink, stockpiling of excavated materials and drilling of ventilation shaft by a raised borer.

- Mining Operations – incorporates emissions from the operational ventilation shaft.

5.6 Emission Factors

A review has been carried out of the potentially particulate-generating activities expected at the Project Site. The following activities (where applicable) have been included in the particulate emissions inventory;

- Overburden extraction using an excavator.
- Drilling by raised borer.
- Wind erosion from excavated materials stockpile.
- Stack-source emissions from the operational ventilation shaft.

Table 7 presents the emission factors used for the key atmospheric pollutants used in the dispersion modelling carried out for this report. These relate to emissions expected under normal operating conditions. The proportion of the PM_{10} fraction for each activity was derived primarily from the National Pollutant Inventory document, *Emission Estimation Technique Manual for Mining, Version 2.3*, (hereafter, "EETMM") (Environment Australia, 2001).

The emission factor for "Excavator" has been derived in accordance with Table 1 of the EETMM using equations drawn from the United States Environment Protection Agency (USEPA) AP-42 documentation *Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources*, (USEPA, 2001). Default emission factors for drilling and wind erosion were derived in accordance with Table 1 of the EETMM.

Table 7 Particulate Emission Factors for Air Quality Dispersion Modelling

Activity	Total Particulate Emission Factor[1]	PM_{10} Emission Factor	Emission Factor Units
Excavator	0.0052	0.0025	kg/t
Drilling	0.59	0.31	kg/hole
Stockpile Wind Erosion	0.4	0.2	kg/ha/hour

Note 1: Total Particulate emission factor is used to derive the rate of dust deposition

5.7 Construction Phase Emission Inventory

Appendix D provides details of the emission inventory associated with the two modelling scenarios for the Project using the emission factors given in **Table 7**. The emission inventory has been derived to reflect the worst case scenario for airborne emissions over a 24 hour period, and mean average operational conditions for the annual assessment period.

The following assumptions were made in creating the emissions inventory for the Project.

- All components are assumed to be in operation for 24 hours a day, seven days a week. Excavation operations are assumed to occur for three weeks (21 days), while drilling is assumed to be conducted for 6 weeks (42 days).
- To simulate worst case emissions during the construction phase of the Project, it is assumed that the excavator and drilling operations are occurring concurrently. This is considered to be conservative.
- Based on a depth of 11 m and a diameter of 4.1 m, the total volume of extracted materials during the pre-sink works is assumed to be 145 m^3. Assuming a density of 1.8 t/m^3, the excavated materials from this component is expected to total 260 t.

- Based on an assumed height of 3 m and the above calculated volume, the stockpile of excavated materials is assumed to consist of sides 7 m in length.
- A moisture content of 8% has been assumed for the calculation of emissions from excavated materials.
- Due to the prescribed method for construction of the power supply corridor involving minimal clearing of vegetation and soil excavation, no emissions from this aspect of the Project have been included in the modelling assessment.
- There are anticipated to be periodic heavy vehicle movements during the construction phase of the Project, however due to the relatively low gross mass of these vehicles, no emissions from the movement of these trucks have been included in the modelling assessment.

5.8 Operation Phase Particulate Matter Emission Inventory

Particulate emissions from the ventilation shaft have been incorporated within the assessment. This stack source has been based on the measured emissions of PM_{10} associated with the ventilation shaft of an operational underground coal mine of annual coal production of 5.2 Mt (EML, 2005). As the underground mine component (Longwalls 29-31) that the ventilation shaft will service has an estimated maximum annual coal production rate of 1.7 Mt (based on 5 Mt of ROM coal extracted over three years), it is anticipated that potential PM_{10} impacts from this ventilation shaft may be conservatively assessed through the use of this data. Conservative estimations have been taken to be:

- an in-stack PM_{10} concentration of 1.6 mg/m^3;
- an exit velocity of the order of 10 m/s;
- an exit temperature of 293 K (20°C);
- a stack release height of the order of 4 m;
- a stack diameter of the order of 3.1 m; and
- a volumetric flow rate of the order of 77.9 m^3/s.

It is noted that the in-stack PM_{10} concentration adopted for this assessment corresponds to the measured in-stack total particulate matter concentration of the referenced coal mine. It is estimated that this will return a conservative prediction of air quality impacts of PM_{10} from the ventilation shaft.

5.9 Operation Phase Odour Emission Inventory

Odorous gases such as methane are created during the coal formation process. As coal is mined, these gases are released and transported to the surface via the ventilation shaft. To investigate potential odour impacts associated with the Project, an emissions assessment of this parameter has been conducted.

The assessment uses the Ausplume atmospheric dispersion model (Version 6.0) to assess impacts. The model has been used with a meteorological input file representative of the site (refer **Section 5.3**) and has utilised measured odour emissions associated with a ventilation shaft of an operational underground coal mine in NSW.

The AMMAAP states that Peak-to-Mean ratios should be incorporated when conducting atmospheric dispersion modelling of odour.

It is commonly recognised that dispersion models such as Ausplume need to be supplemented to accurately simulate atmospheric dispersion of odours. This is because the instantaneous perception of odours by the human nose typically occurs over a time scale of approximately one second but dispersion model predictions are typically valid for time scales equivalent to ten minutes to one hour averaging periods.

To estimate the effects of plume meandering and concentration fluctuations perceived by the human nose, it is possible to multiply dispersion model predictions by a correction factor called a "peak-to-mean ratio".

The peak to mean ratio (P/M60) is defined as the ratio of peak 1-second average concentrations to mean 1-hour average concentrations.

For screening purposes, a P/M60 ratio of 2.3 has been applied to the 1-hour average Ausplume model output. This value has been adopted to be conservative, and corresponds to the value recommended within Table 6.3 of the AMMAAP document, applicable to near/far field wake-affected point sources in flat terrain.

In lieu of site specific emissions data, the current assessment has been based on the measured odour emissions associated with the ventilation shaft of an operational underground coal mine of annual coal production of 5.2 Mt (EML, 2005). As discussed previously, the underground mine component that the ventilation shaft will be servicing has an estimated maximum annual coal production rate of 1.7 Mt, therefore it is anticipated that potential odour impacts may be conservatively assessed through the use of this data.

The odour impact analysis has thus assessed a stack source with exit parameters as described in **Section 5.8**, plus additionally.

- an in stack odour emission rate of 3,590 OU.m^3/s.

6 EMISSIONS ASSESSMENT

6.1 Dust Deposition

Table 8 shows the results of the Ausplume predictions for dust deposition from Scenario 1 (Construction Phase) of the Project, using the emission rates calculated in **Appendix D**, at each of the identified receptors.

The results show the mean average monthly dust deposition predicted at the nearest residences surrounding the Project Site over a one-year time frame. As detailed in **Section 3.1** the background level of dust deposition for the area surrounding the Project Site is taken as 1.8 g/m^2/month.

The results presented in **Table 8** indicate that the total mean monthly dust deposition (background plus increment) associated with the Project are predicted to be less than 2.1 g/m^2/month, at all the nearest residences. The predicted incremental increase in dust deposition is less than 2 g/m^2/month at the nearest residences.

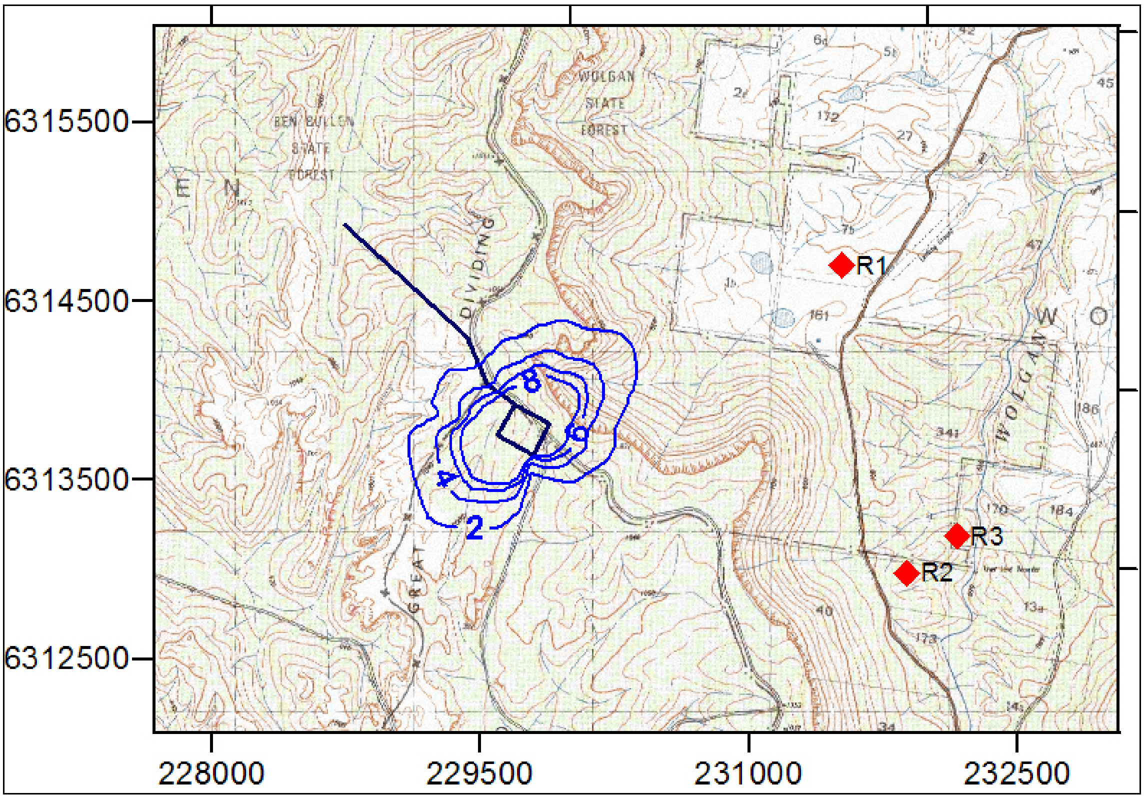
A contour plot of the incremental increase in dust deposition is presented in **Figure 10**. The contour plot is indicative of the levels of dust deposition that can be potentially reached under the conditions modelled.

As detailed in **Section 4.3**, dust deposition is a measure of fugitive emissions of dust, typically arising from wind and human-related disturbances of soil. As the Operational Phase of the Project focuses on the emissions from the Ventilation Shaft, dust deposition from this phase of the Project has not been assessed.

Table 8 Background and Incremental Dust Deposition at Nearest Residences – Scenario 1

Residence	Dust - Annual Average (g/m^2/month)			
	Background	**Increment**	**Background + Increment**	**Project Goal**
R1	1.7	0.4	2.1	4
R2	1.7	0.1	1.8	4
R3	1.7	0.2	1.9	4

Figure 10 Annual Average Dust Deposition Contours (g/m²/month) – Scenario 1



6.2 PM_{10} (24-Hour Average)

Table 9 shows the results of the Ausplume predictions for 24-hour average PM_{10} concentrations, using the emission rates calculated in **Appendix D**, at each of the identified receptors

As detailed in **Section 3.2**, it has been assumed that background levels of PM_{10} vary on a daily basis. These background levels have been incorporated into the model. However as noted previously, elevated PM_{10} concentrations within the background file already exceed the impact assessment criteria on four separate occasions.

In accordance with Section 5 of the AMMAAP, the purpose of this assessment is to demonstrate that no additional exceedances of the impact assessment criterion would occur as a result of the Project. Accordingly, the results in **Table 9** present the maximum (background plus increment) 24-hour average concentration of PM_{10} predicted at the residences surrounding the site, excluding the four days when the background already exceeds the DECC impact assessment criterion.

Similarly, a contour plot of the 5th highest 24-hour PM_{10} concentration (background plus increment) attributable to Scenario 1 (Construction Phase) and Scenario 2 (Operation Phase) of the Project are presented in **Figure 11** and **Figure 12** respectively.

As discussed in **Section 3.2**, the use of a daily-varying PM_{10} dataset recorded at Bathurst for the background concentrations at the Project Site is a conservative approach, however, even with the use of this data, the maximum 24-hour average concentration of PM_{10} associated with the construction and operation of the proposed ventilation shaft is predicted to be well below the DECC goal of 50 µg/m^3 at all residences. The maximum predicted ground-level concentrations are in the order of 47 µg/m^3 at all nearest residences. Modelling indicates an incremental increase of 1 µg/m^3 at R1 and zero at R2 and R3 during the construction phase, resulting in concentrations below the project goal. An incremental increase of 0.9 µg/m^3 was estimated during the operational phase at R1 and zero at R2 and R3, again resulting in 24-hour average concentrations below the project goal of 50 µg/m^3.

It should be noted that the varying background concentrations at each receptor shown in **Table 9** is due to the daily varying background dataset used in the modelling of operations at the Project Site.

Table 9 Background and Incremental 24-hour Average PM_{10} Concentrations at Nearest Residences

Residence	PM_{10} – 24-hour Average (µg/m^3)			
	Background	Increment	Background + Increment	Project Goal
Scenario 1 - Construction Phase				
R1	46.9	1.0	47.9	50
R2	47.2	0.0	47.2	50
R3	47.2	0.0	47.2	50
Scenario 2 - Operation Phase				
R1	46.9	0.9	47.8	50
R2	47.2	0.0	47.2	50
R3	47.2	0.0	47.2	50

Figure 11 Predicted 5th Highest 24-hour Average Ground Level Concentrations of PM_{10} (µg/m^3) – Scenario 1

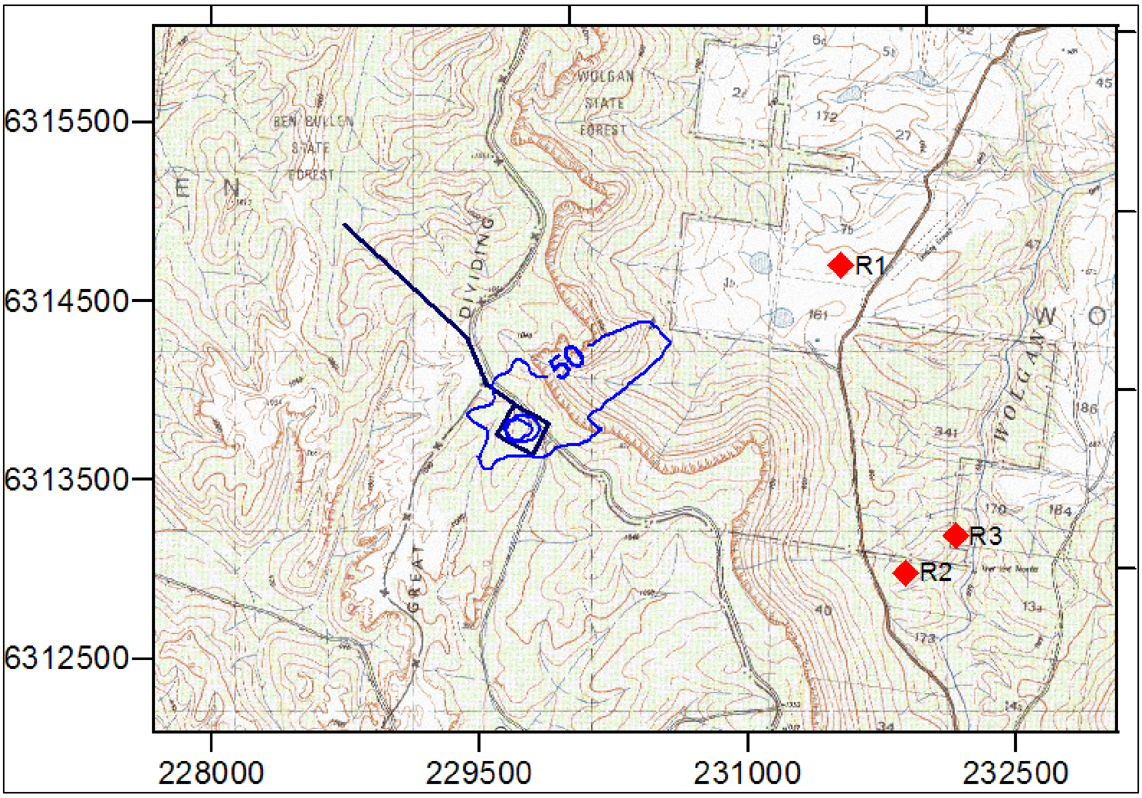
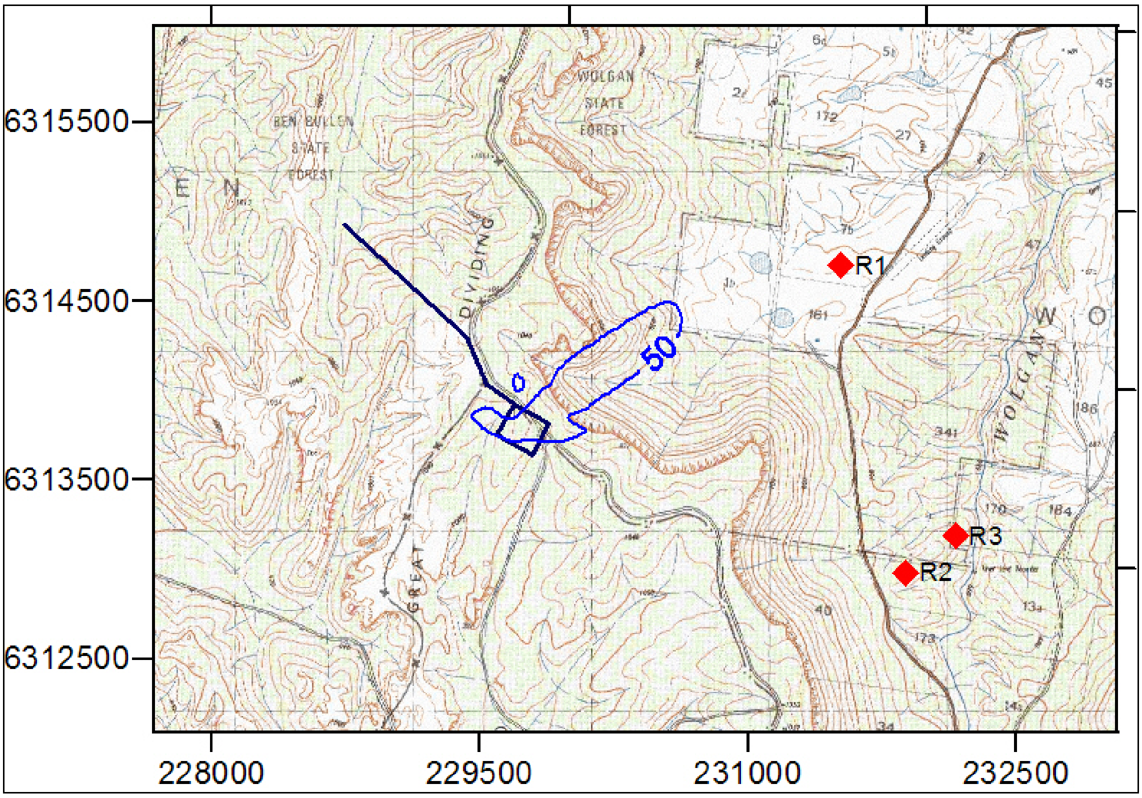


Figure 12 Predicted 5th Highest 24-hour Average Ground Level Concentrations of PM_{10} (µg/m³) – Scenario 2



6.3 PM_{10} (Annual Average)

Table 10 shows the results of the Ausplume predictions for annual average PM_{10} concentrations, using the emission rates calculated in **Appendix D**, at each of the identified receptors

As detailed in **Section 3.2** the annual average background concentration of PM_{10} assumed for the Project Site is 18 µg/m³. This background level has been incorporated into the model.

The results presented in **Table 10** indicate that annual average PM_{10} concentrations (background plus increment) associated with the Project are predicted to be below the project goal of 30 µg/m³ (annual average) at each residence.

A contour plot of the annual average PM_{10} concentrations (background plus increment) attributable to Scenario 1 and 2 of the Project are presented in **Figure 13** and **Figure 14** respectively.

Table 10 Annual Average PM_{10} Concentrations at Nearest Residences

Residence	PM_{10} – Annual Average (µg/m³)			
	Background	Increment	Background + Increment	Project Goal
Scenario 1				
R1	18	0.2	18.2	30
R2	18	0.2	18.2	30
R3	18	0.2	18.2	30
Scenario 2				
R1	18	0.4	18.4	30
R2	18	0.2	18.2	30
R3	18	0.2	18.2	30

Figure 13 Predicted Annual Average Ground Level Concentrations of PM_{10} (µg/m³) – Scenario 1

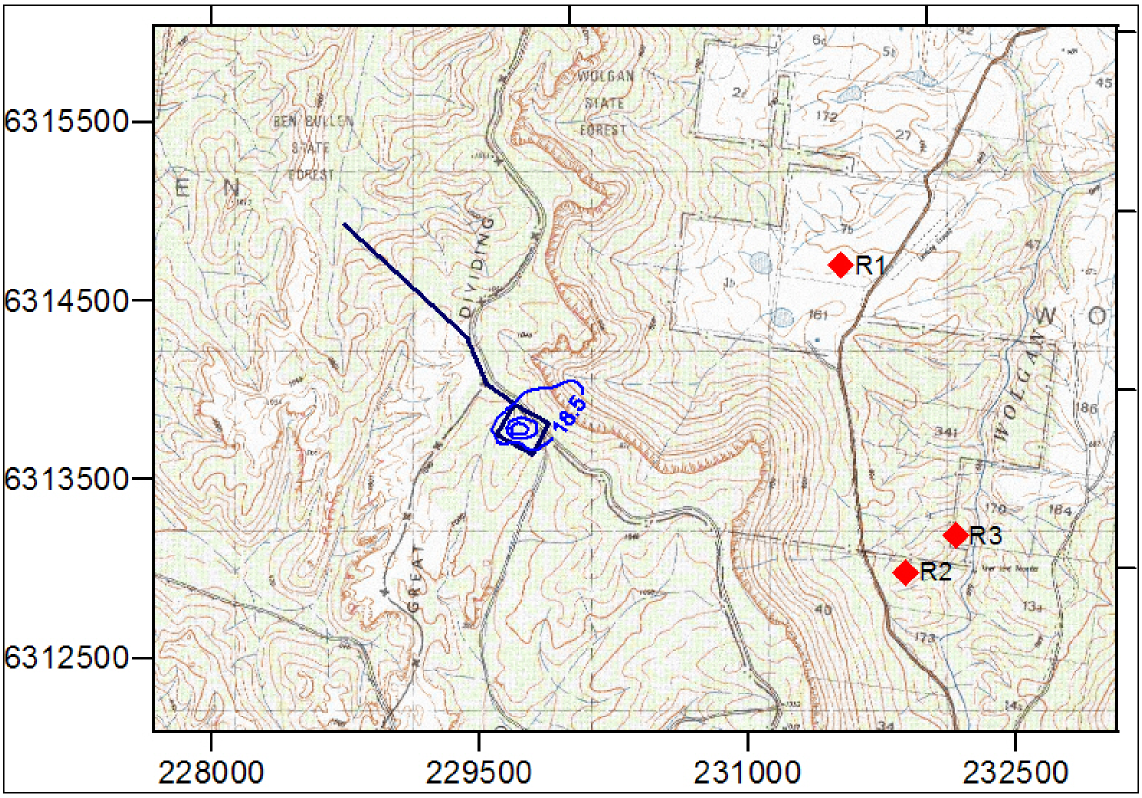
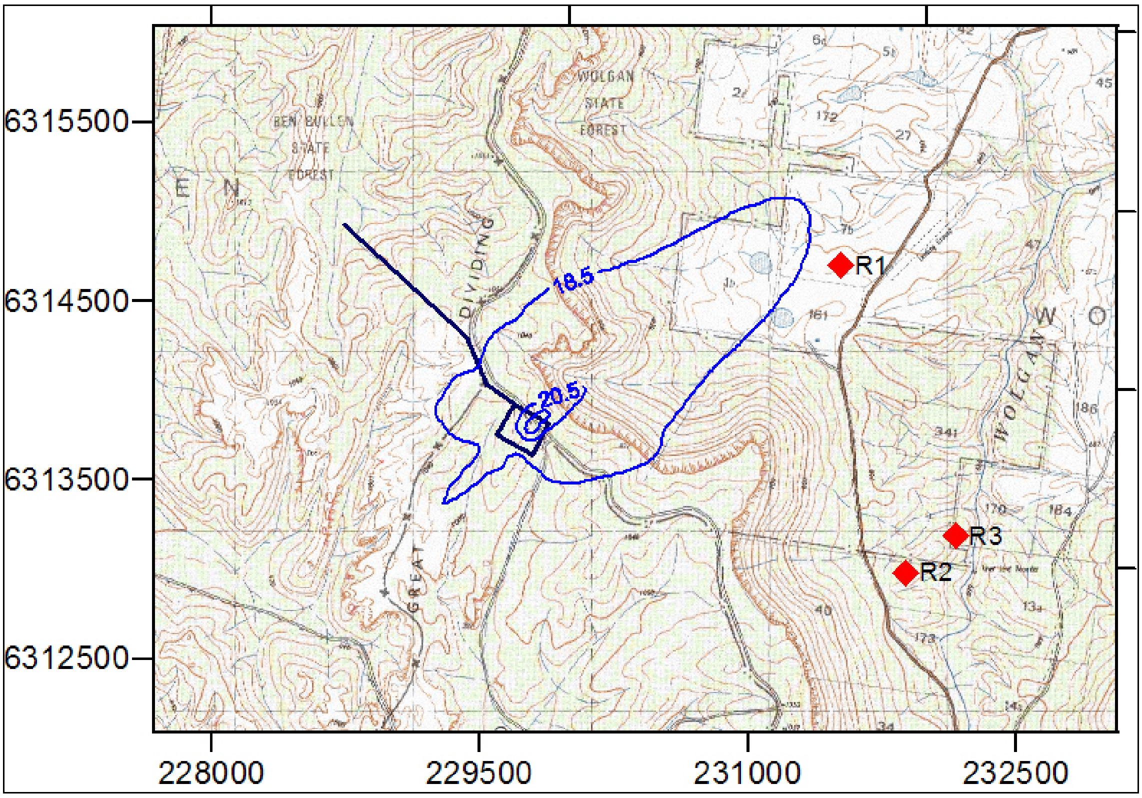


