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Airly Mine Extension Project

Noise and Vibration Impact Assessment

Report Number 630.10123.03010R1

31 January 2014

Centennial Airly Pty Limited
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Airly Mine Extension Project

Noise and Vibration Impact Assessment

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DOCUMENT CONTROL

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630.10123.03010R1	Revision 0	31 January 2014	Katie Teyhan	Tristan Robertson	Katie Teyhan

Executive Summary

SLR Consulting Australia Pty Ltd (SLR) has been commissioned by Centennial Airly Pty Limited (the Applicant), a wholly owned subsidiary of Centennial Coal Company Limited (Centennial), to undertake a Noise and Vibration Impact Assessment (NVIA) for the Airly Mine Extension Project (the Project).

Broadly, the objective of the NVIA was to conduct noise modelling of the existing, approved and proposed operations of Airly Mine to identify the potential impacts of noise from its operations; and to provide recommendations with regard to noise management strategies and mitigation measures where necessary, with the aim of achieving the project specific noise criteria during operations.

Operational Noise Assessment

Operational noise levels from Airly Mine are predicted to be below the project specific noise criteria established in accordance with the NSW Industrial Noise Policy (INP) at all noise-sensitive assessment locations under all considered meteorological conditions.

Sleep Disturbance Assessment

Operational L_{Amax} noise levels are predicted to be below the project specific sleep disturbance criteria for night-time operations at the mine site under prevailing weather conditions (worst case scenario) at all noise-sensitive assessment locations.

Road Traffic Noise Assessment

The calculated day and night-time road traffic noise level at the nearest roadside residential receivers meets the criteria detailed in the NSW Road Noise Policy (RNP) under all prediction scenarios.

Construction Noise Assessment

The modelling results indicate that the predicted $L_{Aeq(15minute)}$ noise levels from proposed construction activities are below the 'Noise Affected' construction noise goals at all residences.

The calculated day time construction road traffic noise level at the nearest roadside residential receivers meets the criteria detailed in the RNP under all prediction scenarios.

Rail Noise assessment

Currently approved rail traffic volumes will not change as a result of the Project.

Based on currently approved volumes, predicted rail traffic noise levels with and without the Project comply with the $L_{Aeq(15\ hour)}$ trigger levels for residents 25 m from the rail line. Existing rail traffic noise levels without Airly Mine-related traffic already exceed the night-time $L_{Aeq(9\ hour)}$ trigger levels for residents within 50 m of the rail line. Furthermore, the existing rail noise maximum passby noise level is predicted to exceed the relevant trigger levels at residences within 100m of the rail line.

Inclusion of Airly Mine-related rail traffic results in an increase to existing rail noise of 0.5 dBA and 0.6dBA during the day and night respectively. This negligible noise level increase would not be noticeable. Furthermore, the rail noise maximum passby noise level will not increase as a result of the Project.

It is relevant to note that rail traffic volumes will not change as a result of the Project. Hence, rail traffic noise levels currently experienced by residences in the vicinity of the rail corridor will not increase or change as a result of the modification.

Executive Summary

Vibration Assessment

Given the separation distance between mining operations and the nearest potentially affected residential locations vibration levels from the Project during operations is predicted to be negligible and below levels for human perception at the nearest residential locations.

Due to the separation distance to the nearest affected residential receptor, the level of vibration caused by construction activities is predicted to be below the level of human perception at any of the nearest receptors and therefore below the criteria for “minimal risk of cosmetic damage” at surrounding residential premises.

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1 INTRODUCTION

SLR Consulting Australia Pty Ltd (SLR) has been commissioned by Centennial Airly Pty Limited (Centennial Airly), a wholly owned subsidiary of Centennial Coal Company Limited (Centennial), to undertake a Noise and Vibration Impact Assessment (NVIA) for the Airly Mine Extension Project (the Project). Centennial Airly is the applicant for the Project.

The Project involves the extension of mining operations into the eastern sections of its existing Mining Lease ML1331 and within its Authorisation 232 (A232) area at Airly Mine (Airly). Airly is located approximately 40 kilometres north-northwest of Lithgow NSW.

1.1 Acoustic Terminology

The following report uses specialist acoustic terminology. An explanation of common terms is provided in **Appendix A**.