Figure 14 Predicted Annual Average Ground Level Concentrations of PM_{10} ($\mu g/m^3$) – Scenario 2



6.4 Odour Impact

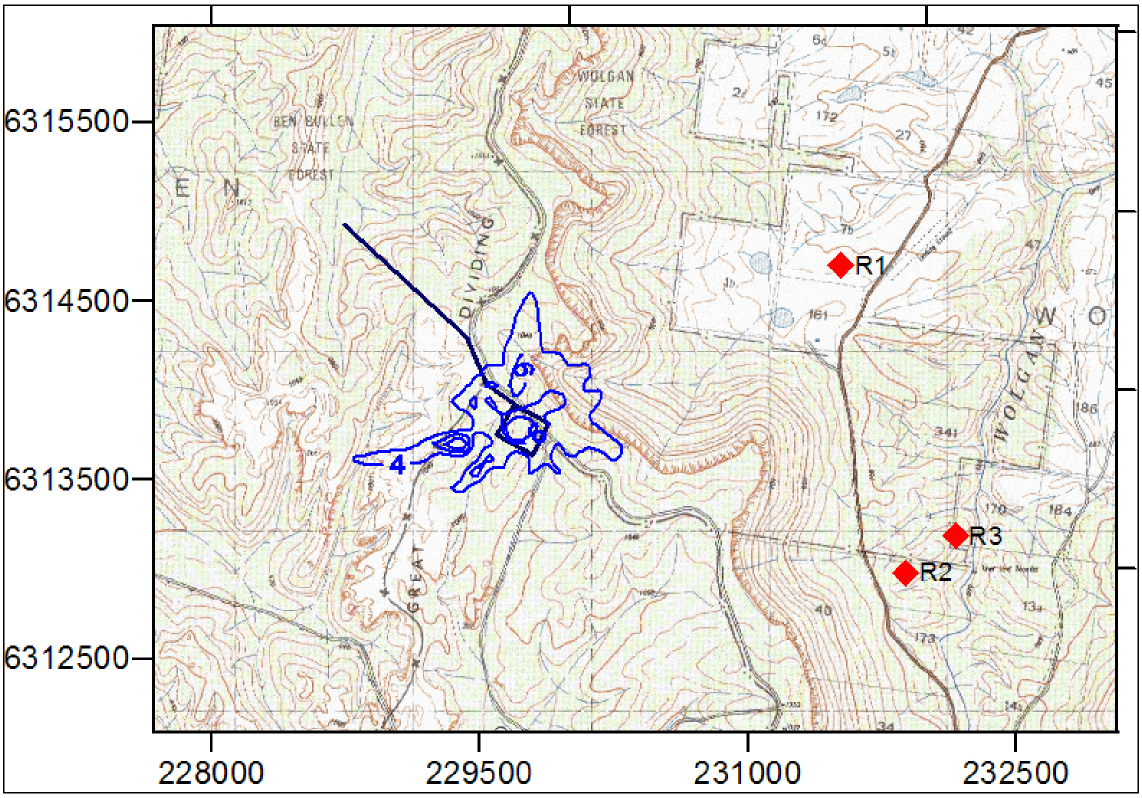
Table 11 shows the results of the Ausplume predictions for the maximum odour concentration attributable to Scenario 2 (Operation Phase) activities at each of the nearest receptors with peak-to-mean ratios applied, over a one year time frame.

The results presented in **Table 11** indicate that at all receptors, the predicted odour concentration associated with operation of the Ventilation Shaft do not exceed the project goal of 6.0 OU/m^3 (100^{th} percentile) expressed as a nose response average (1-second) value. A contour plot of the modelled maximum predicted 1-second average odour concentrations attributable to the Project is presented in **Figure 15**.

Table 11 Predicted Maximum Odour Concentrations at Nearest Receptors

Residence	Maximum (100^{th} percentile) (OU/m^3)	Project Goal
R1	1.4	6
R2	0.9	6
R3	0.8	6

Figure 15 Predicted Maximum (100th Percentile) Ground Level Concentrations of Odour (1-Second Average)



7 GREENHOUSE GAS ASSESSMENT

Planned operations at the Project Site have the potential to generate greenhouse gas emissions from a number of sources. This assessment of greenhouse gas emissions from the Project has been conducted in accordance with the methodologies established in a number of policies and guidelines, which are detailed in **Appendix E**. On-site greenhouse gas sources include the following.

- The combustion of fuel by diesel-powered equipment and vehicles during construction phase (Scope 1);
- Methane released from the mined coal (Scope 1); and
- The consumption of electricity during operational phase (Scope 2 and 3).

From this list, it should be noted that there are three greenhouse gas emission scopes, which are defined as follows:

- Scope 1 emissions are those which result from activities under a company's control or from sources which they own. (eg on-site generation of electricity, on-site transportation emissions)
- Scope 2 emissions are those which relate to the generation of purchased electricity consumed in its owned or controlled equipment or operations.
- Scope 3 emissions are defined as those which do not result from the activities of a company although arise from sources not owned or controlled by the company. (eg off-site transportation of purchased fuels, the use of sold products and services).

Carbon dioxide (CO_2) is produced during fuel combustion as a result of the oxidation of the fuel carbon content. CO_2 is likely to make the largest contribution to greenhouse gas emissions from fuel combustion as approximately 99% of automotive diesel oil (ADO) fuel is oxidised during the combustion process (AGO, 2006a).

Other greenhouse gases emitted as a result of mining operations at the Project Site may include carbon monoxide (CO), methane (CH_4), oxides of nitrogen (NO_X) and non-methane volatile organic compounds (NMVOCs). These are produced by the coal itself, incomplete fuel combustion, reactions between air and fuel constituents during fuel combustion, and post-combustion reactions. Fugitive emissions of NMVOCs may also be expected due to fuel evaporation.

In accordance with the Australian Greenhouse Office document *AGO Factors and Methods Workbook – December 2006* (AGO, 2006b) (hereafter AGO Workbook), the greenhouse gas emissions that are required for measurement from the Project are Direct (Scope 1) emissions relating to onsite fuel combustion and coal bed methane release, and Indirect (Scope 2) emissions resulting from the purchase and consumption of electricity. There are not envisaged to be any Indirect (Scope 3) emissions associated with the Project.

For comparative purposes, non-CO_2 greenhouse gases are awarded a "CO_2-equivalence" based on their contribution to the enhancement of the greenhouse effect. The CO_2-equivalence of a gas is calculated using an index called the Global Warming Potential (GWP). The GWPs for a variety of non-CO_2 greenhouse gases are contained within Table 23 of the AGO Workbook. The GWPs of relevance to this assessment are:

- **Methane (CH_4)**: GWP of 21 (21 times more effective as a greenhouse gas than CO_2); and
- **Nitrous Oxide (N_2O)**: GWP of 310 (310 times more effective as a greenhouse gas than CO_2).

The short-lived gases such as CO, NO_2, and NMVOCs vary spatially and it is consequently difficult to quantify their global radiative forcing impacts. For this reason, GWP values are generally not attributed to these gases nor have they been considered further as part of this assessment.

An assessment of the predicted greenhouse gas emissions from the operation of the Project Site has been undertaken for each of the aforementioned sources and is outlined below.

It is noted that the scope of this greenhouse gas assessment is to account for emissions directly related with the construction and operation of the Ventilation Shaft. The greenhouse gas emissions associated with the coal mined from Longwalls 29-31 will be addressed in a separate Review of Environmental Factors (Part 5 assessment under the EP&A Act).

7.1.1 Diesel Combustion

The primary fuel source for the mining equipment and vehicles would be ADO. Based on information supplied by the Proponent, the expected diesel consumption rate associated with construction and on-site electricity generation activities during the construction phase would be approximately 230 000 litres.

The annual emissions of CO_2 and other greenhouse gases from this source have been estimated using Table 3 of the AGO Workbook (AGO, 2006b). It has been assumed that the energy content of ADO is 38.6MJ/L (AGO, 2006b).

A summary of the predicted annual emissions is provided in **Table 12**.

Table 12 Predicted Annual Greenhouse Gas Emissions from Diesel Fuel Combustion

Diesel Consumption (kL)	Energy Content (MJ/kL)	Emission Factor (kg CO_2-e/GJ)	Greenhouse Gas Emissions (t)
230	38.6	69.8	619.7

7.1.2 Electricity

Electricity will be used to power the ventilation shaft during the operational phase of the Project. The annual electricity consumption at the Project Site is estimated to be of the order of 1.75 GWh/annum, based on the ventilation fan power requirements of 200 kW.

An estimate of the annual emissions of carbon dioxide from the consumption of electricity associated with operation of the Ventilation Shaft has been derived using the AGO Workbook's emission factor of 1.068 kg CO_2-equivalent/kWh.

Based on these assumptions, it is predicted that the use of electricity associated with the operation of the Ventilation Shaft at the Project Site will result in the emission of approximately 1,869 t of CO_2-equivalent per annum.

7.1.3 Coal Bed Methane

The process of coal formation creates significant amounts of methane (CH_4). This CH_4 remains trapped in the coal until the pressure on the coal is reduced, which occurs during the coal mining process. The stored CH_4 is then released to the atmosphere.

An estimate of the annual emissions of CH_4 from the extraction of coal at Longwalls 29-31 that are to be vented by the Ventilation Shaft has been derived using the AGO Workbook's emission factor of 8.4 kg CO_2-equivalent/tonne of raw coal. It is noted that, due to the Class B "non-gassy" classification of the Baal Bone underground mine in Appendix A of the AGO document *Australian Methodology for the Estimation of Greenhouse Gas Emissions and Sinks 2005* (AGO, 2006c), this emission factor relates to "non-gassy" underground mines. Finally, annual extraction of coal is assumed to be 1.7 Mt per year, based on the estimated 5 Mt of coal within Longwalls 29-31 and the expected three year mining campaign to access it.

Based on these assumptions, it is predicted that release of coal bed CH_4 through the operation of the Ventilation Shaft at the Project Site will result in the emission of approximately 14,000 t of CO_2-equivalent per annum.

7.1.4 Total Annual Greenhouse Gas Emissions

A summary of the predicted greenhouse gas emissions resulting from all operations at the site are presented in **Table 13**. It is noted that the diesel combustion related emissions are only expected to occur during the initial site establishment phase of the Project (estimated to be 20 weeks). However for the purpose of deriving worst case annual emissions from the Project, all emissions are included on an annual basis in this assessment.

Table 13 Predicted Annual Greenhouse Gas Emissions from Operation of Ventilation Shaft

Source	**Predicted Emissions CO_2-e (t)**
Diesel	619.7
Electricity	1,869
Coal Bed CH_4	14,000
Total	16,489

As shown in **Table 13** the total estimated annual emissions of CO_2-Equivalent as a result of operations at the site are likely to be of the order of 16,489 t of CO_2-Equivalent per annum. This will reduce to 15,869 t after the first year, in the absence of onsite diesel consumption.

Greenhouse gas estimates are assessed relative to 1990 baseline levels for reporting purposes. The AGO (AGO, 2006d) estimates that in 1990, Australian greenhouse gas emissions totalled 551.9 Mt CO_2-equivalent. A comparison of the predicted emissions with the 1990 estimate demonstrates that operations would represent an annual increase of approximately 0.0029 % of the total baseline Australian emissions.

8 CONCLUSION

Heggies Pty Ltd has been commissioned by Umwelt (Australia) Pty Ltd, on behalf of The Wallerawang Collieries Limited, to conduct an assessment of the air quality impacts in relation to the installation and operation of a ventilation shaft, proposed to assist in the continuation of the underground coal mining operations of the Baal Bone Colliery.

Two scenarios were modelled to reflect worst case particulate matter generating activities which could occur during the construction and operation of the ventilation shaft. Odorous emissions of underground gases were also assessed during an operational scenario.

Atmospheric dispersion modelling was undertaken using the Ausplume Gaussian Plume Dispersion Model software developed by EPA (Victoria) to assess fugitive emissions.

These predictions indicate that particulate matter, dust deposition and odour attributable to both the construction and operation of the ventilation shaft are anticipated to be within the current DECC (and NEPM) air quality goals at all of the surrounding residences.

9 REFERENCES

The following documents and resources have been used in the production of this report:

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10 GLOSSARY OF TERMS, SYMBOLS AND ACRONYMS

ADO	Automotive Diesel Oil
AGO	Australian Greenhouse Office
AHD	Australian Height Datum
AMMAAP	*Approved Methods for the Modelling and Assessment of Air Pollutants in NSW*, (DECC, 2005)
AWS	Automatic Weather Station
BoM	Australian Bureau of Meteorology
CO	Carbon Monoxide
CO_2	Carbon Dioxide
CO_2-e	Carbon Dioxide-equivalent
CH_4	Methane
CSIRO	Commonwealth Scientific and Industrial Research Organisation
DECC	NSW Department of the Environment and Climate Change
GWP	Global Warming Potential
Heggies	Heggies Pty Ltd
IPCC	Intergovernmental Panel on Climate Change
kW	Kilowatt
LVAS	Low Volume Air Sampling
mg	Milligram (g x 10^{-3})
µg	Microgram (g x 10^{-6})
µm	Micrometre or micron (metre x 10^{-6})
m^3	Cubic meter
Mt	Megatonnes
MWh	Megawatt-Hour
NEPC	National Environment Protection Council
NEPM	National Environment Protection Measure
NHMRC	National Health and Medical Research Council
NO_2	Nitrogen Dioxide
N_2O	Nitrous Oxide
NO_X	Oxides of Nitrogen
OU	Odour Unit
PM_{10}	Particulate matter less than 10microns in aerodynamic diameter
$PM_{2.5}$	Particulate matter less than 2.5microns in aerodynamic diameter
TAPM	“The Air Pollution Model”
TEOM	Tapered Element Oscillating Microbalance
TSP	Total Suspended Particulate
Umwelt	Umwelt (Australia) Pty Ltd
USEPA	United States Environmental Protection Agency

Climate Averages - Lithgow (Birdwood St) AWS - 1889 to 2004

Table A1 Climate Averages for Lithgow (Birdwood St) AWS

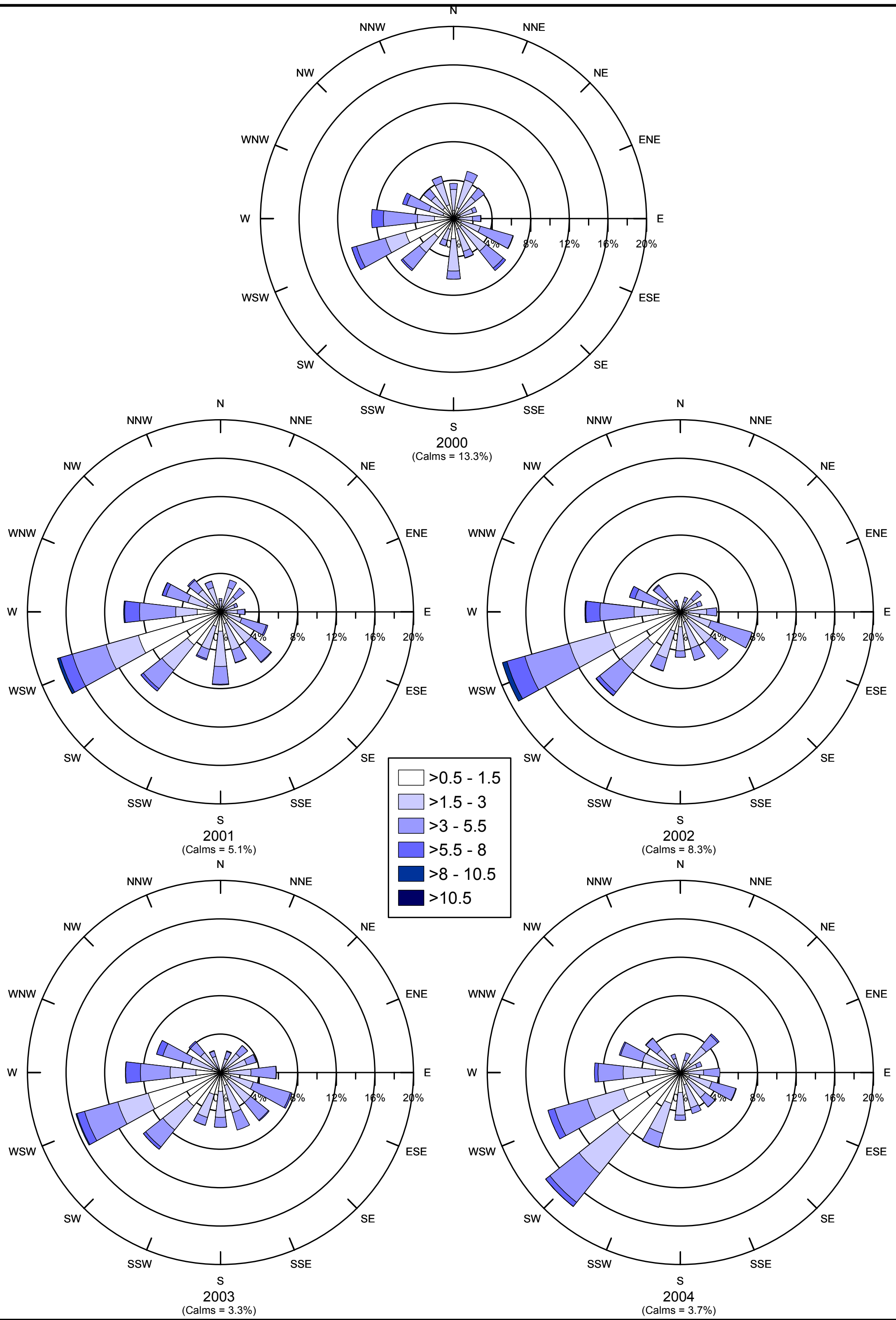
Element	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Mean daily maximum temperature - deg C	25.5	24.7	22.5	18.4	14.3	11.1	10.4	12	15.4	18.7	21.6	24.5	18.3
Mean no. of days where Max Temp >= 40.0 deg C	0	0	0	0	0	0	0	0	0	0	0	0	0
Mean no. of days where Max Temp >= 35.0 deg C	0.8	0.4	0	0	0	0	0	0	0	0	0.2	0.1	1.5
Mean no. of days where Max Temp >= 30.0 deg C	6.4	4.4	1.3	0	0	0	0	0	0	0.1	1.5	4.1	17.9
Highest daily Max Temp - deg C	37.7	38.4	35.1	30.8	24.6	21.3	21.5	22.5	27.6	33.1	37.2	36.2	38.4
Mean daily minimum temperature - deg C	11.8	12.1	10.1	6.7	3.9	1.8	0.7	1.3	3.4	5.9	8	10.4	6.3
Mean no. of days where Min Temp <= 2.0 deg C	0	0	0.3	2.6	9.5	14.8	19.6	16.8	10.1	4	1.2	0.3	79.3
Mean no. of days where Min Temp <= 0.0 deg C	0	0	0	0.9	4.4	9.1	13.3	10.3	4.6	1.1	0.2	0	44
Lowest daily Min Temp - deg C	2.8	3.5	0	-4	-6.1	-7	-8	-7.7	-5	-2.3	-1.7	0.6	-8
Mean 9am air temp - deg C	18.7	17.8	15.9	12.4	8.5	5.6	4.7	6.4	10	13.5	15.7	18.1	12.3
Mean 9am wet bulb temp - deg C	14.8	14.7	13.2	10.3	7.1	4.4	3.3	4.5	7.1	9.8	11.6	13.9	9.5
Mean 9am dew point - deg C	12.2	12.8	11	8.5	5.8	3.1	1.3	2	3.6	6	7.9	10.1	6.8
Mean 9am relative humidity - %	64	71	72	75	81	82	77	72	64	60	60	60	70
Mean 9am wind speed - km/h	6.9	6.3	6.6	7.6	7.4	8.4	8.5	10.3	11.1	9.9	9	7.9	8.3
Mean 3pm air temp - deg C	23.6	22.9	20.8	17.3	13.3	10	9.3	10.8	13.7	17	19.5	22.5	16.8
Mean 3pm wet bulb temp - deg C	17.1	17.2	15.3	12.5	9.8	7.2	6.1	6.9	9	11.6	13.3	15.3	11.6
Mean 3pm dew point - deg C	12.1	13	11.1	8.2	6	3.7	1.8	1.6	3.2	5.8	7.7	9.6	6.8
Mean 3pm relative humidity - %	51	56	56	55	62	65	60	54	51	50	49	47	55
Mean 3pm wind speed - km/h	10.3	9.1	8.9	9.3	9.8	10.7	11.5	13.4	12.9	11.8	11.5	11.3	10.9
Mean monthly rainfall - mm	92.9	84.3	84.8	63.7	64.2	67.1	67.7	64.2	59	66.9	69.1	76.3	860.1
Median (5th decile) monthly rainfall - mm	79.8	65.6	66.8	50.5	45.6	52	48	48.6	53.4	58.9	65.6	67	858.6
9th decile of monthly rainfall - mm	183.5	179.6	159.4	125.6	132.3	149.2	140	136.8	105.1	133.2	144	146.8	1117.7

Table A1 Cont. Climate Averages for Lithgow (Birdwood St) AWS

Element	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
1st decile of monthly rainfall - mm	25.2	10.8	20.9	11.3	16.3	16	15	14.7	20	19.1	17.8	18.1	612.7
Mean no. of raindays	10.5	10.3	10.6	9.2	10.5	11.7	11.7	11.1	10.2	10.2	9.9	9.8	125.7
Highest monthly rainfall - mm	242	330.1	338.8	295.2	335.9	242.4	349.5	374.4	195.6	233	187.3	235.5	
Lowest monthly rainfall - mm	4.8	0.3	6.9	2.1	2.6	9	2.7	2.2	7.2	3	1.8	0.3	
Highest recorded daily rainfall - mm	89.9	101.9	112	147.3	135.4	179	163.8	165.4	97.5	65	83.6	101.6	179
Mean no. of clear days	7.3	5.4	7.1	7.8	7.2	6	7.9	9.3	8.6	7.1	6.6	8.1	88.6
Mean no. of cloudy days	12	12.7	12.6	10.2	13.3	14.1	12.5	11	10.3	11.4	11.6	10.5	142.1

Source: Bureau of Meteorology, 2007

Annual and Seasonal Wind Roses - Mt Piper Power Station



Heggies Pty Ltd
Consulting Engineers and Scientists
2 Lincoln Street
Lane Cove NSW 2066 Australia
PO Box 176 Lane Cove NSW 1595
Telephone +612 9427 8100 Facsimile +612 9427 8200
Email Sydney@heggies.com.au

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Appendix B1: Annual Wind Roses for Mt Piper Power Station (2000 - 2004)

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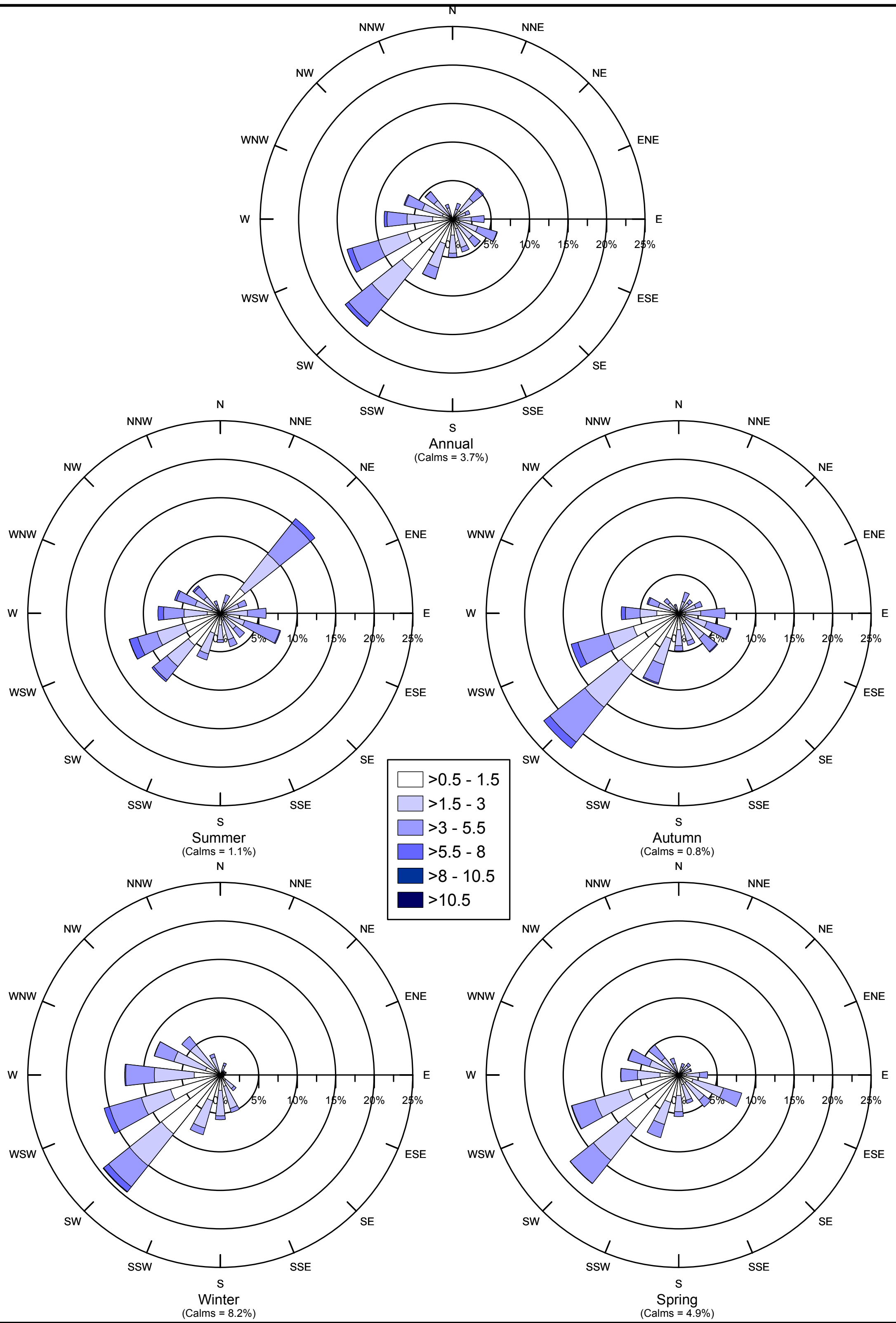
Annual and Seasonal Wind Roses - Mt Piper Power Station



Heggies Pty Ltd	Designed by	Checked by	Approved by - date	Filename	Dated
Consulting Engineers and Scientists 2 Lincoln Street Lane Cove NSW 2066 Australia PO Box 176 Lane Cove NSW 1595 Telephone +612 9427 8100 Facsimile +612 9427 8200 Email Sydney@heggies.com.au	SF	DR		10—5070	22/02/07
	Appendix B2: Seasonal Wind Roses for Mt Piper Power Station (2004)				

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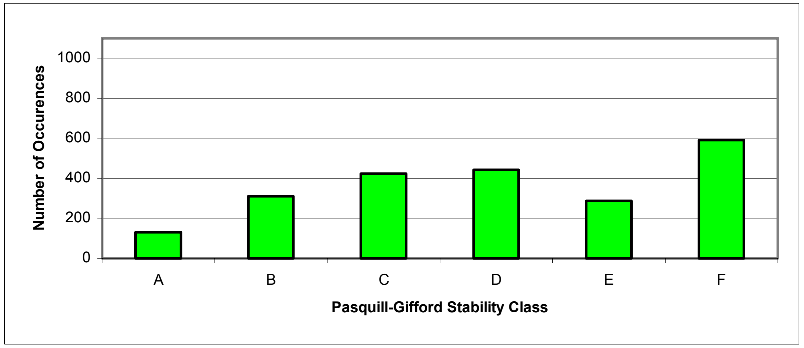
TAPM Predicted Seasonal Stability Classes for the Mt Piper Power Station



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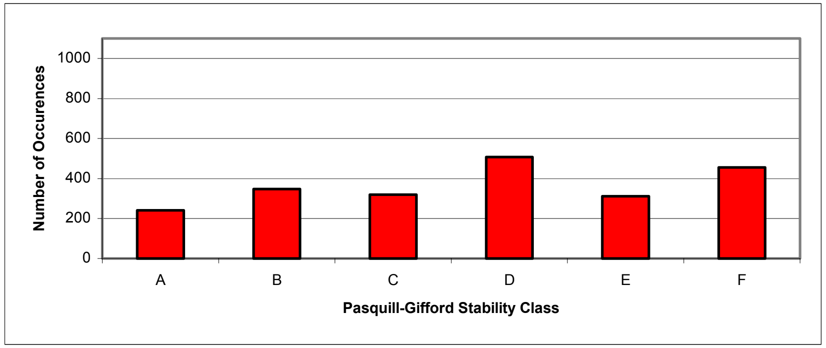
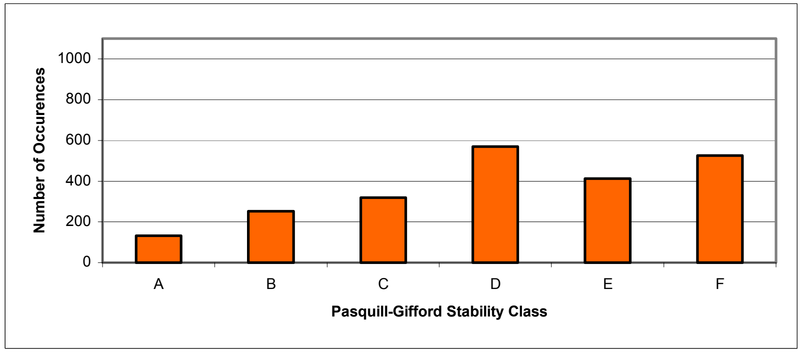
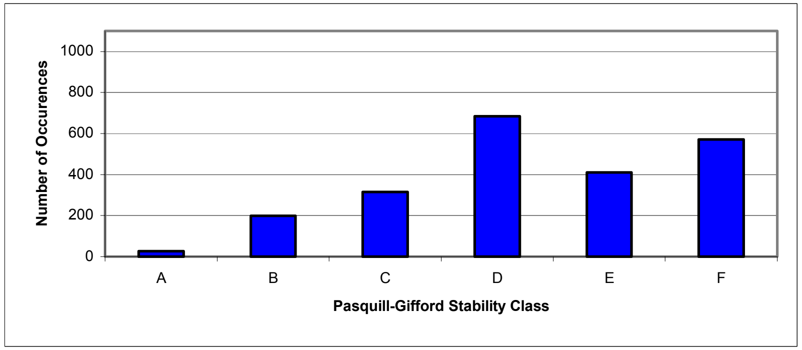


Summer



Autumn



Winter

Heggies Pty Ltd
Consulting Engineers and Scientists
2 Lincoln Street
Lane Cove NSW 2066 Australia
PO Box 176 Lane Cove NSW 1595
Telephone +612 9427 8100 Facsimile +612 9427 8200
Email sydney@heggies.com.au

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Seasonal Stability Class Frequency Distribution for Mt Piper Power Station - 2004

Emissions Inventory for Operations at Project Site - Scenario 1 and Scenario 2

SCENARIO 1 Baal Bone Colliery Ventilation Shaft - Construction Phase	**TSP Emission Factor**	**PM_{10} Emission Factor**	**Emission Factor Units**	**Hourly Throughput**	**Working days available**	**Working hours per day**	**TSP Emission Rate (mg/s)**	**Annual PM_{10} Emission Rate (mg/s)**	**PM_{10} Emission Rate (mg/s)**	**TSP Emission Flux ($mg/s/m^2$)**	**PM_{10} Emission Flux ($mg/s/m^2$)**
Excavator (on Overburden)	0.005	0.002	kg/t	0.52	21	24	0.04	0.02	0.36	N/A	N/A
Drilling	0.59	0.31	kg/hole	N/A	42	24	18.86	9.91	86.11	N/A	N/A
Processing Area Stockpile Wind Erosion	0.40	0.20	kg/ha/hr	N/A	N/A	N/A	N/A	N/A	N/A	0.011	0.006

SCENARIO 2 Baal Bone Colliery Ventilation Shaft - Operational Phase	**In-stack PM_{10} Concentration (mg/m^3)**	**In-stack Odour Concentration (OU)**	**Shaft Diameter (m)**	**Shaft Height (m)**	**Exit Velocity (m/s)**	**Exit Area (m^2)**	**Flow Rate (m^3/s)**	**PM_{10} Emission Rate (mg/s)**	**Odour Emission Rate ($OU.m^3/s$)**
Ventilation Shaft	1.6	46	3.15	4	10	7.8	77.9	124.7	3590.1

Heggies Pty Ltd
Consulting Engineers and Scientists
2 Lincoln Street
Lane Cove NSW 2066 Australia
PO Box 176 Lane Cove NSW 1595
Telephone +612 9427 8100 Facsimile +612 9427 8200
Email sydney@heggies.com.au

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Emissions Inventory for Operations at Project Site - Scenario 1 and Scenario 2

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1 The Greenhouse Gas Protocol Initiative

The Greenhouse Gas Protocol Initiative (hereafter, "the GHG Protocol") is a multi-stakeholder partnership of businesses, non-governmental organizations (NGOs), governments, and others convened by the World Resources Institute (WRI), a U.S.-based environmental NGO, and the World Business Council for Sustainable Development (WBCSD), a Geneva-based coalition of 170 international companies. Launched in 1998, the Initiative's mission is to develop internationally accepted greenhouse gas (GHG) accounting and reporting standards for business and to promote their broad adoption. (WBCSD, 2005)

The GHG Protocol comprises two separate but linked standards:

- *GHG Protocol Corporate Accounting and Reporting Standard* (this document, which provides a step-by-step guide for companies to use in quantifying and reporting their greenhouse gas emissions).
- *GHG Protocol Project Quantification Standard* (forthcoming; a guide for quantifying reductions from greenhouse gas mitigation projects).

There are three scopes of emissions that are established for greenhouse gas accounting and reporting purposes, defined as follows.

1.1 Scope 1 Emissions – Direct GHG Emissions

The GHG Protocol defines Scope 1 emissions as those which result from activities under the company's control or from sources which they own. They are principally a result of the following activities:

- generation of electricity, heat or steam. These emissions result from the combustion of fuels in stationary sources, e.g. boilers, furnaces or turbines;
- physical or chemical processing. The majority of these emissions result from the manufacture or processing of chemicals and materials e.g. the manufacture of cement, aluminium, adipic acid and ammonia, or waste processing;
- transportation of materials, products, waste, and employees. These emissions result from the combustion of fuels in company owned/controlled mobile combustion sources (e.g., trucks, trains, ships, airplanes, buses, and cars)
- fugitive emissions. These emissions result from intentional or unintentional releases, e.g., equipment leaks from joints, seals, packing, and gaskets; methane emissions from coal mines and venting; hydrofluorocarbon (HFC) emissions during the use of refrigeration and air conditioning equipment; and methane leakages from gas transport.

1.2 Scope 2 Emissions – Electricity indirect GHG Emissions

Scope 2 emissions are those which relate to the generation of purchased electricity consumed in its owned or controlled equipment or operations. For many companies, purchased electricity represents one of the largest sources of GHG emissions and the most significant opportunity to reduce these emissions.

1.3 Scope 3 Emissions – Other indirect GHG Emissions

The GHG protocol states that Scope 3 reporting is optional and covers all other indirect GHG emissions. Scope 3 emissions are defined as those which do not result from the activities of a company although arise from sources not owned or controlled by the company. Examples of Scope 3 emissions include the extraction and production of purchased materials, transportation of purchased fuels and the use of sold products and services.

In the case of the coal mining industry, Scope 3 emissions may include the transportation of sold coal and the use of this coal, either at home or overseas.

The GHG protocol flags the issue that the reporting of Scope 3 emissions may result in the double counting of emissions. A second problem is that as their reporting is optional, comparisons between countries and / or projects may become difficult. The GHG protocol also states that compliance regimes are more likely to focus on the "point of release" of emissions (direct emissions) and / or indirect emissions from the use of electricity. However, for GHG risk management and voluntary reporting, double counting is less important.

2 AGO Workbook

The Australian Greenhouse Office (AGO) Workbook, published by The Department of Environment and Heritage (DEH) in December 2006 provides a single source of current greenhouse gas emission factors for Australian organisations to estimate their emissions and abatement. It should be noted that the emission factors in the December 2006 AGO Workbook have been harmonised with the international reporting framework of the World Resources Institute / World Business Council for Sustainable Development (The GHG Protocol).

2.1 Direct Emissions

Direct emissions are defined in the AGO Workbook as those which are produced from sources within the boundary of an organisation and as a direct result of that organisation's activities and arise from the following activities:

- generation of energy, heat steam and electricity, including carbon dioxide (CO_2) and the products of incomplete combustion (methane (CH_4) and nitrous oxide (N_2O);
- manufacturing processes, which produce emissions (for example, cement, aluminium and ammonia production);
- transportation of materials, products, waste and people; for example, use of vehicles owned and operated by the reporting organisation;
- fugitive emissions – intentional or unintentional GHG releases (such as methane emissions from coal mines, natural gas leaks from joints and seals); and
- on-site waste management, such as emissions from company owned and operated landfill sites.

The AGO gives several examples of direct emissions; a company with a vehicle fleet would report the GHG emissions from the combustion of petrol or diesel in these vehicles as direct emissions. A mining company would report methane escaping from a coal seam during mining (fugitive emissions) as direct emissions and a cement manufacturer would report carbon dioxide released during cement production as direct emissions.

2.2 Indirect Emissions

The AGO Workbook defines indirect emissions as those which are generated in the wider economy as a consequence of an organisation's activities (particularly from its demand for goods and services), but which are physically produced by the activities of another organisation. The most important category of indirect emissions is from the consumption of electricity. Other examples of indirect emissions from an organisation's activities include upstream emissions generated in the extraction and production of fossil fuels, downstream emissions from transport of an organisation's product to customers, and emissions from contracted / outsourced activities. The appropriate emissions factor for these activities depends on the parts of the upstream production and downstream use considered in calculating emissions associated with the activity.

For purposes of harmonisation, the AGO emission factors for indirect emissions have been subdivided into Scope 2 and Scope 3 emissions (adopted by the GHG Protocol).

Broadly, the AGO Workbook defines Scope 3 emissions as including;

- disposal of waste generated (e.g. if the waste is transported outside the organisation and disposed of);
- use of products manufactured and sold;
- disposal (end of life) of products sold;

- employee business travel (in vehicles or aircraft not owned or operated by the reporting organisation);
- employees commuting to and from work;
- extraction, production and transport of purchased fuels consumed;
- extraction, production and transport of other purchased good and materials;
- purchase of electricity that is sold to an end user (reported by electricity retailer);
- generation of electricity that is consumed in a transport and distribution system (reported by end user);
- out-sourced activities; and
- transportation of products, materials and waste.

3 Draft Guidelines for Energy and Greenhouse in EIA

The Draft NSW EIA Guidelines were prepared in August 2002 by the NSW Sustainable Energy Development Authority (SEDA) and Planning NSW (now the Department of Planning (DOP)). The guidelines state that they are an advisory document and should principally be applied to projects which require an EIS under Part 4 and Part 5 of the Environmental Planning and Assessment Act 1979 (NSW) but can also be used for the assessment of other projects.

The Draft NSW EIA Guidelines define four scopes of emissions, the first three being adopted along the lines of the GHG Protocol with the fourth relating to emission abatement;

3.1 Scope 1: Direct Energy Use or GHG Emissions

Scope 1 considers energy use and GHG emissions that occur on site or are under a proponent's direct and immediate control. Scope 1 emissions broadly consist of the energy use and GHG emissions produced by the following activities;

- production of electricity, heat or steam;
- combustion of fossil fuels for any other purpose;
- physical or chemical processing on site;
- transportation of materials, products, waste and employees by proponent controlled vehicles;
- fugitive emissions occurring on site;
- on site landfill wastes or wastewater treatment;
- animal husbandry; and
- on site vegetation or soil disturbance.

3.2 Scope 2: Indirect Energy Use or GHG Emissions from Import and Exports of Electricity, Heat or Steam

Scope 2 broadly focuses on the indirect emissions associated with the generation of purchased and imported electricity, heat or steam.

3.3 Scope 3: Other Indirect Energy Use or GHG Emissions

Scope 3 considers the indirect energy use or GHG emissions that are a consequence of the Project but do not occur on site or those emissions which are removed from the proponent's direct control. Examples of Scope 3 emissions as described in the Draft NSW EIA Guidelines include the following;

- off site waste management (e.g. land filled waste or waste water treatment);
- transportation of products, materials and waste by vehicles not controlled by the proponent;
- employee related business or commuter travel;
- outsourced activities;
- production of imported materials, plant and equipment; and
- use of products or services produced by the Project (and end of life phases of products).

3.4 Scope 4: GHG Emission Abatement from Offset Opportunities

Scope 4 reporting under the Draft NSW EIA Guidelines allows the reporting of any carbon offsets which have occurred as a direct result of the Project. Proponents may report the following if applicable;

- carbon sequestration performed by the proponents;
- community based energy use or emissions reduction initiatives;
- the use of government endorsed Kyoto Protocol flexibility mechanisms such as Clean Development Mechanism (CDM) and Joint Implementation (JI) (refer **Section 3.4.1** below).

3.4.1 Kyoto Protocol Flexibility Mechanisms

Although Australia has not currently ratified the Kyoto Protocol (KP) and is therefore not bound by its commitments, the GHG offset mechanisms contained within the KP can be used as instruments for carbon reduction and can be reported in Scope 4 of the Draft NSW EIA Guidelines. The following mechanisms are relevant for reporting under Scope 4:

- Clean Development Mechanism (CDM) – Developed countries can invest in greenhouse gas emission reduction projects in developing countries;
- Joint Implementation (JI) – Developed countries can invest in greenhouse gas reduction projects in other developed countries.

4 Policy Instruments

4.1 The NSW Greenhouse Plan

Published in November 2005, the NSW Greenhouse Plan is a strategic document which sets out the NSW Government's aims and initiatives in terms of greenhouse gas emissions abatement over the next 20 to 45 years. The NSW Government state that it would like to meet the following criteria:

- a 60% reduction in greenhouse gas emissions by 2050; and
- cutting greenhouse gas emissions to year 2000 levels by 2025.

The NSW Greenhouse Plan does not set out a methodology for reporting greenhouse gas emissions, rather seeks to:

- increase awareness among those expected to be most affected by the impacts of climate change;
- begin to develop adaptation strategies to those unavoidable climate change impacts; and
- put NSW on track to meeting the targets set out above.

5 References

- Commonwealth of Australia (2006), *AGO Factors and Methods Workbook, December 2006*.
- NSW Government (2005), *NSW Greenhouse Plan*
- Sustainable Energy Development Authority and Planning NSW (2002), *Draft NSW Energy and Greenhouse Guidelines for Environmental Impact Assessment.*
- World Business Council for Sustainable Development and World Resources Institute (2005), *The Greenhouse Gas Protocol: A Corporate Accounting and Reporting Standard*

APPENDIX 6

Aboriginal Heritage Assessment


Environmental & Heritage Management P/L


INDIGENOUS HERITAGE ASSESSMENT

FOR

PROPOSED 1.7 KM, 11kV POWERLINE CORRIDOR & VENTILATION FAN COMPOUND

Baal Bone Colliery - Ben Bullen State Forest, 4 km northeast of Cullen Bullen, NSW.



MAY 2007

REPORT PREPARED BY

OZARK ENVIRONMENTAL & HERITAGE MANAGEMENT P/L


FOR
UMWELT AUSTRALIA


OZARK ENVIRONMENTAL & HERITAGE MANAGEMENT P/L–PO Box 2069/145 Wingewarra St, Dubbo NSW 2830
Tel: 6882 0118; Fax: 6882 0630; Mob: 0403 763 504 / 0423 198 898
E-mail: jodie@ozarkehm.com.au / phil@ozarkehm.com.au Web: www.ozarkehm.com.au

Executive Summary

This study was commissioned by Umwelt Australia on behalf of Baal Bone Colliery (operated by The Wallerawang Collieries Pty Limited). It details the results of an Indigenous heritage assessment undertaken for the construction of an 11kV powerline corridor and ventilation shaft compound in the Ben Bullen State Forest, near Cullen Bullen, NSW (Figures 1-3).

No Indigenous sites were recorded as a result of the current assessment. Overall the Baal Bone study area was assessed as having low archaeological sensitivity due to the generally sloping nature of the landforms or the distance from permanent water sources. This assessment is supported by the nearby presence of Long Swamp to the south, the Wolgan Valley to the east and Jews Creek to the north, all of which would have provided plentiful resources and appropriate occupation site locations.

Consequently, there are no constraints to the proposed construction of the 11kV powerlines and ventilation shaft compound in the Ben Bullen State Forest on the grounds of Indigenous heritage.

Should any ‘relics’ or other Aboriginal sites be identified anywhere in the study area during the course of construction, work in that area should cease and the DECC and the respective Aboriginal community organisation or LALC be contacted to discuss how to proceed.

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Appendices

1. INTRODUCTION

This report was commissioned by Umwelt (Australia) on behalf of Baal Bone Colliery (operated by The Wallerawang Collieries Pty Limited). It details the results of an Indigenous heritage assessment undertaken over the area proposed for the construction of an 11kV powerline corridor and ventilation shaft compound in the Ben Bullen State Forest, near Cullen Bullen, NSW (Figures 1-3).

This report comprises part of a Part 3A Environmental Assessment.

1.1 Project Scope

The consultant was briefed to undertake survey and assessment for Indigenous heritage issues relevant to the construction of a proposed 11kV powerline corridor and ventilation shaft compound in the Ben Bullen State Forest.