2 STATUTORY REQUIREMENTS

The Director-General of the NSW Department of Planning and Infrastructure (DP&I) issued Director General's Requirements (DGRs) for the Project on 6 November 2012. The DGRs relevant to noise are provided in **Table 1** together with the relevant section of the NIA indicating where the requirements have been addressed.

Table 1 Environmental Assessment Requirements - Noise

EAR		Relevant NIA Section
Noise – including a quantitative assessment of potential:		
-	Construction, operational and off-site transport noise impacts.	**Sections 10,11,0,13**
-	Reasonable and feasible mitigation measures, including evidence that there are no such other available measures available.	**Section 15**
-	Monitoring and management measures, in particular real-time and attended noise monitoring.	**Section 15**

Attachment 1 to the EARs also provides relevant technical and policy guidelines. These, and others that have been identified as relevant to this assessment, are provided in **Table 2**.

Table 2 Technical and Policy Guidelines – Noise and Vibration

Guideline	Comment
Specified in EARs	
NSW Industrial Noise Policy (EPA, 2000)	This NVIA also refers to the Application Notes to the INP (approved December 2010)
Environmental Noise Management – Assessing Vibration: a technical guide (DECC, 2006)	
NSW Road Noise Policy (DECCW, 2011)	
Technical basis for guidelines to minimise annoyance due to blasting overpressure and ground vibration (ANZECC)	Assessment of blasting emissions is not within the scope of this NVIA
Environmental Assessment Requirements for Rail Traffic – Generating Development (OEH)	This Interim Guideline is now provided as Appendix 2 of the Rail Infrastructure Noise Guideline (EPA, 2013)
Other Relevant Guidelines	
Australian Standard AS1055:1997 Description and Measurement of Environmental Noise Parts 1, 2 and 3	
Rail Infrastructure Noise Guideline (EPA, 2013)	
NSW Interim Construction Noise Guideline (DECC, 2009)	
German Standard DIN4150 Part 3:1999 Structural Vibration: effects of vibration on structures	
British Standard BS6472-1:2008 Guide to evaluation of human exposure to vibration in buildings – Vibration sources other than blasting	

This NVIA has been prepared with reference to all the technical and policy guidelines provided in **Table 2**.