The current assessment included the following aspects:

- A search of the NSW DEC Aboriginal Heritage Information Management System (AHIMS) for any previously recorded sites, a search of NSW State Heritage Register and Inventory; the Australian Heritage Database, the Register of the National Estate; and the Lithgow Council LEP;

- A review of relevant literature including previous consulting reports, academic theses, articles or published works on the archaeology and ethnography of the Cullen Bullen area;

- Indigenous community consultation, including the Bathurst Local Aboriginal Land Council (BLALC); Warrabinga Native Title Claimants Aboriginal Corporation (WNTCAC) and North East Wiradjuri Native Title Party (NEWNTP);

- Pedestrian field survey to identify and record all cultural heritage sites and relics along the 1.7 kilometre x 50 metre wide corridor and 200 x 200 metre area proposed for the ventilation shaft compound;

- Assessments of significance of any recorded sites and the formulation of appropriate management strategies; and

- Completion of documentary evidence (e.g. DEC Site Cards) for any sites/relics located during the survey for the notification of the relevant authorities.

Figure 1: Locality map (Source: Umwelt).

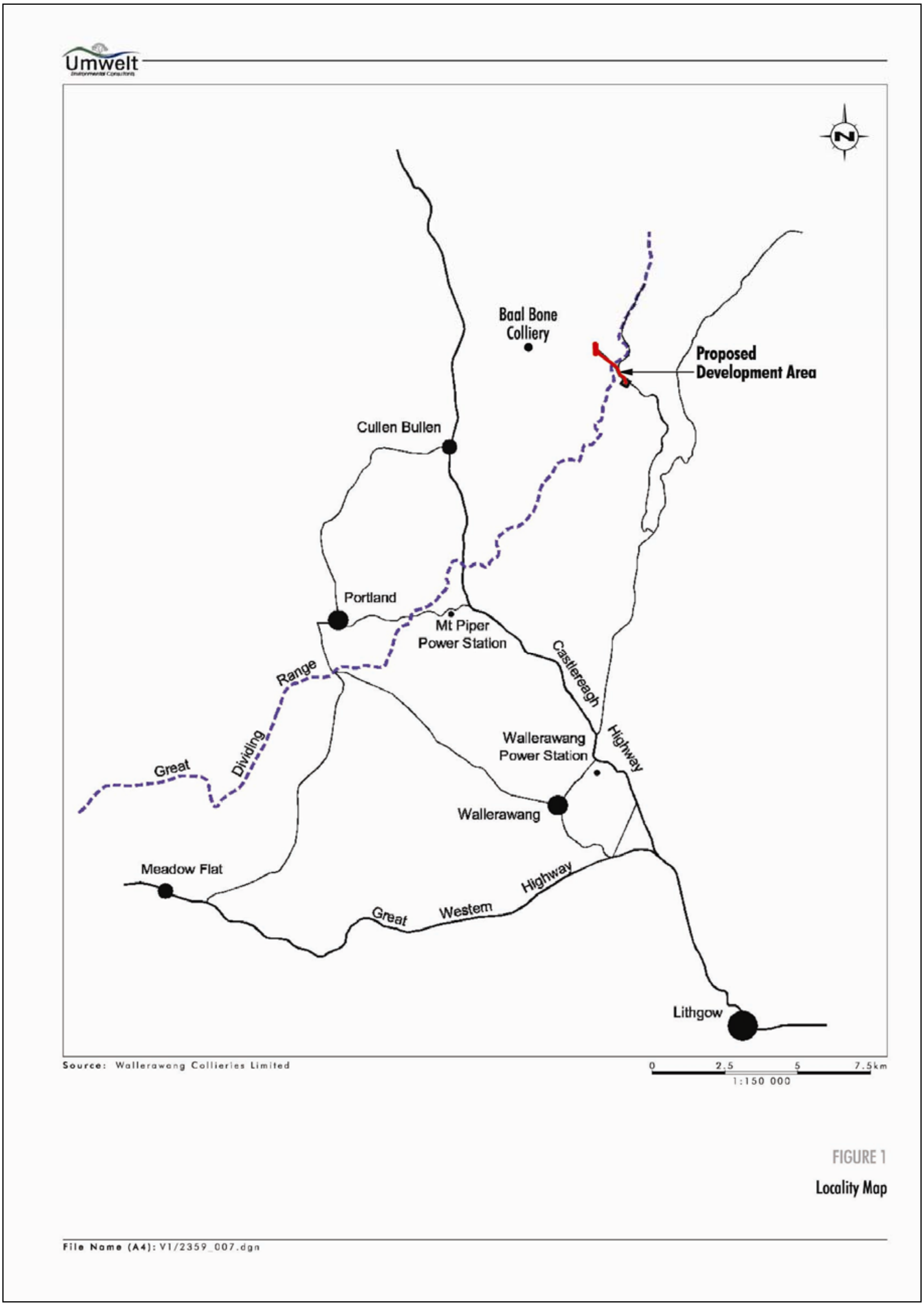


Figure 2: Map showing the location of the proposed corridor and ventilation shaft compound, delineated in blue (Source: Xstrata Coal) The red line indicates the subsidence management plan area.

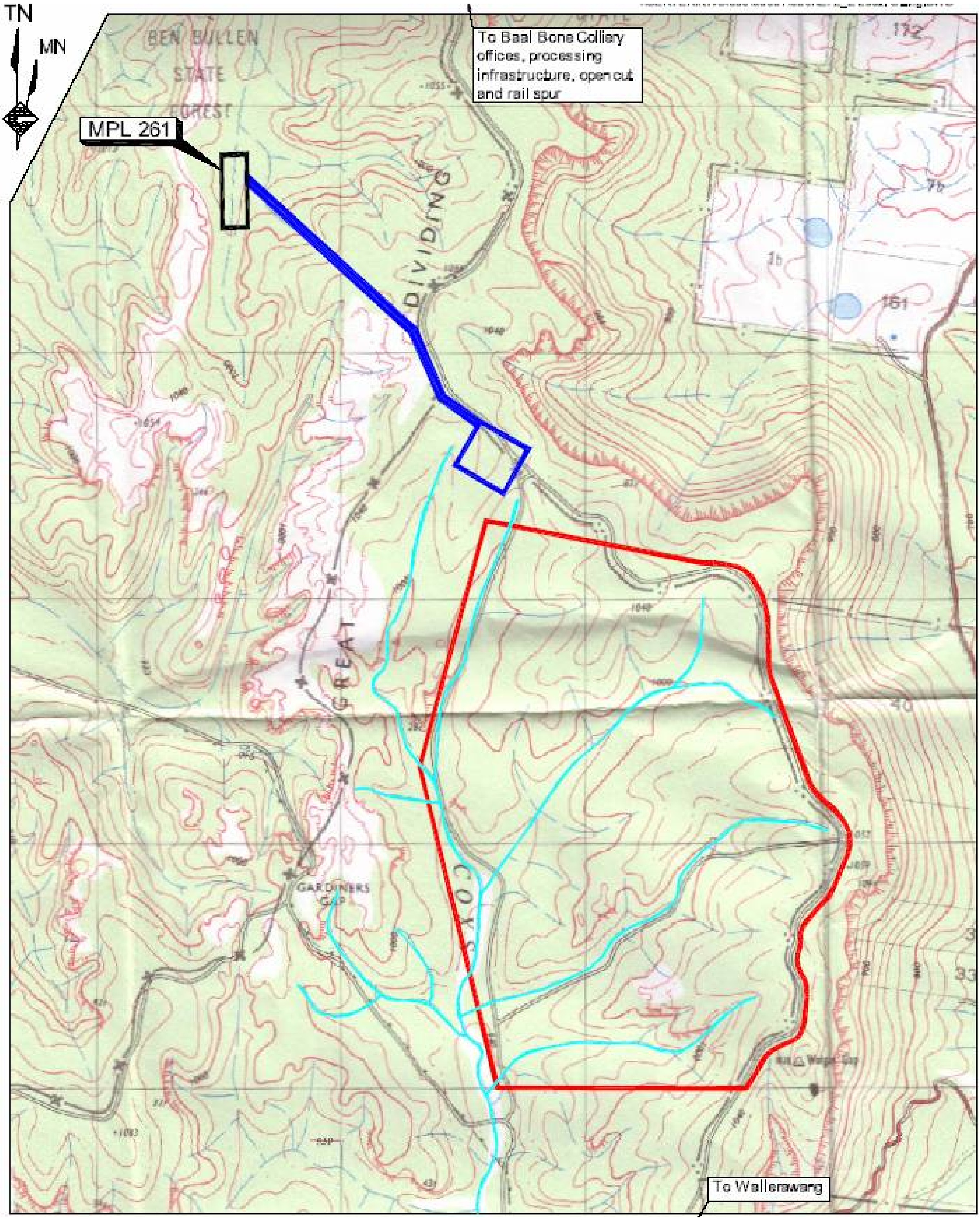
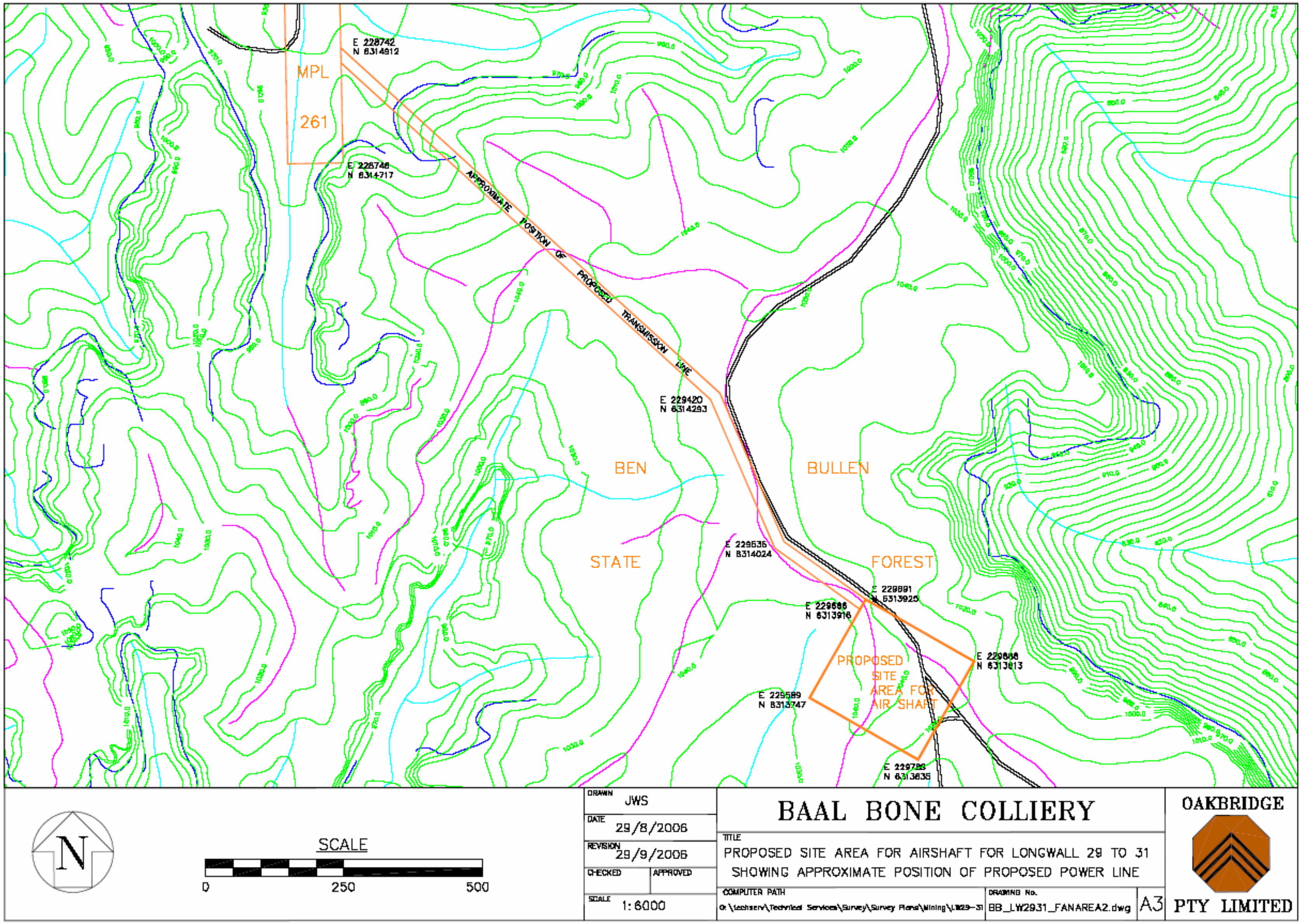


Figure 3: Detailed plan of proposed corridor and ventilation shaft compound (orange) (Source: Xstrata Coal).



1.2 Proposed Works

Baal Bone Colliery wishes to extend their underground mining area. Predicted air flows into the new resource extraction area will be insufficient for the needs of the miners and as such a new air vent will be required. The electricity to power the fan will be sourced from an existing dewatering borehole circa (c.) 1.7 km to the west. A powerline in the form of an aerial bundle cable will be required to connect the proposed compound to the existing dewatering borehole power supply (Figure 3). Some underground cabling may also be utilised in areas with existing ground surface disturbance such as adjacent to access roads. The proposed air vent will be drilled from the underground mining area and as such will have less surface impacts than are normally associated with surface drill rigs. Although only 50 x 50 m is required for the compound 200 x 200 m area was assessed similarly, 50 m width for the corridor was assessed giving the Proponent flexibility in planning.

1.3 Project Constraints and Limitations

Survey was limited to the area delineated in orange in Figure 3. Overall, ground surface visibility across the majority of the study area was poor.

1.4 Report Authorship

This investigation was undertaken by Dr Jodie Benton and Phillip Cameron (OzArk Environmental & Heritage Management Pty Ltd), accompanied by Richard Peters, representative of the Bathurst Local Aboriginal Land Council and Wendy Lewis representing the Warrabinga Native Title Claimants Aboriginal Corporation. This report was written by Dr Jodie Benton.

2. ABORIGINAL COMMUNITY INVOLVEMENT

Aboriginal community consultation for the project was undertaken using the DEC's "Interim Community Consultation Requirements for Applicants" which became effective on the 1st January 2005. An advertisement was placed in the local print media seeking expressions of interest from Indigenous groups and organisations in the Cullen Bullen area to participate in the heritage assessment process. Letters were sent to local and state government agencies seeking knowledge of any Indigenous stakeholder groups, as well as being sent out to groups already known to OzArk, including Bathurst Local Aboriginal Land Council (BLALC), North East Wiradjuri Native Title Party (NEWNTP), Warrabinga Native Title Claimants Aboriginal Corporation (WNTCAC) and Gundungurra Tribal Aboriginal Corporation (GTAC).

Responses received include letters from NEWNTP and WNTAC expressing interest in being part of the consultation process, and a phone call from BLALC expressing their interest as well. Response from GTAC indicates that this group has recently spit into two – one remaining with the same name, the other becoming the Gundungurra Aboriginal Heritage Association (GAHA). The latter group responded that they felt the location of the current proposal was outside their area and no response was received from GTAC[1].

[1] A representative of GAHA, Sharyn Halls, did not that think that GTAC was functioning normally since the split.

Field assessment for this project included provision of two positions for Aboriginal community representatives, who were chosen from those who expressed interest. Choice of possible participants was based on several factors including experience with and local knowledge of Indigenous heritage places / sites in the Cullen Bullen area, provision of relevant Workers Compensation insurance documents and breadth of representation in relation to group membership. Using these factors, Richard Peters of the BLALC and Wendy Lewis of the WNTCAC were offered the two field survey positions and both attended the survey of the Baal Bone powerline corridor and ventilation shaft compound study area. All groups who have expressed interest in being part of the consultation process will be kept informed of the results of the survey and forwarded a draft copy of the report for their review.

Written correspondence from these groups can be found in Appendix 2.

2.1 Native Title

The ventilation shaft site is located within a current mining lease application area. This area is just located within the boundaries of the Native Title Claim NC97/7, Gundungurra Tribal Land Council Aboriginal Corporation #6. This is currently being addressed by Baal Bone Colliery (the lease applicants), as part of the process of obtaining appropriate mining leases for the underground mining area.

3. THE STUDY AREA

The current study area is located entirely within the Ben Bullen State Forest and is managed by the Department of Primary Industries - Forests NSW (DPI-FNSW). The study area comprises two separate portions of land. The first, a 200 x 200 metre area, has been earmarked for a ventilation facility whilst the second is for a proposed powerline corridor. An area of 1.7 km x 50 metres was assessed for the corridor. The construction of the aerial bundle cable will require minimal vegetation and ground surface disturbance and the route will be identified within this corridor in order to avoid large trees and rock exposures.

The subject land is located wholly within the Greater Lithgow Local Government Area (LGA) and is governed by the Greater Lithgow Local Environmental Plan (LEP) of 1994. It is situated within Blaxland Shire, County of Cook and Parish of Cox. The land is zoned 1(f) forestry. The LEP adopts the Environmental Planning and Assessment Model Provisions and therefore the proposed development falls within the ambit of clause 35 Schedule 1 of the Model Provisions. The proposed development therefore does not require development consent under Part 4 of the EP&A Act.

3.1 Topography, Hydrology and Climate

According to the DEC website (2005), the study area lies within the South Eastern Highlands Bioregion which covers the dissected ranges and plateau of the Great Dividing Range.

The subject land comprises a relatively flat portion of elevated plateau as well as a minor escarpment leading down into a valley where an existing borehole is located. Elevations range from 950 to 1040 m. One ephemeral drainage line is traversed by the corridor at the western end, being a headwater tributary that flows north into Jews Creek.

Cullen Bullen, the nearest residential area (c. 1 km from Baal Bone Colliery) has a mild climate with a wet, late summer (average temperature is 16.5^{o} C with a maximum of 35.1^{o}) and cold, dry winters (average temperature 5.1^{o} C with a minimum of -9.4^{o}). Summer is the pronounced wet season, particularly from January to March, often accompanied by high intensity storms. Only intermittent rains are received during winter (Australian Bureau of Meteorology 2006).

3.2 Geology

The South Eastern Highlands Bioregion comprises part of the Lachlan fold belt that runs through the eastern states as a complex series of metamorphosed Ordovician to Devonian sandstones, shales and volcanic rocks intruded by numerous granite bodies and deformed by four episodes of folding, faulting and uplift. The general structural trend in this bioregion is north-south and the topography strongly reflects this.

More specifically, the study area is situated near the edge of the Permo-Triassic Sydney Basin, in an area known as the Western Coalfields. This is comprised of an extensive plateau of erosion resistant Triassic sandstone dissected by steep-sided valleys. There is a remnant surface layer of weathered sandstone and shales of the Narrabeen Group overlying a complex stratigraphic sequence including the Lidsdale and Lithgow Seams, which are both sub-groups of the Illawarra Coal Measures.

3.3 Vegetation and Fauna

Vegetation is dominated by the community referred to as Hill Woodland, comprising Broad-leaved Peppermint (*Eucalyptus dives*), Brittle Gum (*E. mannifera* ssp. *mannifera*), Red Stringybark (*E. macrorhynca*) and Western Scribbly Gum (*E. rossii*), on the mid-upper hill slopes. There is a shrub layer of low to medium density and a ground layer vegetation of medium to high density.

Prior to European occupation the general area would have provided a rich resource base for animals including gliders, possums, macropods and bandicoots and a large variety of reptiles and amphibians. The wetlands and permanent creeks within close proximity of the study area would have undergone inundation and seasonal movements of fauna would have supported a greater diversity and number of species, predominantly birds but including other species such as: swamp wallabies, grey kangaroos, rock wallabies, swamp rats, frogs and tortoise, as well as predator species such as the red bellied black snake and carpet python. A myriad of different migratory bird species would have also utilised these swamp areas (i.e. Long Swamp) and the flowering eucalypts present on site would have attracted nectar and insect feeding birds, including parrots and honey eaters and also a large number of species of bats.

3.4 Existing Levels of Disturbance

Treed hills within the assessed area remain relatively undisturbed despite being subject to selective logging, vehicle access tracks, limited mineral exploration and grazing from domestic stock in former eras. Several shallow gullies between the hills and knolls showed signs of erosion due to changes in hydrology and the majority of trees showed evidence of bushfire (within 15 years).

4. ETHNOHISTORIC SOURCES OF PAST ABORIGINAL CULTURE

According to Tindale (1974), the current study area falls within the eastern limits of the lands occupied by the Wiradjuri tribe. However, due to the location of this area at the western base of the mountains it has often been referred to as zone of interaction between the Wiradjuri, the Dharug to the east and the Gundungurra to the south (Bowdler 1984).

Few archival sources are available which give any great detail regarding local Aboriginal culture at the time of contact or even soon after. The Lithgow area seems to have undergone little study by professional or amateur ethnologists and anthropologists despite its close proximity to Sydney.

A resident of nearby Lidsdale, Fay Hasler, has written notes based on oral histories of people in the area (reproduced in part in Kelton 2002a: 12-13), which are held by the Lithgow and District Family Historical Society. The salient points derived from these notes are as follows:

- A large Aboriginal settlement is described as being located at Pipers Flat, with the burial ground being located at Lidsdale;

- The Pipers Flat Aborigines would regularly travel to Richmond to fight the local Aboriginals and bring back women to combat in-breeding;

- The tribes occupying the valleys in the area were wiped out by disease including measles and small pox; and

- Stories of massacres of Aborigines by soldiers at Capertee and settlers at Marrangaroo were often spoken about by the elders, together with the poisoning of flour which killed women, children and men.

Interviews with Fay Hasler during March and May 1999 (Gay 1999) indicate that the burial ground at Lidsdale was located on the river flats either side of the current Coxs River alignment. It is noted that the colliery railway line was constructed through this area in the 1920's and further disturbance would have affected this area during the Coxs River realignment in the 1950's (Gay 1999: 15).

Gay (1999: 16) also notes an historical reference to the burial of an Aboriginal Elder in the Wallerawang area. King Myall (Mylles) had worked for James Walker who had been granted land in the Wallerawang and Lidsdale districts during the 1820's. The burial site of King Myall was drawn and published in the Sydney Illustrated News in October 1880, showing a burial mound and carved trees. This may be part of the burial ground referred to by Fay Hasler (Gay 1999: 16).

5. ARCHAEOLOGICAL CONTEXT

5.1 Regional Context

Current understanding of the types of sites present or likely to be present, within the Coxs River valley and surrounding hill country remains sketchy. Data from excavated sites combined with information derived from surveys, points to a variable use of the valley, with some sites indicating ephemeral, casual or limited use, while other sites show more intensive or repeated use.

Sites and studies within a c. 10 km radius of the current project area will be considered in the following section (5.2 Local Context), while those from the general Coxs River valley and surrounds will be briefly reviewed here.

In the mid 1960's, McCarthy excavated a series of sites to the north of the current survey area, in the Capertee Valley, identifying an early stone tool industry that predated what was then called the Australian Small Tool Tradition. He named this industry the Capertian and described it as consisting of non-specialised flake and core scrapers, also known as the Core Tool and Scraper Tradition (Mulvaney and Kamminga 1999: 44).

Development driven survey in the Coxs River area (south of the current study area) such as that undertaken by Rich (1988) and Silcox (1988) provided further evidence for a site occupation pattern previously postulated by Rich, indicating that open sites are most frequent on elevated ground close to permanent water, such as the Coxs River. Again quartz was seen as the dominant raw material, in contrast to sites on the Newnes Plateau, which appear to have mudstone and chert dominated assemblages. The limited presence of cortex on some of the quartz artefacts led Rich to argue that artefacts may have been carried to these locations after primary/initial flaking elsewhere. The general quality of the quartz was reported as high, with few fracture plains.

In 1992 a survey for the Springvale Colliery and conveyor (Rich and Gorman) recorded 35 sites situated in the Coxs River Valley. Site 2, located on the southern bank of Pipers Flat Creek, consisted of over 100 artefacts within a 200 x 40 m area. Two quartz knapping floors with artefact densities of over 25/m^2 were identified at Site 2 as were a smaller number of indurated mudstone artefacts. Site 9, located c. 700 m west of Duncan street, on elevated terrain above and on the west side of the Coxs River, was comprised of 26 artefacts, primarily quartz, with a maximum artefact density of 6/m^2. As a result of this study, Rich argues that the larger sites within her study area lie closest to the Coxs River and Pipers Flat Creek (Rich & Gorman 1992: 73).

Also in 1992, Haglund & Brayshaw undertook survey for the proposed Lamberts Gully open cut mine at Western Main Colliery (Haglund & Brayshaw 1992a). Six (6) Aboriginal sites were recorded as a result of this survey, predominantly located at the southern end of Lamberts Creek. Later that year test excavations were carried out at two PADs, one having been recorded during their Lamberts Gully survey (POS A), and the second being a PAD recorded by Rich and Gorman in 1992 (POS2). The latter site came to be known as Lamberts Creek 6 (#45-6-2355) and while POSA came to be known as Lamberts Creek 7 (#45-6-2354). Test excavation of these locations revealed them to be open sites although of a "one-off" nature, likely to date within the last 3,000 yrs due to the presence of a backed blade and bipolar knapping technology (Brayshaw 1993: 8).

Again in 1992, Brayshaw & Haglund surveyed an easement linking Mt Piper Power Station with Angus Place Colliery (Haglund & Brayshaw 1992b). This study recorded two open camp sites and one isolated find. During his 2002 study for the Boulder project, Kelton attempted to relocate these sites and was unsuccessful, concluding that site # 45-2-0217 must have been destroyed during the construction of the transmission line easement immediately south of the haul road (Kelton 2002: 32). Site # 45-2-0216, however, although not relocated by Kelton, was subsequently relocated by OzArk EHM during their 2004 survey in the face of the proposed Neubecks Open Cut Coal Mine (OzArk 2004).

Brayshaw (1993) undertook further survey for the Western Main colliery, although this extension was to the north of the previous study, being close to the Castlereagh Hwy. Three sites were recorded in this survey, all open camp sites, as the study area was situated within the Neubecks creek valley rather than in the more hilly country to the south. Brayshaw notes that the open sites identified were relatively small and sparse and were situated in positions elevated above swampy areas and creeks.

Lyell Dam, situated in the Coxs River catchment approximately 15 kms south of the current study area, was formed by damming the Coxs River. Three open sites located on the slopes of spurs overlooking the Coxs River floodplain were investigated here in 1994, prior to raising the water level in the lake. All three sites were situated c. 400 m from the river margin (Gay 1999: 14).

At open site Lyell Dam 3 (LD3) a quartz block fractured knapping floor was found. Although the assemblage was dominated by quartz, other raw materials such as indurated mudstone (silicified tuff) and stone of volcanic origin was also present. In terms of surface manifestations of this site, the highest artefact density recorded was $3/m^2$, with most sample areas showing lower densities (Barton & McDonald 1995: 25). The excavated assemblage, however, was far larger, with estimated thousands of artefacts present at this location. Barton & McDonald (1995: 35) interpreted this site as being repeatedly occupied by people carrying out the same range of tasks.

Conclusions of the Lyell Dam site investigation project can be summarised as follows (from Barton & McDonald 1995: 67 as summarised in Gay 1999: 15):

- Cobbles of igneous, metamorphic and sedimentary rocks were procured locally, primarily from the bed of the Coxs River;

- Quartz was locally available and the ease with which it was procured eliminated the need to flake using the bipolar technique;

- Quartz was used to create medium sized flakes and some smaller retouched tools;

- Volcanic stone was used to create large or heavy tools; and

- All three sites were interpreted as representing repeated short-term occupation areas that focussed on acquiring resources such as specific plants or animals endemic to the swampy margins of the Coxs River.

As may be expected, research into the known archaeological sites in the region surrounding the current study area has shown that the majority of sites are located on landforms close to water sources. Most sites were small, containing low densities of artefacts, with only one large site present, being LD 3 situated in the Lyell Dam area. Quartz dominates the artefact assemblages that are characterised by the Core and Flake tradition (Gay 1999: 15).

In 1998 Mills undertook survey of the proposed Ivanhoe Stage 4 project c. 7 km southwest of the current study area. The survey identified six (6) open sites, two (2) isolated artefacts and eight (8) other areas of potential archaeological deposit. Mills concluded that the presence of high quality milky white quartz flakes and debitage at all sites recorded in the survey area may indicate that it was a procurement place for the raw material however, no source was located.

A survey undertaken by Gay in 1999 indicated the possibility of an Aboriginal burial area being located close to the road alignment between Duncan Street and the coal conveyor at Lidsdale. Oral history from a local informant provided primary data for the location of the burial ground and test excavations of this general area were undertaken in 1993 (McIntyre as reported in Gay 1999: 17). During this work two areas were tested, and although no skeletal remains were uncovered, a minor open site was identified on the west side of the railway line (AHIMS # 45-1-237), where stone tools were said to have been manufactured or repaired.

McIntyre concluded that the reported burial ground may have been destroyed during the Coxs River deviation works in the 1950's, although there is still the possibility that skeletal material may occur east of the railway and river. She further notes that the presence of artefacts within the level ground adjacent to the river indicates the potential this landscape unit has for the occurrence of Aboriginal sites (McIntyre as reported in Gay 1999: 16-17).

In 1999 and 2000, Kelton undertook surveys in the Wallerawang and Marrangaroo areas respectively. Of the seventeen sites recorded at Marrangaroo, the majority were rock shelter sites, as most of the study area was within the sandstone escarpment. Kelton notes that the location and nature of sites recorded conforms to the previously developed site prediction and distribution models outlined above (Kelton 2000: 101).

An area covering almost 300 ha was surveyed for the proposed Cullen Valley open cut mine extension, northwest of the town of Cullen Bullen (and c. 8 kms west of the current study area) by Kelton in 2002. The landforms encountered included exposed sandstone formations, although few alluvial valleys. One open camp site comprising 9 stone artefacts primarily of chert and one rock shelter with no artefacts and some charcoal were recorded as a result of this assessment (Kelton 2002b).

To the southeast of Invincible mine and just outside (southwest) the 10 x 10 km area surrounding the current Baal Bone study area, Kelton (2002a) undertook survey of a c. 50 ha area for the proposed Boulder Road coal mine, which has now been incorporated into the proposal for the Neubecks Open Cut Coal Mine. During this survey, Kelton identified one isolated find (BP-IF1 - # 45-1-2582), apparently situated on a high flat spur overlooking the tributary into Neubecks Creek, and one open camp site (BP-OS1 - # 45-1-2581) containing seven recorded artefacts in a disturbed context next to the transmission line easement immediately east of the Castlereagh Hwy.

In 2003 further survey was undertaken (Appleton 2004) in the face of proposed coal mining at Pine Dale Coal Mine, immediately north of Enhance Place coal mine, c. 8 kms SSW of the current study area. This study recorded one isolated find – WC1A (a silicified metasedimentary flake).

In 1999 and 2000, two surveys by Gay were undertaken in the face of the proposed Castlereagh Highway deviation at Lidsdale. One open site and two PADs were identified and test excavation of the latter two was recommended. Subsequently, large scale test and salvage excavations were carried out at these sites, located on a crest above the Coxs River (OzArk 2004a). Part of the site revealed deep soils with evidence for cultural stratification. Sediment samples were dated using the OSL technique providing determinations of 7, 400 $\pm$700 BP at 30 cm depth and 13, 500 $\pm$1, 000 BP at 45 cm depth. While these sediment samples may not directly date the lithic assemblage, they do give an indication of potential age range, particularly the presence of a pre-Bondaian assemblage in the deepest spits. This interpretation is supported by an absence of Bondaian technical features within the lithic assemblage from spits 3 and 4.

The assemblage from the lower spits lacked backed artefacts and evidence of asymmetric alternating flaking and no flakes with faceted platforms were recovered. This Pre-Bondaian assemblage is dominated by quartz, and has higher frequencies of quartzite and igneous artefacts than the more recent assemblage and average artefact weight is higher than in the upper spits. The assemblage from spits 1 and 2 both include backed artefacts, some cores show asymmetric alternating platforms and some flakes have faceted platforms. Both upper spit assemblages are dominated by quartz, but siliceous tuff / FGS is more frequent in spit 1 than in spit 2. A few bipolar artefacts occur in spit 2. A piece of utilised pigment was also found in spit 2. Average artefact weight is lowest in spit 1 (Table 2).

Table 1: Summary of the assemblage from Lidsdale open site, Area I

Age BP	Spits	Total artefacts	% Quartz	% S.Tuff	Mean weight Quartz	Mean weight S.Tuff	% Backed artefacts	% Cores	% Bipolar artefacts
	1	559	*71.4*	*26.1*	1.2g	1.2g	*2.1*	*0.6*	
7,400$\pm$700 before 2000AD (K-0032) (ANU$_{OD}$1591)	2	642	*84.6*	*12.8*	1.6g	2.4g	*1.9*	*1.1*	*0.6*
13,500$\pm$1000 before 2000AD (K-0033) (ANU$_{OD}$1592)	3+4	284	*79.9*	*11.6*	2.9g	3.9g		*1.4*	

(Assemblage data from White 2004; sediments dated using OSL, reported in OzArk CHM 2004a)

OzArk (2004b) undertook survey for the proposed Neubecks open cut coal mine. This survey was carried out over the Neubecks valley, on the property between Pinedale and Boulder, c. 5 kms south of the current study area. The Indigenous heritage component of the study recorded five (5) Indigenous sites. Two were open camp sites with Potential Archaeological Deposit – PAD, a further two were small open camp sites and the last is an isolated find. Both open camp sites with PAD were recorded on knolls / elevated spurs while the remaining sites were located on the colluvial / alluvial terraces adjacent to Neubecks Creek.

OzArk (2005a & b) undertook a survey within ML 1448 Lamberts Gully and recorded one open camp site with potential archaeological deposit (SVW-OS1 with PAD). This site was located adjacent to an ephemeral drainage line on flat ground at the base of the surrounding hills. Previous studies undertaken within the same study area (Rich and Gorman 1992, Rich 1993a and 1993b and Brayshaw 1993) identified eight Aboriginal sites. Of these three Aboriginal open camp sites # 45-1-0218, # 45-1-0208 and an isolated find IF2 (not registered on the DEC AHIMS) remain intact within ML 1448. Two of the sites (open camp site # 45-1-0208 and IF2) were not relocatable.

OzArk (2005c) undertook archaeological assessment over the North Ivanhoe rehabilitation project which is located on the western side of the Castlereagh Highway, c. 6-7 kms southwest of the current study area. The survey assessed 23 ha of land over the site of the proposed Ivanhoe North Rehabilitation Project and recorded no Indigenous sites. The degree of slope was assessed as generally unsuitable for camping locations and would have more likely been used for resource gathering.

5.2 Local Context

A search of the DEC AHIMS database (search date 7.12.06) shows the presence of 25 recorded sites within a 10 x 10 km square area centred on the current study area (Zone 56: 225000-235000E / 6307000-6317000N). Table 3 provides a breakdown of site types. The most frequent site types recorded in the vicinity of the current study area are rockshelters, comprising 80% of all site types. These may have occupation deposits (52%) or art (20%) and in two instances, caves had both art and deposit (8%). Obviously the escarpment country in which the current Baal Bone study area is located (albeit on the western perimeter of this landscape) provides the requisite geological landforms for habitable rockshelters.

Again the relatively small percentage of open campsites (16%) reflects the overriding topography of the searched area. The recorded camp sites are all located next to drainage features, one next to Ben Bullen Creek and the other three adjacent to more ephemeral waterways that drain into Jews Creek. The only isolated find is recorded south of the current study area, very close to Blackfellows Hand Rock.

Table 2: Number, type and percentage frequency of sites within a 10 x 10 km^2 including centred on the Baal Bone study area.

Site Type	Total	*%Frequency*
Shelter with Deposit	13	*52*
Shelter with Art	5	*20*
Shelter with Art & Deposit	2	*8*
Open Camp Site	4	*16*
Isolated Finds	1	*4*
Totals	***25***	***100***

With reference to surveys undertaken within a c. 5 km radius of the current study area, the most relevant are three assessments undertaken for Baal Bone Colliery by Haglund in 1990 and Kohen in 1992 and 1996. It has only been possible to source one of these reports (Kohen 1996), although review of the AHIMS search data for the area sees three (3) sites recorded on the Baal Bone lease by Brayshaw and Haglund in 1990. These comprise the open campsites mentioned above, that are situated on the headwater tributaries draining northwest into Jews Creek[2]. The subsequent study by Kohen in 1992 recorded one Indigenous site, being the open camp site on Ben Bullen Creek which was comprised of 47 stone artefacts (Kohen 1996: 12).

During Kohen's 1996 survey of the northern extension to the Baal Bone underground mining activities, he notes that a single site had been previously recorded within his study area, being a rock shelter recorded by Ian Brown for NPWS in 1984 (DEC # 45-1-0097). The site is described as an overhang situated along a track under which a chert scraper was recorded.

[2] It is noted in Kohen (1996: 12) that one of the three open sites recorded by Brayshaw and Haglund in 1990 (Baal Bone 3, DEC # 45-1-0120) had a consent to destroy permit issued for it in 1993.

Outside the current study area c. 1 km to the west, was the location of Kohen's 1994 study, which involved the excavation of two rockshelters at Gardiners Gap. Further attempts will be made to source these reports, which are not held by the current owners of Baal Bone, Xstrata Coal.

McIntyre's work in the Kariwara Project Area (1990) included a large area encompassing the Newnes Plateau and part of the AHIMS search area for the current project. A total of 42 sites, predominantly rockshelters (n=41) along the escarpment were recorded, including many of the 'shelter sites' documented in Table 2. McIntyre's work specifically targeted potential impacts from the effects of long wall mining on this landform and its associated Indigenous sites. Three major site complexes were identified as a result of her work, at Mt Horne, the upper reaches of the Wolgan River and Black Fellows Hands site. From this study McIntyre postulated the following hypotheses:

1. That major site complexes were most likely to be situated at the top of open gullies where access from the ridge tops to major creeks and rivers where resources were concentrated. These complexes may also be located on the plateau where localised resources and good vantage points coincided;

2. Large, open camp sites were also located along the western flank of the plateau where streams entered the Coxs River Valley; and

3. Smaller open camp sites representing sporadic visits were found at the end of long ridges.

In 1996 a survey was undertaken c. 3 kms to the northwest of the current project, reported as being for the Feldmast Coal Project (Mills 1996). This survey covered a large area immediately north of Cullen Bullen, part of which lies outside the 10 km^2 area searched for the current project (hence the sites recorded did not come up in the search results although survey area did overlap with the searched area). Three sites were recorded as a result of this study, an open camp site and isolated find were recorded on Western Springs Creek and Cullen Creek respectively, while a grinding groove site was recorded at an area of exposed sandstone adjacent to the headwaters if unnamed creek.

Silcox (1997) undertook archaeological survey within the Invincible mining lease area (immediately south of Baal Bone Colliery) for the original Invincible ML 68 open cut coal mine and haulage road. No sites were detected within the study area.

Also in 1997, Hunt is recorded as having undertaken archaeological investigations in the vicinity of Black Fellows Hand site. Five of the shelter sites revealed in the AHIMS site search relate to this project, although no original report for this study has been located.

In February 2006 OzArk undertook assessment of the former ML 68 (Invincible) open cut coal mine which occurs at the margin of the current 10 x 10 km search area. Approximately 10 ha of the Ben Bullen State Forest was assessed as a result of the coal extraction proposal. Survey of this area recorded no Indigenous sites within the proposed impact footprint and haulage road.

5.3 Predictive Model for Site Location

Predictive modelling aims to establish a theoretical model for site location / distribution within a given area. This model provides a comparative situation against which the results of the investigation can be discussed, taking into account the affects of post formation processes, such as visibility, land use etc.

Proximity to a permanent water supply is generally considered the primary factor determining the location of Aboriginal camp sites. In the Sydney region, stream ordering has been used to predict the potential for site occurrence, and further to indicate the possible nature of these sites in terms of their complexity. Results of an integrated series of studies including a serious excavation component (Jo McDonald CHM 1997), suggests a high correlation between the permanence of a water source and the permanence and/or complexity of the areas' Aboriginal occupation. This was further reflected in the lithic assemblages from sites close to permanent water, which suggested that a greater range of activities were represented (e.g. tool use, manufacture and maintenance, food processing and quarrying). Sites near ephemeral water sources had evidence for one-off occupation (e.g. isolated knapping floors or tool discard), and creek junctions were also proven to be foci for site activity.

More closely related to the current study area, are some extrapolations concerning site nature and distribution in the Cox's River Valley and surrounding escarpment country, as summarised above in the Regional and Local Context for the current project. Based on these results and using the concept of stream ordering, the following general predictions can be made regarding the nature of sites and their location in the current study area:

- On major creeklines and rivers archaeological evidence will tend to indicate more permanent or repeated occupation. Sites may be complex, with a range of lithic activities represented, and may even be stratified. Proximity to resource rich zones also indicates a higher likelihood of the presence of complex occupation sites.

  - From review of the topographic data relating to the current study area and as a result of physical inspection, the only waterway is ephemeral and the gullies seem to have significant slope. Consequently large open camps sites are considered unlikely in the current study area.

- Further from permanent water, sites are likely to be smaller, less complex and more likely to be the result of one-off occupation episodes.

  - The current study area appears to fall into this category, consequently small sites may be located on appropriate elevated, well drained areas near ephemeral water, although few likely places were noted.

- In escarpment country or upper hillslopes where appropriate, habitable sandstone overhangs and caves are present, occupation sites are likely and their size will be determined by the extent of available space in the shelters.

  - The current study area comprises significant high country. The nature and quality of the sandstone will determine the likelihood of shelters occurring and being used. Personal communication from a Baal Bone Colliery representative indicates the quality of the sandstone is quite friable. Depending on the condition and aspect of available overhangs, rock shelter sites with or without art and/or deposits may be recorded.

From the known sites outlined previously in Section 5.2, and the landform potential as detailed above, it is possible to say that the most likely sites to be encountered in the Baal Bone study area are:

- Rock shelter sites may occur wherever there are suitable overhangs / caves. The quality and extent of such features will determine the nature and type of potential occupation;

- Open camp sites (on elevated terraces and low spurs close to water). Due to the ephemeral nature of the water courses within the study area and the significant slope of the landform, such sites may be unlikely, but if present may be the result of one-off occupation episodes;

- Scarred trees (frequently close to creeks and rivers but also found further afield). Few mature trees of an age to bear cultural scars are likely to remain in the study area (due to logging), although some remnant individuals may be present;

- Grinding grooves may occur where exposed sandstone is evident;

- Natural mythological or cultural / ceremonial sites may occur anywhere, although are less likely on significant slopes;

- Isolated finds may occur anywhere, especially in disturbed locations near water sources or in areas close to ephemeral water – i.e. headwaters.

For the purposes of the current study site type definitions can be found in Appendix 4.

6. SURVEY METHODOLOGY

The Baal Bone study corridor was traversed using both pedestrian transects and through driving all available vehicle tracks. There was essentially no ground surface visibility at all off the vehicle tracks. Nonetheless, the entire length of the powerline corridor was surveyed by all four surveyors. It was attempted to locate and assess all areas of significant outcropping sandstone suitable for the presence of overhangs and / or rockshelters, as well as all areas that were relatively flat (suitable for camping) or within close proximity of a waterway.

7. SURVEY RESULTS

The current study recorded no Indigenous sites.

8. DISCUSSION

8.1 Aboriginal Site Distribution

The Baal Bone powerline corridor and vent fan compound study area is comprised of three major landform units:

- Ephemeral, gully drainage line (not named);
- Sandstone escarpment / hill slopes;
- Ridge crests.

The lack of sites recorded during the current survey is thought to be the result of two primary interrelating factors:

1. That the landforms within the study area have an overall low sensitivity for the presence of Indigenous sites due to the distance from permanent water and the general sloping nature of the land. The Wolgan Valley to the east, Long Swamp to the south and the Jews Creek valley to the north would have provided rich, permanent resource areas which would have been favoured over the undifferentiated, wooded slopes of the current study area.

2. The almost complete lack of ground surface visibility impeded the detection of occupation sites over the current study area. This factor is exacerbated by the removal of the majority of old growth trees of an age to have been scarred.

In summary, the overall lack of sites was predicted (Section 5.3) due to the assessed nature of the landforms, although poor visibility may have exaggerated this result.

8.2 Aboriginal Site Assessment

The appropriate management of cultural heritage items is usually determined on the basis of their assessed significance as well as the likely impacts of any proposed developments. Scientific, cultural and public significance are currently identified as baseline elements of this assessment, and it is through the combination of these elements that the overall cultural heritage values of a site, place or area are resolved.

As no sites were recorded as a result of the current assessment, the remainder of this section has been omitted.

8.3 Likely impacts of the proposed powerline corridor and ventilation shaft compound in the Ben Bullen State Forest.

As no sites of Indigenous heritage significance were recorded within the current study area, there will be no impacts to cultural heritage.

8.4 Relevant Legislation

Base line principles for the conservation of heritage places and relics can be found in the Burra Charter[3], which recognizes that there are places worth keeping because they can enrich our lives on many levels. The significance of such places may be embodied in fabric (physical material), environmental setting, contents, use or its meaning to people, and should be assessed through methodical data collection. Since its adoption in 1979, The

[3] The Burra Charter defines the basic principles and procedures to be followed in the conservation of all kinds of places such as monuments, buildings, Aboriginal sites, roads, archaeological sites, whole districts or even regions. It was first adopted in 1979, based on the Australian ICOMOS (International Council on Monuments and Sites) review (1977) of the 1966 Venice Charter (Australian ICOMOS Inc. 1998).

Burra Charter has become the standard of best practice in the conservation of heritage places in Australia, and heritage organisations and local government authorities have incorporated the inherent principles and logic into guidelines and other conservation planning documents. The Burra Charter generally advocates a cautious approach to changing places of heritage significance. This conservative notion embodies the basic premise behind legislation designed to protect our heritage, which operates primarily at a State level.

A number of Acts of parliament provide for the protection of Aboriginal heritage at various levels of government[4]. The three most important statutes in New South Wales are the:

- *Environmental Planning and Assessment Act 1979* (EP&A Act), amended by the *Environmental Planning and Assessment Amendment (Infrastructure and Other Planning Reform) Act 2005* (EP&AAAct);

- *National Parks and Wildlife Act 1974 (*NPW Act*;*

- *Heritage Act 1977 (*H Act*);*

While at Commonwealth level, the following statutes are relevant:

- *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) amended by the *Environment and Heritage Legislation Amendment Act (no. 1) 2003,* the *Australian Heritage Act 2003 (*AHC Act*)* and the *Australian Heritage Council (Consequential and Transitional Provisions) Act 2004 (*AHC (CT) Act*).*

<u>State legislation</u>

<u>The EP&A Act 2005</u> is founded on the *Environmental Planning and Assessment* Act 1979 that requires environmental impacts, including cultural heritage, to be considered at a land-use planning and decision making level.

Under this Act Aboriginal heritage is protected in three different ways:

1. Through planning instruments such as Regional Environmental Plans (REPs) and Local Environmental Plans (LEPs). Such plans outline permissible land use as well as identifying potential constraints. Section 112 (1) of the EP & A Act delineates that no approval for either prescribed developments or developments likely significantly affect the environment, may be granted without prior appropriate environmental impact assessment.

2. Section 90 of the Act (Part 4, Division 5) lists impacts to the environmental resource, including cultural heritage, which must be considered before development approval is granted.

3. All State Government agencies acting as determining authorities on environmental issues must consider a range of community and cultural factors, including Aboriginal heritage, in their decision-making process. The factors to

[4] NSW Heritage Office 1998: Living with Aboriginal Culture, p. 3

be considered in such assessments are set out in the EP & A Regulations (1980), Part VII.

The *National Parks and Wildlife Act 1974* (as amended; particularly sections 83-91A) provides statutory protection for all Aboriginal relics and places, regardless of significance, land tenure or whether they have been previously recorded in the DEC AHIMS. Areas may be gazetted as Aboriginal 'places' when the Minister is satisfied that sufficient evidence exists to demonstrate that the area is or was of special significance to Aboriginal people.

Under Section 90 of this Act it is an offence to knowingly damage, deface or cause or permit the destruction of an Aboriginal relic or place without the prior written consent of the Director-General of the NSW DEC. Prosecution for such offences may include the imposition of financial penalties and/or imprisonment. Reporting the discovery of previously unknown Aboriginal sites to the Director-General of the DEC within a reasonable time of discovery is also obligatory under Section 91 of the Act.

However, under Part 3A of the EP&A Act, a Section 90 permit under the *National Parks and Wildlife Act* 1974 is not required where development consent is granted for a Major Project. Any disturbance to Aboriginal sites, however, must be undertaken in accordance with the conditions of development consent.