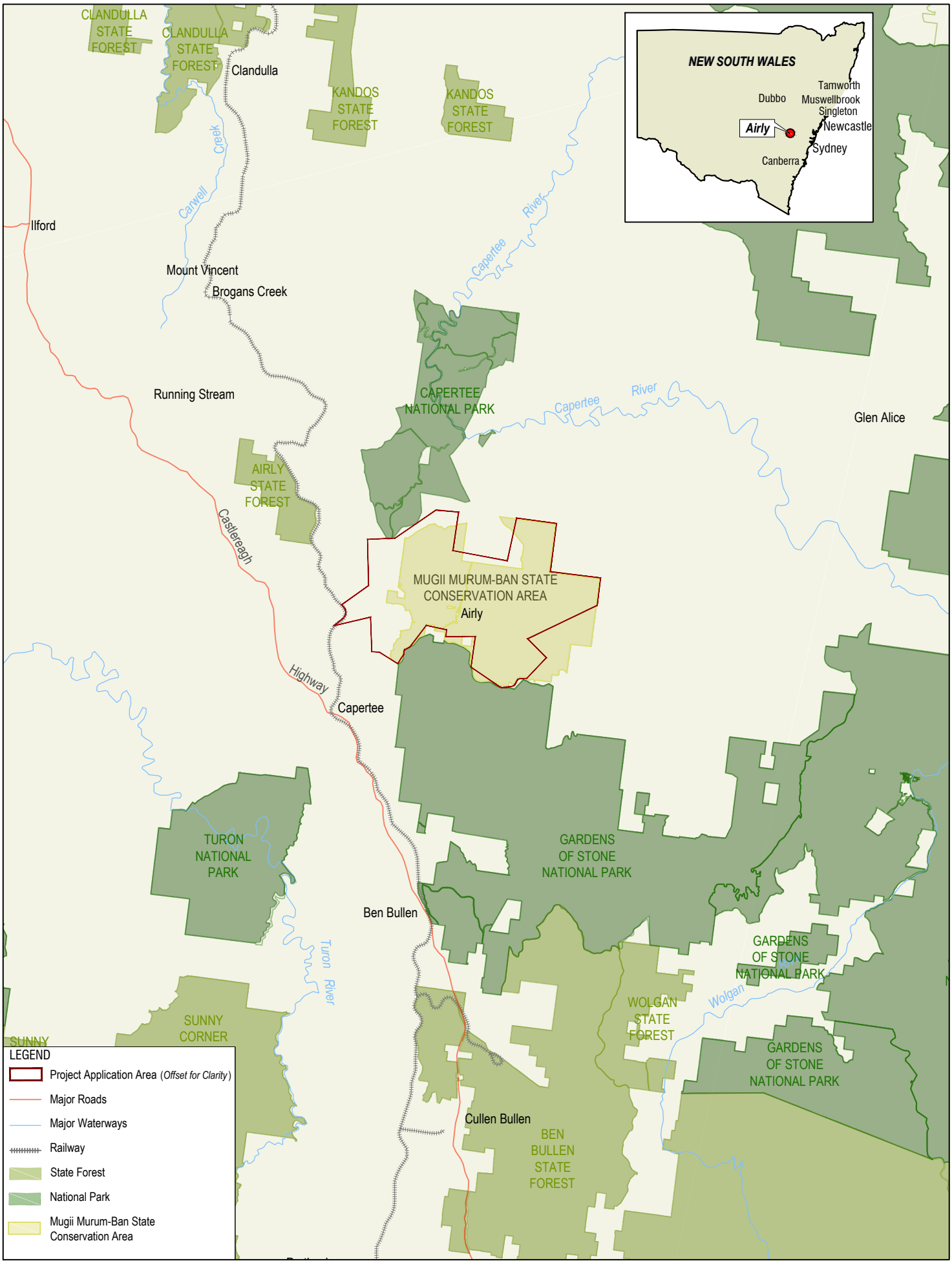
3 PROJECT OVERVIEW

Airly Mine was granted Development Consent DA162/91 on 14 April 1993 by the then Minister for Planning for the development of an underground coal mine following a Commission of Inquiry (COI) held in 1993. DA162/91 is supported by the *Airly Coal Project Environmental Impact Statement (Novacoal, 1991)*, and the addendum, titled *Supplementary Report to Environmental Impact Statement (Novacoal, 1992)*. The development consent allows Airly to extract up to 1.8 Mtpa of ROM coal. Condition 2 in Schedule 2 of DA162/91 limits the duration of the consent to 21 years from the granting of ML1331. Given that the ML1331 was granted on 12 October 1993, DA162/91 is due to expire on 12 October 2014

3.1 Project Location

Airly Mine is situated approximately 40km north-northwest of Lithgow and around 4km northeast of Capertee, as shown in **Figure 1**.

Access to the area is via the Castlereagh Highway to Capertee and then 3 km along the Glen Davis Road to the private Mine Access Road leading to the pit top. The Wallerawang - Gwabegar railway line is situated 3 km to the west of the pit top area. Centennial Airly owns the freehold land on which the Airly Mine infrastructure is located as well as a substantial buffer zone (approximately 2,000 ha) around the pit top.