The *Heritage Act 1977* (amended 1999) protects the State's natural and cultural heritage and contains measures to protect archaeological remains. Generally, Aboriginal sites are protected by the NPW Act, but if certain sites are deemed as having great significance, they can be further protected by a heritage order, issued by the Minister, on the advice of the Heritage Council.

Commonwealth legislation

The *Environment Protection and Biodiversity Conservation Act 1999* protects the environment, particularly matters of National Environmental Significance. It streamlines national environmental assessment and approvals process, protects Australian biodiversity and integrates management of important natural and cultural places. Under the EPBC Act, definitions of the "environment" include the following:

- Ecosystems and their constituent parts, including people and their communities;
- Natural and physical resources;
- The qualities and characteristics of locations, places and areas;
- Heritage values of places and
- The social, economic and cultural aspects of a thing mentioned in the above points.

There are seven matters of National Environmental Significance under the EPBC Act:

  - World Heritage properties;
  - National Heritage places;
  - Wetlands of international importance (Ramsar Wetlands);
  - listed threatened species and ecological communities;
  - listed migratory species;

- the Commonwealth marine area; and
- nuclear actions, including uranium mining.

The EPBC Act provides that any action assessed as likely to have a significant affect on these listed matters of national environmental significance is to be known as a *controlled action, and* may only proceed with the Minister of the Environment's approval.

In January 2004 changes to the protection of national heritage came into affect through amendments to the EPBC Act and through the passing of the AHC Act and the AHC (CT) Act. The first was covered above; where National Heritage places joined the previous six listed Matters of National Environmental Significance.

The AHC Act provided for the establishment of the Australian Heritage Council (AHC), an independent advisory body to the Commonwealth Minster for the Environment and Heritage. This body replaces the earlier Australian Heritage Commission, established in 1975 under the *Australian Heritage Commission Act 1975 (*AHC Act 1975*).* The register of heritage places set up under the AHC Act 1975, known as the Register of the National Estate (RNE), is retained under the new AHC Act, but it is noteworthy that this list provides no specific legislative protection, although listing on the RNE recognises the heritage values of such places.

The AHC (CT) Act repeals the AHC Act 1975 and provided amendment to various Acts, allowing a transitional period for the establishment of the National Heritage List (NHL) and the Commonwealth Heritage List (CHL).

9. RECOMMENDATIONS

Under Section 91 of the NP & W Act (1974 as amended) the Director-General of the NSW DEC must be notified of the location of all Aboriginal sites recorded under any auspices. As a professional in the field of cultural heritage management it is the responsibility of OzArk EHM to ensure this process is undertaken.

To this end it is noted that no sites were recorded as a result of the current assessment.

The following recommendations are made on the basis of:

- Legal requirements under the terms of the *National Parks and Wildlife Act of 1974* (as amended) whereby it is illegal to damage, deface or destroy an Aboriginal relic/object without the prior written consent of the Director, DEC;

- The findings of the current investigations undertaken within the study area; and

- The interests of the Bathurst Local Aboriginal Land Council (BLALC), North East Wiradjuri Native Title Party (NEWNTP) and Warrabinga Native Title Claimants Aboriginal Corporation (WNTCAC).

It is recommended that:

1) No Indigenous sites were recorded as a result of the current assessment. Overall the Baal Bone study area was assessed as having low archaeological sensitivity due to the generally sloping nature of the landforms and the distance from permanent water sources. This assessment is supported by the nearby presence of Long Swamp to the south, the Wolgan Valley to the east and Jews Creek to the north, all of which would have provided plentiful resources and appropriate occupation site locations. These locations are likely to have been utilised in preference to the Baal Bone study area.

2) Consequently, there are no constraints on the grounds of Indigenous heritage to the proposed Baal Bone Colliery construction of the 11kV powerline and ventilation shaft compound in the Ben Bullen State Forest, NSW.

3) Should any ‘relics’ or other Aboriginal sites be identified anywhere in the study area during the course of construction, work in that area should cease and the DECC and the respective Aboriginal community organisation or LALC be contacted to discuss how to proceed.

4) One copy of this report should be sent to:

Gundungurra Tribal Council Aboriginal Corporation
PO Box 419
Katoomba NSW 2780

Members - Bathurst Local Aboriginal Land Council
c/o Mr Warwick Peckham, Coordinator

PO Box 1500
Bathurst NSW 2795

Members - Warrabinga Native Title Claimants Aboriginal Corporation
c/o Ms Wendy Lewis, Cultural Heritage Liaison Officer
PO Box 771
PICTON NSW 2574

Members – North East Wiradjuri Native Title Party
c/o Ms Lyn Syme, Secretary
17 Main St
ULAN NSW 2850

5) Two copies of this report should be sent to:

Manager, Aboriginal Heritage Unit
Cultural Heritage Division,
NSW DEC
PO Box 1967
HURSTVILLE NSW 2220

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Appendix 1 – Plates

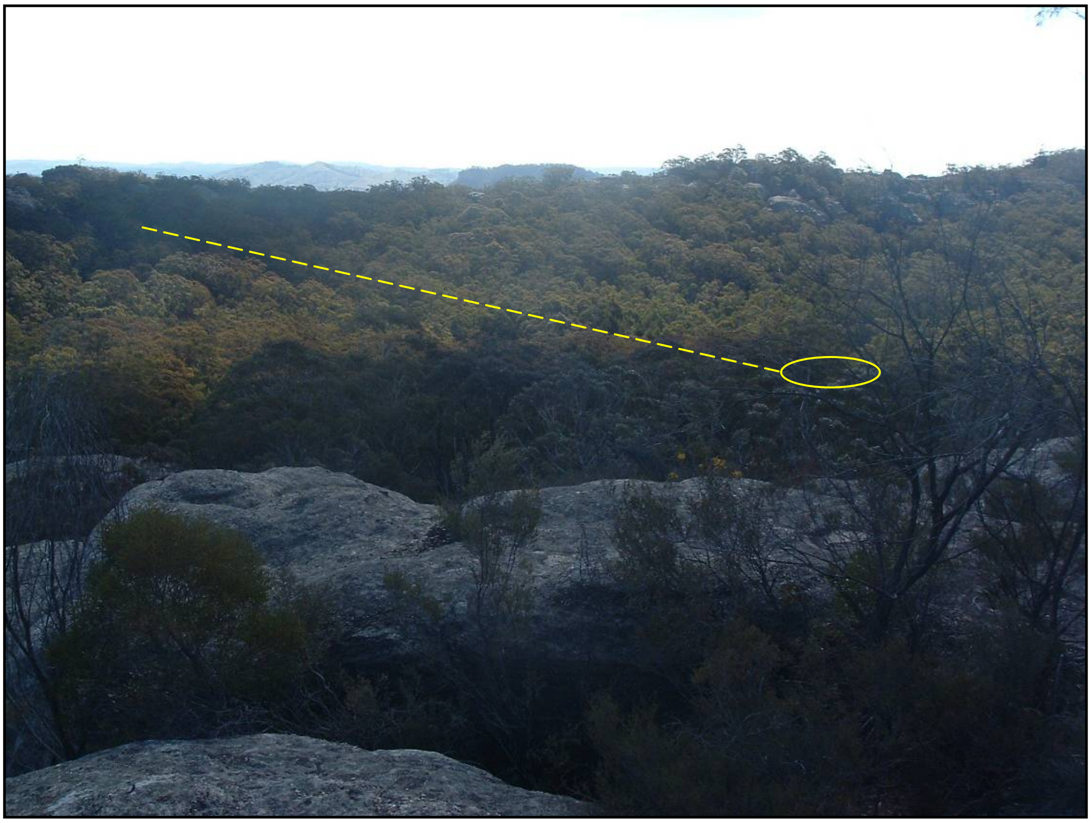

Plate 1: View west from the top of the escarpment along the proposed easement route showing the location of the existing dewatering borehole in the valley below. The proposed easement is likely to span from this point to the existing infrastructure**.**

Plate 2: View of a typical woodland habitat in the general vicinity of the proposed ventilation shaft compound.

Plate 3: View east from the existing dewatering borehole towards the drainage feature to be spanned by the easement.

Appendix 2 – Aboriginal Community Correspondence

WARRABINGA

Native Title Claimants Aboriginal Corporation
PO Box 771
Picton NSW 2574
MOBILE: 0409 966 371 or 0409 966 163
FAX: 02 4677 0454

12th December, 2006

Kylie Sutherland
Ozark
PO Box 2069
DUBBO. NSW 2830

Dear Kylie

Re: Expression of Interest
Aboriginal Cultural & Heritage Interests
Proposed extensions to Baal Bone Colliery at Cullen Bullen

I write to advise you of this organisation's interest in any work you may be undertaking in NSW in relation to Native Title and Aboriginal cultural heritage issues.

Membership of our organisation is open to adult Aboriginal persons who are descendants of Dabee, Mudgee, Capertee, Coxes River, Goulburn River, Cudgegong River, Gulgong, Cassilis, Bylong, Lithgow, Abercrombie, Jenolan and Wombeyan Caves and Wollimi and Oberon Clans.

Warrabinga Native Title Claimants Aboriginal Corporation was established to represent the interests of a large number of individual Aboriginal clan groups in the areas outlined above.

Broadly our organisation has members with native title interests over the lands and waters associated with the Cox's River, Goulburn River and the Cudgegong River and other waterways within these boundaries .

Our organisation consists of a number of members with knowledge essential to completing Aboriginal cultural heritage assessments and our executive committee make determinations for the most suitably qualified individual(s) for any field work.

Warrabinga is fully insured for both Public Liability and Workers Compensation (Certificates of currency are available upon request, should they be required for any work).

An important point is that under the amended National Parks legislation all sites are protected regardless of whether they have been previously identified or not.

WARRABINGA

Native Title Claimants Aboriginal Corporation

'O Box 771
'icton NSW 2574
MOBILE: 0409 966 371 or 0409 966 163
'AX: 02 4677 0454

We would therefore request that you maintain contact with us, consult with us and we can provide *expertise services under contract should you require* such services.

Professional Fees:

Our organisation has previously worked in association with other Environmental Consultants on other projects within our area of interest.

What we would require from you:

Definitive survey dates 10 days prior to commencement of work.

Should you have any further queries relating to Warrabinga or require more specific information please feel free to contact me on the above numbers.

Yours in Indigenous spirit,

W. Lewis
per [illegible]

Wendy Lewis
Cultural Heritage Liaison Officer

NORTH EAST WIRADJURI NATIVE TITLE PARTY

C/- Lyn Syme
17 Main St., Ulan. 2850

0263734875
0425332434
lsyme@aapt.net.au

12th December, 2006

Kylie Sutherland
OzArk
PO Box 2069
DUBBO. NSW. 2830

Dear Kylie,

Expression of Interest
Aboriginal Cultural Heritage Assessment
Proposed Extensions to Baal Bone Colliery at Cullen Bullen

On behalf of the NE Wiradjuri Native Title Party I wish to register our interest in the Aboriginal Cultural Heritage Assessment for the above Aboriginal Cultural Heritage Assessment.

I can be contacted on the above phone nos. should you require any further information.

Yours in Indigenous Spirit

Lyn Syme
Secretary.

BATHURST LOCAL ABORIGINAL LAND COUNCIL

149 Russell Street
Bathurst NSW 2795

PO Box 1500
Bathurst NSW 2795

Phone: 02 6332 6835
Fax: 02 6332 3623

LONGWALL 29 - 31

Three separate surveys were conducted for Baal Bone Colliery on over a three-day period 27th, 28th and 29th of December 2006 for the proposed airshaft bore hole, power transmission line and longwalls 29-31. The survey areas are located within the Ben Bullen State Forest east of Lithgow NSW. This is an extension survey to a pervious survey conducted on Monday the 17th September 2006 with Phillip Cameron from Ozark Environmental & Heritage Management.

Survey One – Proposed Air Shaft Bore Hole

The proposed airshaft bore hole site is located on Long Swamp Road. The area surveyed covered approximately 200 x 200 meters. This area has been severely disturbed, consisting of sandy soil covered with heavy ground growth creating nil visibility. Clearing of this survey area will be required for the installation of the airshaft bore hole.

Survey Two – Power Transmission Line

The power line will be installed adjacent to the existing bush track for 700 meters, after that distance it will veer northwest into the bush land. This bush land is comprised of an extremely rough terrain and covered in dense ground cover such as leaves, fallen trees, branches and other forest matter thus creating nil visibility difficult access.

Two shelters were located within the survey area. These shelters displayed *no evidence of* aboriginal occupancy and will not be impacted on by the installation of the power line. No evidence of Aboriginal activity, artefacts, shelters or scared trees was recorded or discovered during either survey.

Survey Three – Longwalls 29 - 31

Two shelters were located within the Longwalls survey area. These shelters *displayed no* evidence of aboriginal occupancy however one isolated artefact was located. This artefact was rerecorded and replaced in the same region. Visibility was extremely poor due to thick undergrowth and bush litter. The area provided no potential for Aboriginal occupation.

The Bathurst Local Aboriginal Land Council has no objections to the commencement of the proposed Air Shaft bore hole, power transmission line and longwalls installation commencing *within the surveyed areas.*

Present at this were surveys:

Jodie Benton	Archaeologist	Ozark Environmental *& Heritage Management*
Phillip Cameron	Ecologist	Ozark Environmental & Heritage Management
Wendy Lewis	Representative	Warrabinga Aboriginal Council
Richard Peters	Sites Officer	Bathurst Local Aboriginal Land Council

Richard J. Peters

RICHARD J PETERS
SITES OFFICER
3 January 2007

WARRABINGA

Native Title Claimants Aboriginal Corporation

535 Pheasants Nest Road
Pheasants Nest, NSW 2574
PH: 02-46841341
MOB: 0409966163 EMAIL: lewisbarton@bigpond.com.au
FAX: 02-46843454

Baalbon Ventilation Shaft Compound.
28 29 30/12/2006 & Electrical Line.

No sites found.
No areas of archaeological sensitivity
Yours in Indigenous Unity
Wendy Ann Lewis
WARRABINGA NTCAC.
2/5/2007

Appendix 3 – Site Type Definitions

Rockshelter sites (with art and/or deposit)

Rockshelter sites can only occur where this is suitable topographic and geological factors present, forming overhangs or caves in the eroding bedrock. The size (both horizontal and vertical dimensions) of the space available, the aspect of the opening and the proximity to resources will determine the length and intensity of human occupation. Art in the form paintings may be found in caves, but often suffer considerably from erosion of the sandstone.

Open camp sites

Often called stone artefact scatters, these sites (for the purposes of the DEC AHIMS database) were in the past defined by the presence of two or more stone artefacts located within 50 m of one another. Current guidelines, however, delineate no hard and fast determinations, more loosely describing these camp sites as places exhibiting evidence of past human activity. This can be, and is most frequently, in the form of stone artefacts, but may also include other evidence such as hearths or midden material. Such sites provide evidence for the range of activities that may have been undertaken at a particular place, including the production of stone tools and the preparation of food including the butchering of animals or grinding of seeds. However, the distinction between a single, isolated artefact versus a place where numerous artefacts have been recorded together provides a necessary division in terms of the possible information that a site can reveal about past activities. Further information recorded about open sites includes assessments of the sites' integrity (how intact the site is) and subsequently whether sub-surface deposits are thought to be present.

Isolated Finds

An artefact, usually of stone, but possibly of other materials, that is located but has no relationship to other identifiable archaeological features.

Axe Grinding Grooves

Aboriginal axe heads were usually made from very hard igneous rock, which was first flaked roughly to the appropriate shape and then pecked or ground to an even surface. To keep the edges of these axes sharp, they were ground on the surface of a relatively softer stone (usually sandstone). As the axe is rubbed repeatedly in the same location, a groove forms to fit the shape of the axe. This groove has a roughly elliptical shape and a smooth, regular surface along its base. Arrowheads may also have been sharpened in grooves, which generally appear narrower and deeper.

Grinding groove sites are most often located on the floodplains of rivers and creeks, although they can be in elevated positions above water as well. Sometimes, sandstone flats near water may exhibit hundreds of such grooves, and it is thought that once an axe blank has its edge ground in a groove, then it can only be sharpened in the same groove. Hence, if the owner of the axe is away from its place of origin, then a new groove has to be created for the sharpening of that particular axe head[5]. Grooves are also frequently recorded in smaller groups, especially along more ephemeral water courses.

Scarred Trees

This site type results from the deliberate removal of bark (and sometimes wood) from trees, for the purpose of obtaining raw material for the manufacture of various items of material culture – i.e. shields, coolamons, shelters, canoes, and cradles. They may also result from foraging and hunting - for instance, toe holes cut in trees to allow access to upper branches and hollows, and axe marks around natural hollows for the extraction of small tree-living fauna (such as possums or birds) or honey.

The identification and interpretation of a scar as being Aboriginal in origin can often be difficult, as bark can be removed from trees by a variety of means e.g. animal and bird foraging, the natural breaking off of tree limbs, lightning strikes to the tree, the result of machinery damage to trunks and the removal of bark by Europeans to define land boundaries. To assist archaeologists in the accurate identification of Aboriginal scarred trees, the DEC Western region provides a set of criteria against which each scar must be assessed.

These diagnostic criteria are as follows:

1. *The scar must not touch the ground* - (scars resulting from fire, fungal attack or lightning nearly always reach the ground). Such a termination does not necessarily preclude an Aboriginal origin. Ethno-historic accounts of canoe manufacture occasionally demonstrate scarring to ground level. If the scar does run to the ground, the sides must be relatively parallel (i.e. not triangular). It must be noted that discussion with Native Title from other areas suggests that scars may indeed extend to the ground, especially when the bark is planned for use in a shelter. This information is derived from oral histories recorded in Dubbo and observations from further afield;

2. *The ends of the scar should be squared off or evenly tapered* - Different shapes at the top and bottom (e.g. pointed at top, squared at bottom; round at top, flaring at bottom) are suggestive of natural processes (e.g. branch loss);

3. *The sides of the scar should be parallel or symmetrical* - Few natural scars are likely to have these properties, with the possible exception of fire scars which may be symmetrical but are usually wider at their base. Modern surveyors' marks are typically triangular, and often adzed. These also (regardless of shape) usually have a number carved in the wood, within the scar;

4. *The length of the scar must be on the same axis as the tree and not oblique or slanting across the tree or the branch* - Scars which are natural in origin tend to have irregular outlines, sometimes have irregular regrowth and may occur against the axis of the tree.

[5] As read at the Terramungamine Reserve grinding groove interpretation sign.

5. *The tree should be reasonably old – i.e. over 100 years* - The tree upon which the scar is found should be old enough (i.e. of sufficient age) to have been used by Aboriginal people in (at least) a semi-traditional manner. This means the tree should be at least c. 100 years old. The age of the scar should also be reflected in the thickness of the regrowth. Young scars (e.g. some natural scars caused by branches falling or birds or horses gnawing, have characteristically thin regrowth);

6. *There must be no obvious natural or other artificial cause* such as a branch rip, lightening strike, cockatoo chewed bark or healed bark tears from machinery damage or car impact – Any signs that the scar may not be Aboriginal should be carefully assessed; and,

7. *The tree must not be an introduced species* – For obvious reasons, the tree upon which the scar is found should be endemic to the region, i.e. this excludes historic (exotic) plantings.

Also helpful in scarred tree identification, but not within the DEC criteria are the following points:

8. *Axe or adze marks* - A scar with cut marks on the original wood is likely to be anthropogenic in nature (i.e. as a result of human actions). The location and shape/size may lend support to the scar's origin. For example stone axe marks would indicate an Aboriginal origin, while steel axe marks post-date the arrival of Europeans. These of course could still have been made by an Aboriginal person in the post-contact era; and,

9. *The presence of epicormal growth* – Many scars of Aboriginal origin tend to have an epicormal shoot originating at the base of the scar. This is a new branch shooting from the point of damage and is part of the trees self preservation mechanism.

As noted in the DEC criteria, any tree that does not fit these rules cannot be accepted as likely to be of Aboriginal origin. This may mean that a few authentic scars are omitted from the Aboriginal Sites register, but it is the only means to establish consistency in identification.

However, even when applied, the above criteria cannot always provide a definitive classification, and a natural origin for the scar cannot be ruled out. For this reason interpretations of Aboriginal origin are qualified by the recorders degree of certainty. The following categories are used:

- DEFINITE ABORIGINAL SCAR

This is a scar which conforms to all of the criteria stated above and/or has in addition a feature or characteristic that provides definitive identification, such as diagnostic axe or adze marks, or a historical identification. All conceivably natural causes of the scar can be reliably discounted.

- ABORIGINAL SCAR

This is a scar which conforms to most of the criteria, and where an Aboriginal origin is considered to be the most likely. Despite this, a natural origin cannot be completely ruled out.

- POSSIBLE ABORIGINAL SCAR

This is a scar which conforms to most of the criteria but where an Aboriginal origin would appear unlikely[8].

For the purposes of the current study, on the advice of Allan Hutchins (DEC Western Region), only scars of the first two categories have been recorded as sites to be entered into the DEC ASR. As a general rule, the “Aboriginal scar” and “Probable Aboriginal scar” categories have been collapsed into one, called “Aboriginal scar”.

<u>Natural Mythological or Cultural / Ceremonial sites</u>

Natural mythological sites can be any natural feature and like a cultural / spiritual are not detectable without the traditional knowledge of specific areas. Lindsey Moran from the BLALC is a keeper of such knowledge and was present in an effort to establish the presence of any such site type.

<u>Burials</u>

Human skeletal remains can occur as either single individual burials or as cemeteries containing multiple individuals. Several have been found in the local region (Section 5.2). Individuals may be buried either in a standing or sitting position, often oriented to the east and sometimes marked by carved tree.

APPENDIX 7

Noise Assessment

HEGGIES

REPORT 10-5070-R2

Revision 1

Baal Bone Colliery
Ventilation Shaft Installation and Operation
Noise Impact Assessment

PREPARED FOR

Umwelt (Australia) Pty Ltd
2/20 The Boulevard
TORONTO NSW 2238

28 MAY 2007

Baal Bone Colliery

Ventilation Shaft Installation and Operation

Noise Impact Assessment

PREPARED BY:

Heggies Pty Ltd
ABN 29 001 584 612
Level 2, 2 Lincoln Street Lane Cove NSW 2066 Australia
(PO Box 176 Lane Cove NSW 1595 Australia)
Telephone 61 2 9427 8100 Facsimile 61 2 9427 8200
Email sydney@heggies.com.au Web www.heggies.com.au

DOCUMENT CONTROL

Reference	Status	Date	Prepared	Checked	Authorised
10-5070-R2	Revision 1	28 May 2007	Lindsay Chambers	Dick Godson	Dick Godson
10-5070-R2	Revision 0	15 May 2007	Lindsay Chambers	Dick Godson	Dick Godson

EXECUTIVE SUMMARY

Heggies Pty Ltd has been commissioned by Umwelt (Australia) Pty Ltd on behalf of The Wallerawang Collieries Limited to conduct an assessment of the noise impacts in relation to the construction and operation of a proposed ventilation shaft at the Baal Bone Colliery. The ventilation shaft is sited approximately 25 km north of Lithgow in the Central Tablelands of NSW. The ventilation shaft will allow for the mining of previously inaccessible coal reserves, continuation of the current annual coal production and extension of the lifespan of the Baal Bone Colliery.

For the purposes of assessing the potential noise impacts of the proposed project, an estimate of the noise impacts of the construction and operation of the ventilation shaft is required. Based on a range of provided noise source data, the site-specific scenarios adopted for assessment purposes were assessed under the following weather conditions.

- Day, evening and night-time calm conditions.
- Evening and night-time adverse wind conditions.
- Night-time inversion in winter.

Noise goals consistent with the NSW Department of the Environment and Conservation (DEC) document *Industrial Noise Policy*, 2000 (INP) and Environmental Criteria for Road Traffic Noise, 1999 (ECRTN) have been applied to the project.

Meteorological observations have been sourced from the Wallerawang Power Station Automatic Weather Station.

A review has been carried out of activities with the potential to generate significant noise during the construction and operation of the ventilation shaft. Two scenarios were derived for noise modelling purposes to reflect the construction and operational phases of the Project. The two scenarios are considered representative of the worst case conditions present during these phases and are as follows:

- Ventilation Shaft Construction - incorporates the establishment and construction of the ventilation shaft including the excavation of a shaft collar and any pre-sink, stockpiling of excavated materials and drilling of the ventilation shaft by a raise borer.
- Operation of the ventilation shaft.

Predictions of noise associated with the installation and operation of the ventilation shaft were undertaken using the SoundPLAN noise modelling software developed by Braunstein and Berndt GmbH in Germany. All modelling predictions indicate that noise attributable to the Project would be within the current DEC noise goals at the closest residence.

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1 INTRODUCTION

Baal Bone Colliery (operated by The Wallerawang Collieries Limited and hereafter, “the Proponent”) intends to continue their current underground mining operations at the Baal Bone Colliery in order to maintain their annual coal production capacity and to extend the life of their underground longwall mine by approximately three years.

In order to provide sufficient quantities of air to this area of expansion of the mine, the Proponent plans to install a ventilation shaft approximately 4 km to the east of the Run-of-Mine (ROM) area of the mine.

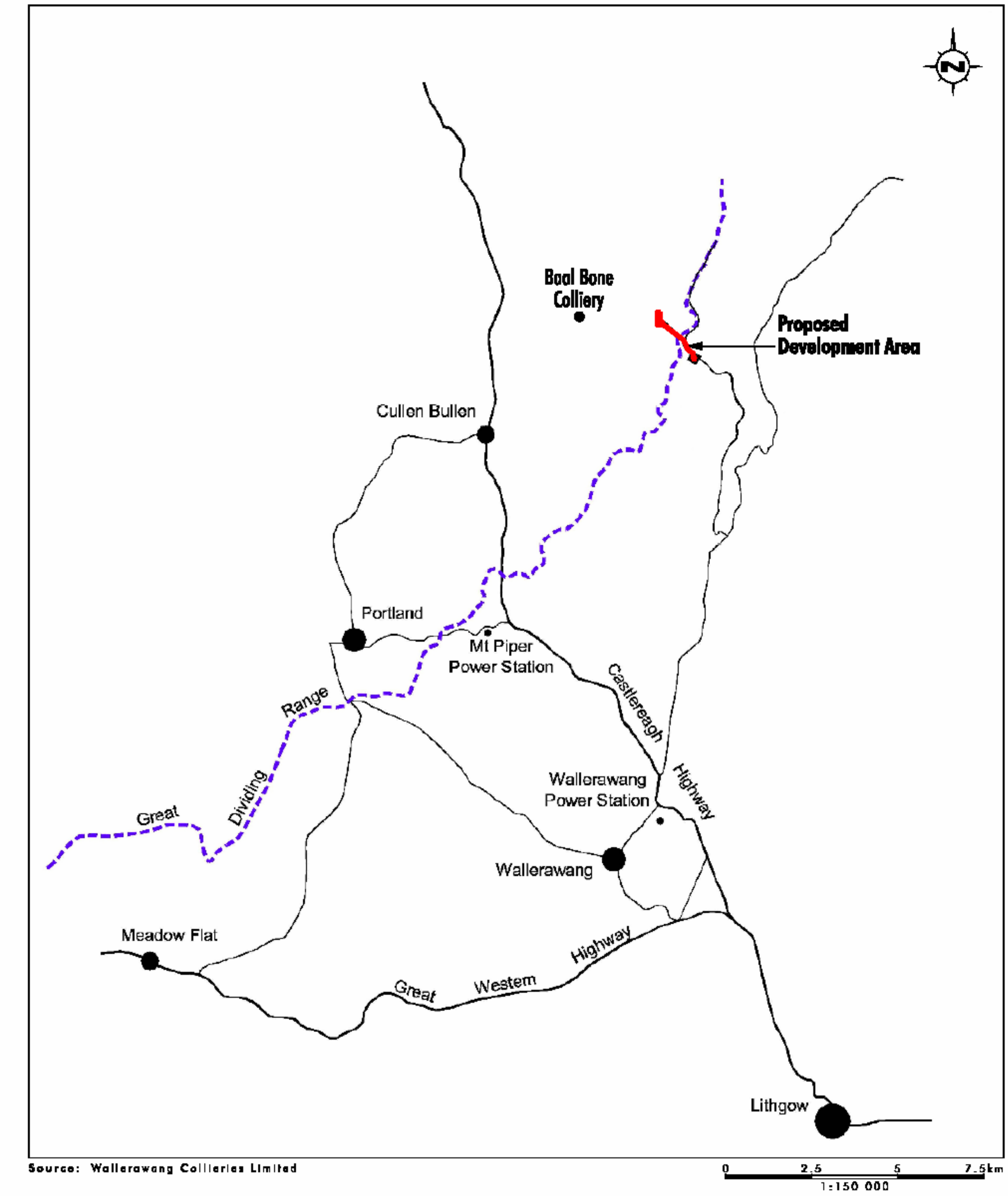
Heggies Pty Ltd (Heggies) has been commissioned by Umwelt (Australia) Pty Ltd (Umwelt) on behalf of the Proponent to conduct an assessment of the noise impacts in relation to the construction and operation of the proposed ventilation shaft (hereafter, “the Project”).

The Project Site is located within the Ben Bullen State Forest, approximately 25 km north of Lithgow and 7 km east of Cullen Bullen, in the Central Tablelands region of NSW. **Figure 1** illustrates the regional setting of the Project Site.

The Proponent commenced underground longwall mining at the Mine in 1985, while open cut mining on the site recommenced in February 2005. Approximately 2.4 million tonnes of saleable thermal and PCI quality coal is produced annually.

The continuation of the Mine’s underground operations to access the previously unmined southeastern reserves, known as Longwalls 29-31, will provide about 5 Mt of ROM coal over an anticipated period of approximately three years.

Figure 1 Regional Setting of the Project Site



2 PROJECT OVERVIEW

2.1 Project Description

The Project Site comprises two areas - a 50 m by 50 m area within which the ventilation shaft and associated equipment will be located; and an approximately 1.7 km corridor for the provision of power supply.

The Project is planned to comprise the following components:

- Topsoil clearing of a maximum 50 m by 50 m zone within the ventilation shaft area in order to account for the both the shaft construction and the subsequent fan installation;
- Excavation of a shaft collar and any pre-sink to a maximum depth of 11 m;
- Stockpiling of all cleared topsoil and spread of excavated material from the collar excavation on site;
- Construction of a 3.15 m diameter shaft to the required depth (approximately 220 m) by the raise bore method;
- Installation of a ventilation fan on the shaft;
- Installation of a power line from an existing source to the new shaft position. The method of power supply is expected to be one of aerial bundle cable (insulated cable) with minimal clearing and the possibility of limited underground cabling;
- Installation of a range of amenity facilities, including temporary office block, bunded diesel tanks, onsite power generator, workshop container and chemical toilet. These facilities will be removed at the completion of the ventilation shaft construction;
- Operation of the ventilation shaft during the underground mining campaign at Longwall 29-31 of the mine (approximately three years); and
- Following completion of the mining campaign, dismantling and removal of the ventilation fan and power line corridor and filling and sealing of the shaft. Both areas will then be rehabilitated.

In addition, the construction stage of the project will involve a periodic and short term increase in traffic along a section of Wolgan Road between the Castlereagh Highway and a forestry access track to the ventilation shaft site. During preliminary site works it is estimated that there will be up to six heavy vehicle movements and ten light vehicle movements per day. During pilot hole drilling water trucks will be making an estimated 20 round trips over a period of approximately five days. Other machinery will be required during fan installation and powerline construction. The worst case traffic scenario for a one hour period during the construction period is estimated to be three heavy vehicles and two light vehicles.

2.2 Project Timing

The following estimate of timing for a range of components of the Project has been provided by the Proponent, as follows:

- Site Construction (all components except raise borer operations are expected to run during daylight hours, 5-6 days per week. Raise borer operations will be undertaken 24 hours per day, 7 days per week. Establishment and set up - 2 to 3 weeks;
  - Pilot hole and raise borer setup - 1.5 to 3 weeks;
  - Raise borer operations - 5 to 8 weeks; and
  - Demobilisation - 1 week.
- Power line construction - concurrent with shaft construction;

- Fan installation and commissioning - 4 weeks; and
- Ventilation Shaft Operation – 24 hours per day, seven days per week for approximately three years.

Duration of the construction phase from preliminary site works to fan commissioning is expected to be approximately twenty weeks, subject to site conditions.

2.3 Local Setting and Nearby Receptors

As discussed in **Section 1**, the Project Site is located within the Ben Bullen State Forest, approximately 25 km north of Lithgow and 7 km east of Cullen Bullen, in the Central Tablelands region of NSW. While the surrounding area is dominated by dense bushland, there are some residences located to the east of the Project Site. **Figure 2** displays the local setting of the Project Site, illustrating the proximity of nearest residences and the township of Cullen Bullen.

It can be seen that the nearest potentially affected residence is R1, which is located 1,860 m from the Project Site. The locations of the three potentially affected residences are shown in **Table 1**.

Figure 2 Local Setting of Project Site

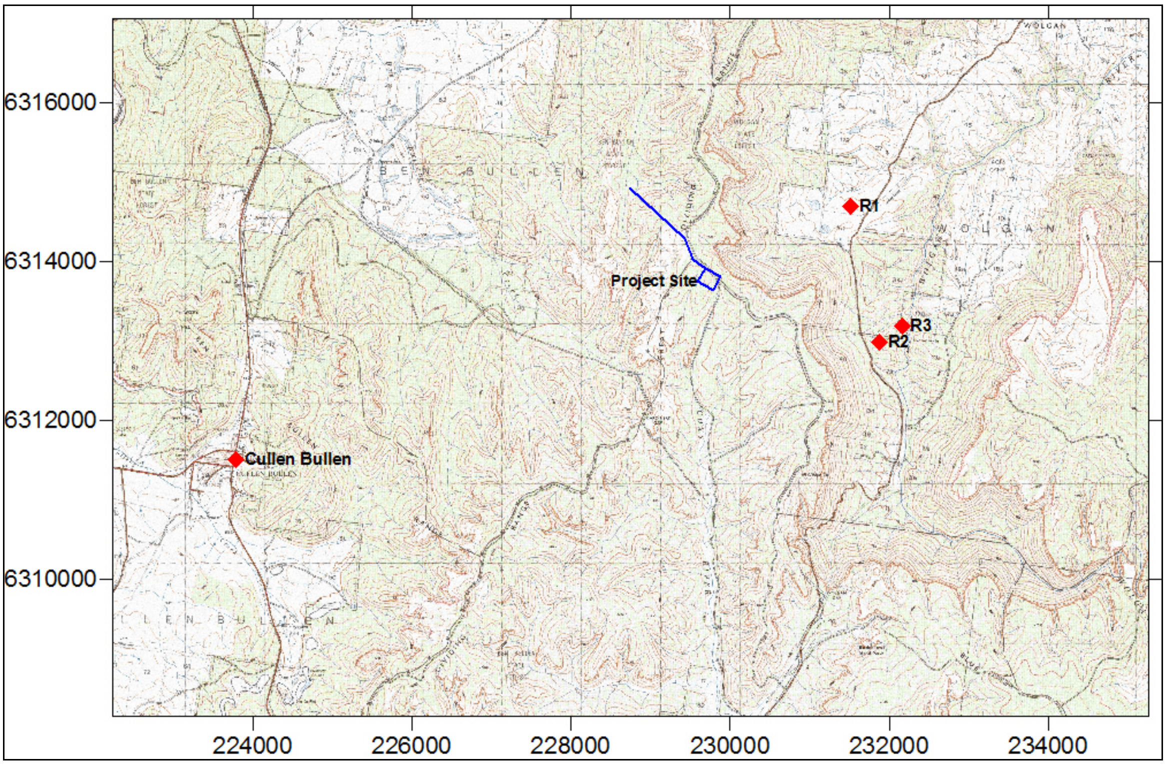


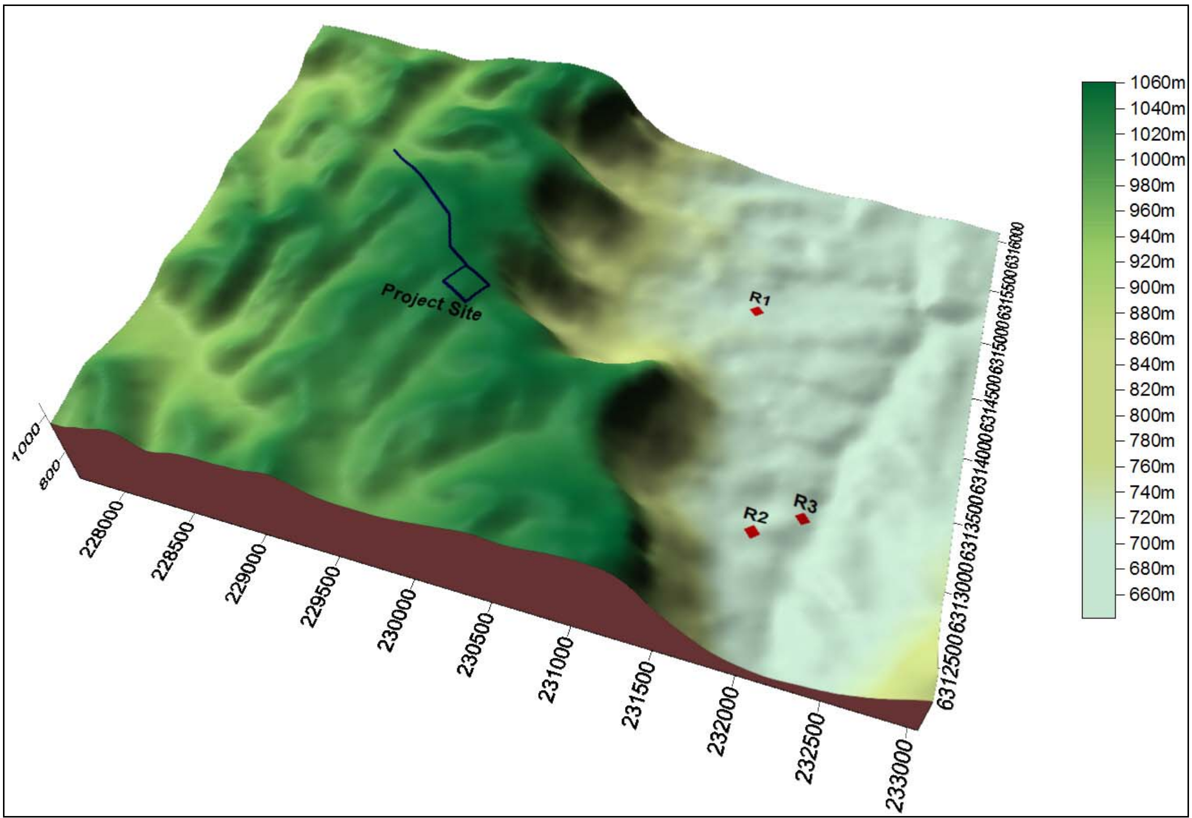
Table 1 Nearest Potentially Affected Residential Dwellings

Property ID	Distance and Direction to Project Site (m) from Residence	Location (MGA)		Elevation (m AHD)
		Easting (m)	Northing (m)	
R1	1,860 m - SW	231519	6314698	705
R2	2,170 m – WNW	231881	6312983	700
R3	2,370 m – WNW	232160	6313187	680

Project Site Topography

The topography surrounding the Project Site is quite complicated, located atop a north-south oriented ridgeline of the Great Dividing Range. Baal Bone Colliery sits at an elevation of between 1,040 m and 1,050 m AHD. To the east of the site, the topography decreases significantly to an elevation of approximately 700 m AHD. It is at this elevation that the three nearby residences are located. **Figure 3** represents a 3-dimensional view of the Project Site and surrounding topography.

Figure 3 3-Dimensional Representation of Local Topography



Note: Topography has Vertical Exaggeration of 2

3 NOISE IMPACT ASSESSMENT PROCEDURE

3.1 Environmental Noise Control - Construction

The Department of Environment and Conservation (DEC) has published guidelines in its Environmental Noise Control Manual (ENCM Chapter 171-1) for the control of construction noise.

In summary, the DEC's preferred approach to the control of construction noise involves the following, where there is a likelihood of annoyance due to noise from construction:

- Noise level restrictions.
- Time restrictions for construction activities.
- Noise mitigation.

3.1.1 Noise Level Restrictions

For a cumulative period of exposure to noise from construction activity of up to 4 weeks in duration, the $L_{A10(15minute)}$ noise level emitted by the works when measured at a residential receiver should not exceed the $L_{A90(15minute)}$ Rating Background Level (RBL) by more than 20 dBA.

For a cumulative period of exposure to noise from construction activity of between 4 weeks and 26 weeks duration, the $L_{A10(15minute)}$ noise level emitted by the works, when measured at a residential receiver should not exceed the $L_{A90(15minute)}$ RBL more than 10 dBA.

For a cumulative period of exposure to noise from construction activity in excess of 26 weeks duration, the $L_{A10(15minute)}$ noise level emitted by the works when measured at a residential receiver should not exceed the $L_{A90(15minute)}$ RBL by more than 5 dBA.

3.1.2 Time Restrictions

Monday to Friday	0700 hours to 1800 hours.
Saturday	0700 hours to 1300 hours if inaudible on residential premises; otherwise 0800 hours to 1300 hours.

No work on Sundays or Public Holidays.

3.1.3 Noise Mitigation

All practical measures should be used to minimise noise emitted from construction equipment, particularly in instances where extended hours of operation are required.

3.2 Environmental Noise Control - Operational

3.2.1 Residential Receivers

The DEC administers the NSW Industrial Noise Policy 2000 (INP) that provides a framework and process for deriving noise criteria and assessing noise impacts.

The specific policy objectives are to:

- Establish noise criteria that would protect the community from excessive intrusive noise and preserve the amenity for specific land uses;
- Use the criteria as the basis for deriving project specific noise levels;

- Promote uniform methods to estimate and measure noise impacts, including a procedure for evaluating meteorological effects;
- Outline a range of mitigation measures that could be used to minimise noise impacts;
- Provide a formal process to guide the determination of feasible and reasonable noise limits for consents or licences that reconcile noise impacts with the economic, social and environmental considerations of industrial development; and
- Carry out functions relating to the prevention, minimisation and control of noise from premises scheduled under the Act.

3.2.2 Assessing Intrusiveness

For assessing intrusiveness, the background noise generally needs to be measured. The intrusiveness criterion essentially means that the equivalent continuous noise level (L_{Aeq}) of the source should not be more than 5 dBA above the measured (or default) RBL at a residential receiver.

3.2.3 Assessing Amenity

The amenity assessment is based on noise criteria specific to land use and associated activities. The criteria relate only to industrial-type noise and do not include road, rail or community noise. If present, the existing noise level from industry is generally measured. If it approaches the criterion value, then noise levels from new industries need to be designed so that the cumulative effect does not produce noise levels that would significantly exceed the criterion. For high-traffic areas there is a separate amenity criterion. The cumulative effect of noise from industrial sources also needs to be considered in assessing the impact.

An extract from the INP that relates to the amenity criteria is given in **Table 2**.

Table 2 Amenity Criteria - Recommended L_{Aeq} Noise Levels from Industrial Noise Sources

Type of Receiver	Indicative Noise Amenity Area	Time of Day	Recommended L_{Aeq} Noise Level	
			Acceptable	Recommended Maximum
Residence	Rural	Day	50 dBA	55 dBA
		Evening	45 dBA	50 dBA
		Night	40 dBA	45 dBA
	Suburban	Day	55 dBA	60 dBA
		Evening	45 dBA	50 dBA
		Night	40 dBA	45 dBA
	Urban	Day	60 dBA	65 dBA
		Evening	50 dBA	55 dBA
		Night	45 dBA	50 dBA
	Urban/Industrial Interface - for existing situations only	Day	65 dBA	70 dBA
		Evening	55 dBA	60 dBA
		Night	50 dBA	55 dBA
School classrooms - internal	All	Noisiest 1-hour period when in use	35 dBA	40 dBA
Hospital ward				
- internal	All	Noisiest 1-hour period	35 dBA	40 dBA
- external	All	Noisiest 1-hour period	50 dBA	55 dBA
Place of worship	All	When in use	40 dBA	45 dBA

Type of Receiver	Indicative Noise Amenity Area	Time of Day	Recommended LAeq Noise Level	
			Acceptable	Recommended Maximum
- internal				
Area specifically reserved for passive recreation (eg National Park)	All	When in use	50 dBA	55 dBA
Active recreation area (eg School playground, golf course)	All	When in use	55 dBA	60 dBA
Commercial premises	All	When in use	65 dBA	70 dBA
Industrial premises	All	When in use	70 dBA	75 dBA

Notes: For Monday to Saturday, Daytime 0700 hours - 1800 hours; Evening 1800 hours - 2200 hours; Night-time 2200 hours - 0700 hours.
On Sundays and Public Holidays, Daytime 0800 hours - 1800 hours; Evening 1800 hours - 2200 hours; Night-time 2200 hours - 0800 hours.
The LAeq index corresponds to the level of noise equivalent to the energy average of noise levels occurring over a measurement period.

3.3 INP Assessment of Prevailing Weather Conditions

3.3.1 Wind

Wind has the potential to increase noise at a receiver when it is light and stable and blows from the direction of the noise source. As the strength of the wind increases, the noise produced by the wind will obscure noise from most industrial (and transport) sources.

Wind effects need to be considered when wind is a feature of the area under consideration. The NSW INP Section 5.3 Wind Effects states:

> *"Wind effects need to be assessed where wind is a feature of the area. Wind is considered to be a feature where source to receiver wind speeds (at 10 m height) of 3 m/s or below occur for 30 percent of the time or more in any assessment period in any season."*

In order to determine the prevailing conditions for the subject site, weather data during the period 17 June 2004 to 17 June 2005 was obtained from a meteorological weather station located at Wallerawang Power Station located approximately 9 kilometres to the south of the project site. The station at Wallerawang was chosen in accordance with the NSW INP requirements that it be located less than 30 km from the subject site and within the same topographical basin. The data was analysed in order to determine the frequency of occurrence of winds of speeds up to 3 m/s in each season. The prevailing winds and estimated atmospheric stability conditions are summarised in **Appendix B**.

The prevailing winds less than (or equal to) 3 m/s with a frequency of occurrence greater than (or equal to) 30% and considered to be relevant to the site in accordance with the INP are presented in **Table 3**.

Table 3 Prevailing Winds for the Lithgow Region

Season	Winds ±45° ≤3m/s with Frequency of Occurrence ≥30%		
	Daytime	Evening	Night-time
Annual	Nil	W, SSW, SW, WSW	SSW, SW, WSW, W
Summer	Nil	Nil	SW, WSW
Autumn	Nil	S, SSW, SW, WSW, W	S, SSW, SW, WSW, W
Winter	Nil	SSW, SW, WSW, W	SSW, SW, WSW, W, WNW
Spring	Nil	SSW, SW, WSW, W	SSW, SW, WSW

The frequency analysis showed that winds did occur for 30% or more during any assessment period. In this situation, the INP states that it is necessary to assess wind effects.

3.3.2 Temperature Inversions

The ventilation shaft and associated equipment will be required to operate 24 hours per day seven days per week and so during evening and night-time periods. Consequently, in accordance with the INP, the night-time operations are required to be assessed under prevailing temperature inversion conditions.

Temperature inversions, when they occur, have the ability to increase noise levels by focusing sound waves. Temperature inversions occur predominantly at night during the winter months. For a temperature inversion to be a significant characteristic of the area it needs to occur for 30% or more of the total night-time during winter or about two nights per week.

The INP, Section 5.2 Temperature Inversions, states:

> *"Assessment of impacts is confined to the night noise assessment period (10.00 pm to 7.00 am), as this is the time likely to have the greatest impact - that is, when temperature inversions usually occur and disturbance to sleep is possible."*

An assessment of atmospheric stability has also been prepared from the meteorological data set previously described. The winter evening and night-time frequency of occurrence of atmospheric stability classes are presented in **Table 4** together with the estimated Environmental Lapse Rates (ELRs).

Table 4 Atmospheric Stability Frequency - Winter Evening and Night-time

Stability Class	Occurrence Percentage	Estimated ELR[1] °C/100m	Qualitative Description
A	0%	<-1.9	Lapse
B	0%	-1.9 to -1.7	Lapse
C	0%	-1.7 to -1.5	Lapse
D	37.6%	-1.5 to -0.5	Neutral
E	15.6%	-0.5 to 1.5	Weak Inversion
F	31.7%	1.5 to 4	Moderate Inversion
G	15.1%	>4.0	Strong Inversion

Note 1: ELR (Environmental Lapse Rate).

The frequency of occurrence of moderate to strong (ie 1.5 to >4.0°C/100 m) winter temperature inversions is 46.8% during the combined evening and night-time period. Appendix F of the INP recommends that locations that are approaching a 30% occurrence level as well as those locations that either equal to or exceed the 30% level be considered when assessing the effects of temperature inversions on noise levels.

3.4 Additional DEC Noise Assessment Information

The DEC's recommended noise assessment criteria aim to limit potential intrusive noise emissions and preserve noise amenity. In cases where the limiting noise assessment criterion (in this case $L_{Aeq(15minute)}$ intrusiveness criterion) cannot be achieved, then practicable and economically feasible noise control measures should be applied. This usually requires demonstrations that Best Achievable Technology and Best Environmental Management Practices have been implemented in order to mitigate adverse acoustical impacts.

In the event that the lowest achievable noise emission levels remain above the noise assessment criteria, then the potential noise impact needs to be balanced and assessed against any economic and social benefits the project may bring to the community. It then follows that where the consenting authority or approval body may consider that the development does offer community benefits, then these may be grounds for permitting achievable noise emission levels as statutory compliance levels.

4 EXISTING ACOUSTICAL ENVIRONMENT

Rather than conducting background noise monitoring programme for the subject site, a conservative approach was adopted and a level of 30 dBA (the INP default level) has been used to represent the background noise level. The site specific noise emissions criteria were subsequently set with reference to the NSW INP.

This is supported by the fact that attended measurements undertaken in the area during the daytime produced background levels of less than 30 dBA. These measurements were taken whilst Heggies personnel were in the vicinity of the subject site attending other business.

5 CONSTRUCTION NOISE EMISSION CRITERIA

The construction stage is expected to take a maximum of 17 weeks. Construction works are to take place during the times specified in **Section 2.2**.

On the basis of the construction noise guidelines outlined in **Section 3.1** and the default daytime $L_{A90(15minute)}$ RBL, the appropriate construction noise assessment criteria for the closest residential receivers are presented in **Table 5**.

Table 5 Construction Noise Criteria - Residential Receivers

Residential Assessment Point	Representative Locality	Default Background Level (RBL) $L_{A90(15minute)}$	Construction Criteria $L_{A10(15minute)}$	
			Day	**Evening/Night**
R1	Northeast of Vent Shaft	30 dBA	40 dBA	35 dBA[1]
R2	Southeast of Vent Shaft	30 dBA	40 dBA	35 dBA[1]
R3	Southeast of Vent Shaft	30 dBA	40 dBA	35 dBA[1]

Note 1: This is the minimum DEC construction noise criterion and would apply when there is no likelihood of annoyance from construction.

6 OPERATIONAL NOISE EMISSION CRITERIA

The ventilation shaft operational noise emission criteria have been set with reference to the DEC's NSW INP, as outlined in **Section 4**. Establishing the operational noise criteria includes an assessment of the default RBL, the intrusiveness criteria and the amenity criteria.

The intrusiveness criteria have been set for the various hours of operation based on the default RBL at the closest receivers.

The residences surrounding the ventilation shaft are best described by the "Rural" receiver type and the amenity criteria have been set using the $L_{Aeq(period)}$ contribution from industrial noise in conjunction with **Table 1**. As the Baal Bone Colliery represents the only existing industry in the area, the default 'acceptable' L_{Aeq} amenity criteria for a rural area have been adopted. This is based on the fact that the estimated existing industrial (Colliery) noise is less than 6 dBA lower than the DEC's recommended amenity criteria for the daytime, evening and night-time periods.

The resulting operational intrusive and amenity noise emission criteria are given in **Table 6**. The lower of the intrusive criterion and the amenity criterion is the controlling criterion and have been shaded grey.

Table 6 Operational Noise Emission Criteria

Residential Assessment Point	Intrusiveness Criterion $L_{Aeq(15minutes)}$			Amenity Criterion $L_{Aeq(period)}$		
	Daytime 0700-1800 Hours	Evening 1800-2200 Hours	Night-time 2200-0700 Hours	Daytime 0700-1800 Hours	Evening 1800-2200 Hours	Night-time 2200-0700 Hours
R1	35 dBA	35 dBA	35 dBA	50 dBA	45 dBA	40 dBA
R2	35 dBA	35 dBA	35 dBA	50 dBA	45 dBA	40 dBA
R3	35 dBA	35 dBA	35 dBA	50 dBA	45 dBA	40 dBA

Note: Controlling daytime, evening and night-time noise criteria are shaded.

7 TRAFFIC NOISE ASSESSMENT CRITERIA

In June 1999, the DEC issued a document entitled "*Environmental Criteria for Road Traffic Noise*" (ECRTN). The relevant assessment criteria on Wolgan Road from the ECRTN for the construction traffic are presented in **Table 7**

Table 7 New Land Use Road Traffic Noise Criteria

Type of Development	Criteria $L_{Aeq(1hour)}$ Daytime	Criteria $L_{Aeq(1hour)}$ Night-time	Where Criteria Are Already Exceeded
8. Land use developments with potential to create additional traffic on collector roads	60 dBA	55 dBA	Where feasible and reasonable, existing noise levels should be mitigated to meet the noise criteria. Examples of applicable strategies include appropriate location of private access roads; regulating times of use; using clustering; using "quiet" vehicles; and using barriers and acoustic treatments. In all cases, traffic arising from the development should not lead to an increase in existing noise levels of more than 2 dBA.

Note: Total traffic noise contribution including existing and project related vehicle movements.
$L_{Aeq(1hour)}$ represents the highest LAeq noise level for any hour during daytime (0700 hrs to 2200 hrs) and night-time (2200 hrs to 0700 hrs).

8 SITE NOISE MODELLING PROCEDURE

8.1 Prediction of Noise Emissions - General Discussion

In order to determine the acoustical impact of the ventilation shaft construction and operations on the surrounding community, a computer model was developed to incorporate the significant noise sources and the intervening terrain to all the potentially affected residential properties.

The computer model was prepared using the SoundPLAN V6.4 Industrial Module, a commercial software system developed by Braunstein and Berndt GmbH in Germany. The software allows the use of various internationally recognised noise prediction algorithms. The CONCAWE algorithm, suitable for the assessment of large industrial plants, has been selected for this assessment as it also enables meteorological influences to be assessed.

The noise modelling takes into account source sound level emissions and locations, screening effects, receiver locations, meteorological effects, ground topography and noise attenuation due to spherical spreading and atmospheric absorption. Ground contours were obtained from the client and supplemented by topographical maps.

Operational noise predictions were calculated to existing residence within proximity to construction and operational plant and equipment. This receiver location, nominated as R1, R2 and R3, are also shown on the Locality Map in **Appendix A**.

8.2 Prediction of Noise Emissions - Construction

The proposed construction works for the ventilation shaft can be summarised by the following scenarios:

Scenario 1

- *Raise Boring:* 25 t excavator, water tanker, 750 kVa generator, SBM 900 raise boring machine; and

Scenario 2

- *Construction of shaft and support equipment:* 25 t excavator, water tanker, 750 kVa generator, concrete trucks.

A list of the L_{Amax} Sound Power Levels (SWLs) for the above equipment has been sourced from the Heggies in-house noise source database and is shown in **Table 8**.

Table 8 Construction Plant and Equipment Sound Power Levels (SWL)

Plant Item	L_{Amax} Sound Power Level
SBM 900 Raise Borer	113 dBA
Concrete Truck	112 dBA
Generator	104 dBA
Water Tanker	112 dBA
Excavator - 25 t	105 dBA

It should be noted that the sound power levels given for each item of mobile equipment do not include noise emissions which emanate from reversing alarms. In the event that reversing alarm noise is considered to be a source of disturbance, the alarm noise level should be checked against the appropriate regulatory and health and safety requirements and the necessary mitigating action taken in order to achieve an acceptable noise reduction without compromising safety standards.

A noise prediction model was developed for the anticipated 'worst case' construction scenario involving both trucks and construction equipment.

8.3 Prediction of Noise Emissions - Operations

8.3.1 Existing Colliery Operations

In order to assess the future operational noise emissions from the ventilation shaft, measurements conducted at the existing ventilation fan at Baal Bone Colliery in January 2007 were used to create noise sources in the computer model.

Table 9 presents the L_{Amax} sound power levels (SWLs) of ventilation plant and equipment in use at the colliery, with other noise sources at the plant emitting minimal noise levels.

Table 9 Existing Ventilation Plant Sound Power Levels (SWLs)

Plant Item	L_{Amax} Sound Power Level
Belt/Generator motor	93 dBA
Ventilation Outlet (4m)	74 dBA
Whole Ventilation Unit (10m)	69 dBA

A combination of the plant listed in **Table 9** operating simultaneously has been adopted as a conservative 'worst-case' existing operational scenario.

8.3.2 Operations with Ventilation Shaft

Of the components in the completed ventilation shaft works, the items likely to cause a change in overall noise emissions from the shaft site are as follows:

- Air Outlet of the ventilation unit.

Table 10 presents the L_{Amax} sound power levels (SWL) for the only acoustically significant plant in use at the ventilation shaft site, with other noise sources at the plant emitting minimal noise levels or being enclosed in buildings or structures.

Table 10 Ventilation Shaft Sound Power Levels (SWLs)

Plant Item	L_{Amax} Sound Power Level
Ventilation Motor	98 dBA

8.4 Meteorological Parameters

The contributed noise emissions for the construction and operational scenarios at the nearest potentially affected residential locations have been calculated with the following meteorological parameters (refer to **Section 3.2**):

Daytime - Calm

- During "calm" conditions (ie 11°C air temperature, 70% Relative Humidity, 0 m/s wind speed and 0°C/100m temperature gradient).

Evening - Calm

- During "calm" conditions (ie 5°C air temperature, 80% Relative Humidity, 0 m/s wind speed and 0°C/100 m temperature gradient).

Night-time - Calm

- During "calm" conditions (ie 1°C air temperature, 90% Relative Humidity, 0 m/s wind speed and 0°C/100 m temperature gradient).

Evening - Wind

- Adverse wind (ie 5°C air temperature, 80% Relative Humidity, 3 m/s W wind speed and 0°C temperature inversion)

Night-time - Wind

- Adverse wind (ie 1°C air temperature, 90% Relative Humidity, 3 m/s W wind speed and 0°C temperature inversion)

Night-time - Temperature Inversion

- A moderate temperature inversion (ie 1°C air temperature, 90% Relative Humidity, 1 m/s wind speed and 3°C/100 m temperature gradient).

9 TRAFFIC NOISE IMPACT ASSESSMENT

An estimate of the worst case hourly construction traffic volume is 3 heavy vehicles and 2 light vehicles.

A review of the offset distances of residences on Wolgan Road indicates that these distances vary from 16 m to 108 m within Lidsdale township and from 18 m to 156 m north of Lidsdale, in the 80 km/hr section of road. Given the traffic noise impacts would be greatest at higher vehicle speeds, the 18 m offset has been used for an assessment of the impacts of traffic noise.

The US Environment Protection Agency's method was used for the prediction of the L_{Aeq} traffic noise levels for the 18 m offset distance and a 100 km/hr vehicle speed.

The US EPA's method for prediction of the L_{Aeq}, noise levels from traffic is an internationally accepted theoretical traffic noise prediction model which takes into account the L_{Amax} vehicle noise levels (light and heavy), receiver offset distance, passby duration, vehicle speed, ground absorption (based on the ratio of soft ground and average height of propagation), number of hourly vehicle movements, receiver height, truck exhaust height and the height and location of any intervening barriers.

The resulting $L_{Aeq(1hour)}$ construction traffic noise contribution based on the US EPA noise model is 48 dBA, resulting from the worst case hourly construction volume of 3 heavy vehicles and 2 light vehicles..

In terms of the existing traffic flows on Wolgan Road, reference was made to traffic flow data collected between Thursday 9 March 2006 and 17 April 2006 at the northern end of Wolgan Road.

This data indicates a maximum daytime hourly traffic flow throughout the whole survey period of 45 vehicles. In the absence of any traffic mix data, a conservative mix of 1 heavy vehicle to every 4 light vehicles has been assumed (ie 20% heavy vehicles).

The US EPA traffic noise model was then used to determine the existing and future with construction traffic noise level (at an offset of 18 m) for comparison with the DEC's recommended $L_{Aeq(1hour)}$ 60 dBA daytime criteria. The input data and the modelling results are presented in **Table 11**

Table 11 Input Data and Traffic Noise Levels

Offset Distance	Existing Traffic		Existing Noise Level ($L_{Aeq(1hour)}$)	Existing Plus Construction Traffic		Total Traffic Noise Level $L_{Aeq(1hour)}$
	Light	Heavy		Light	Heavy	
18 m	36	9	54 dBA	38	12	55 dBA (ie 48 dBA + 54 dBA)

A review of **Table 11** indicates that the combined existing and proposed construction traffic noise level at the closest residence to the road (and therefore at all more distant residences) clearly complies with the DEC's recommended daytime 60 dBA $L_{Aeq(1hour)}$ criterion. Additionally, the temporary increase in traffic noise is within the DEC's specified criteria of less than 2 dBA.

10 VENTILATION SHAFT NOISE IMPACT ASSESSMENT

10.1 Construction Noise Assessment Results

The output results from the ventilation shaft construction noise model are presented in **Table 12**. The relevant construction noise criteria (based on construction duration of greater than 4 weeks but less than 26 weeks) are contained in **Table 13**.

Table 12 Predicted Scenario 1 and 2 Construction Noise Levels - dBA re 20 µPa

Residential Assessment Point	Predicted LAeq(15minute) Noise Level (Scenario 1/Scenario 2)					
	Daytime Calm	Evening Calm	Night-time Calm	Evening Wind 3m/s	Night Wind 3m/s	Night-time Inversion
R1	13/15	13/16	13/16	18/21	18/21	18/21
R2	2/0	2/0	2/0	7/3	7/3	7/4
R3	1/0	1/0	1/0	6/3	7/3	7/3

Table 13 Noise Criteria for the Construction Period

Residential Assessment Points	LAeq(15minute) Noise Criterion		
	Daytime	Evening	Night-time
R1, R2 and R3	40 dBA	35 dBA	35 dBA

The noise modelling results indicate that noise emissions during all construction activities under all meteorological conditions are predicted to be well within the $L_{A10(15minute)}$ criteria at Receivers R1, R2 and R3 and consequently are not likely to result in annoyance at the residential receivers.

10.2 Operational Noise Assessment Results

Based on the output from the noise model and on the noise emissions criteria presented in **Table 13**, **Table 14** presents the predicted future $L_{Aeq(15minute)}$ noise level contributions from the operations of the ventilation shaft with the respective criteria at the residential assessment locations.

Table 14 Predicted Future Ventilation Shaft Operational Noise Levels - dBA re 20 µPa

Residential Assessment Point	Predicted LAeq(15minute) Noise Level					
	Daytime Calm	Evening Calm	Night Calm	Evening Wind 3m/s	Night Wind 3m/s	Night-time Inversion
R1, R2 and R3	0	0	0	0	0	0

It can be seen from a review of **Table 14** that operational noise emissions from the ventilation shaft are not discernable at the residential assessment location under all weather scenarios.

Further assessment and verification of the predicted noise levels confirmed a noise level of 5 dBA at a receiver location selected halfway down the valley.

11 SUMMARY OF RESULTS AND FINDINGS

This report presents the results and findings of an assessment of the potential impacts of the proposed ventilation shaft at the Baal Bone Colliery at Ben Bullen State Forest, NSW, on the existing potentially affected residential receivers.

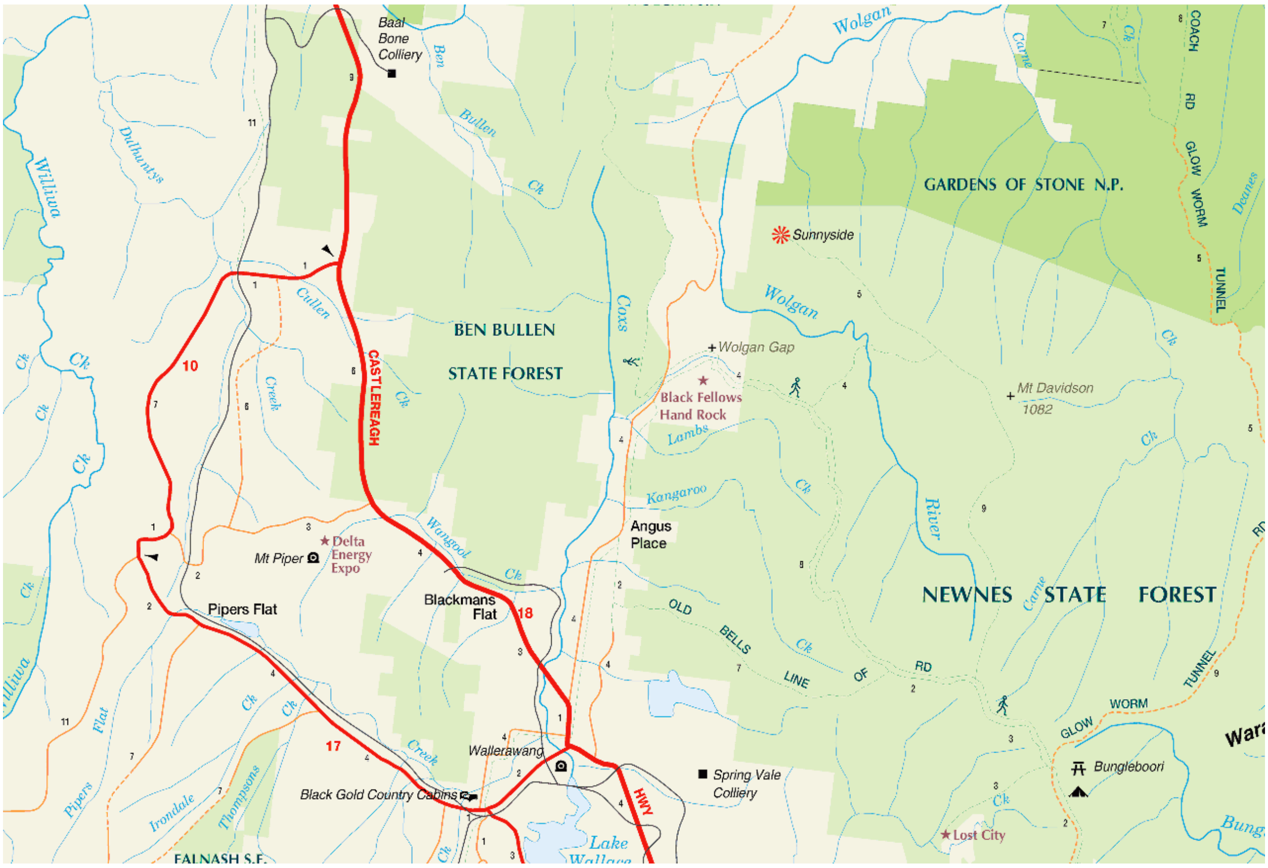
Based on information from the client the construction and operational noise level criteria for the ventilation shaft at the potentially most affected residential receivers were established.

Construction noise emissions are predicted to clearly comply with the $L_{A10(15minute)}$ criteria at Receiver R1, R2 and R3.

It can be seen from a review of **Table 6** and **Table 14** that the operational noise emissions from the ventilation shaft are below the noise criteria at the closest residential assessment location under all weather scenarios.

A review of **Table 11** indicates that the combined existing and proposed construction traffic noise level at the closest residence to the access road clearly complies with the DEC's recommended daytime traffic noise criterion.

LOCALITY PLAN – BAAL BONE COLLIERY



Picture Courtesy of UBD Version 3.0

SITE SPECIFIC WIND CONDITIONS – WALLERAWANG POWER STATION (JUNE 2004 TO JUNE 2005)

Table 1 Seasonal Frequency of Occurrence Wind Speed Intervals – Daytime (%)

Period	Calm (<0.5 m/s)	Wind Direction ±(45°)	Wind Speed		
			0.5 to 1.5 m/s	1.5 to 3 m/s	0.5 to 3 m/s
Annual	5.4%	NNW	9.4%	13.4%	22.7%
Summer	10.5%	NNW	6.1%	16.1%	22.2%
Autumn	0%	NNW	11.5%	15.6%	27.0%
Winter	8.4%	WSW	12.6%	10.1%	22.6%
Spring	3.2%	WSW	9.7%	10.5%	20.2%

Table 2 Seasonal Frequency of Occurrence Wind Speed Intervals - Evening

Period	Calm (<0.5 m/s)	Wind Direction ±(45°)	Wind Speed		
			0.5 to 1.5 m/s	1.5 to 3 m/s	0.5 to 3 m/s
Annual	7.2%	SW	36.0%	7.4%	43.4%
Summer	14.5%	SW	21.8%	4.8%	26.6%
Autumn	0%	SW	47.1%	7.5%	54.6%
Winter	7.0%	SW	37.0%	7.5%	44.5%
Spring	8.8%	SW	34.8%	9.2%	44.0%

Table 3 Seasonal Frequency of Occurrence Wind Speed Intervals - Night-time

Period	Calm (<0.5 m/s)	Wind Direction ±(45°)	Wind Speed		
			0.5 to 1.5 m/s	1.5 to 3 m/s	0.5 to 3 m/s
Annual	11.6%	WSW	35.8%	4.6%	40.4%
Summer	18.5%	WSW	27.3%	4.8%	32.1%
Autumn	1.6%	SW	46.0%	5.2%	51.1%
Winter	11.2%	WSW	34.2%	6.8%	41.0%
Spring	16.6%	SW	33.2%	4.1%	37.2%

Table 4 Frequency of Occurrence of Atmospheric Stability Classes - Daytime

Stability Class	Frequency of Occurrence (%)					Estimated ELR °C/100 m	Qualitative Description
	Annual	Summer	Autumn	Winter	Spring		
A	32.6	46.0	49.1	20.2	19.5	<-1.9	Lapse
B	18.7	21.3	20.5	15.2	18.9	-1.9 to -1.7	Lapse
C	25.8	19.9	22.1	30.2	29.2	-1.7 to -1.5	Lapse
D	19.2	12.3	7.9	26.1	28.1	-1.5 to -0.5	Neutral
E	2.8	0.5	0.4	5.0	4.3	-0.5 to 1.5	Weak Inversion
F	0.1	0.0	0.0	3.1	0.0	1.5 to 4	Moderate Inversion
G	0.9	0.0	0.0	0.0	3.1	>4.0	Strong Inversion
F+G	1.0	0.0	0.0	0.0	3.3		

Note: ELR (Environmental Lapse Rate)

Table 5 Frequency of Occurrence of Atmospheric Stability Classes - Evening and Night-time

Stability Class	Frequency of Occurrence (%)					Estimated ELR °C/100 m	Qualitative Description
	Annual	Summer	Autumn	Winter	Spring		
A	0	0	0	0	0	<-1.9	Lapse
B	0	0	0	0	0	-1.9 to -1.7	Lapse
C	0	0	0	0	0	-1.7 to -1.5	Lapse
D	34.4	32.4	27.7	37.6	39.0	-1.5 to -0.5	Neutral
E	16.8	17.9	17.1	15.6	16.8	-0.5 to 1.5	Weak Inversion
F	38.7	44.5	54.3	31.7	26.6	1.5 to 4	Moderate Inversion
G	10.1	5.1	0.8	15.1	17.6	>4.0	Strong Inversion
F+G	48.8	49.6	55.2	46.8	44.2		

Umwelt (Australia) Pty Limited
2/20 The Boulevarde
PO Box 838
Toronto NSW 2283

Ph. 02 4950 5322
Fax 02 4950 5737