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AIRLY COAL NOISE

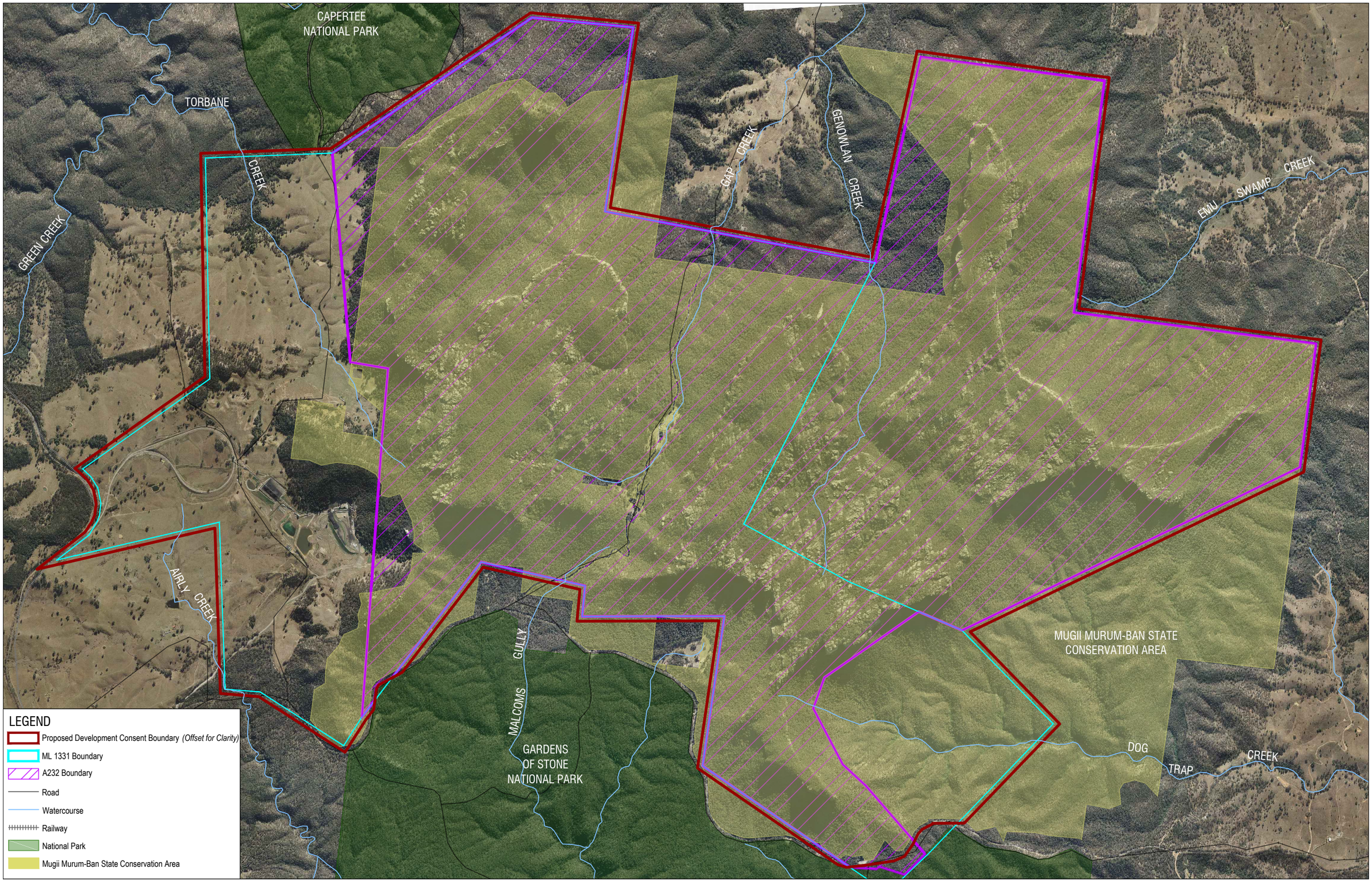
Regional Location

FIGURE 1

3.2 Project Description

The Project will:

- In general, include all currently approved operations, facilities and infrastructure of Airly Mine.
- Continue to extract up to 1.8 million tonnes per annum (Mtpa) of run of mine (ROM) coal from the Lithgow seam underlying the Project Application Area.
- Extend life of mine by 25 years from the date of consent with rehabilitation to be undertaken within this period on cessation of mining.
- Extract coal using partial extraction methods within ML1331 and extend the mining area to the east of the existing workings into A232 area.
- Develop underground access headings and roadways from the current mining area to the east to allow access to the proposed mining areas.
- Use various partial extraction mining methods, that will manage subsidence to 100 mm but not exceeding a maximum of 125 mm in previously unmined areas and minimise further potential subsidence impacts in areas where the historical New Hartley Shale Mine has already impacted the environment.
- Continue to operate and maintain the existing ancillary surface infrastructure for mine access, underground ventilation, electricity, water, materials supply, and communications at the pit top, and upgrade the infrastructure as required for mining operations.
- Continue to manage the handling of run-of-mine (ROM) coal through a crusher and screening plant at the pit top for transfer to the existing and proposed stockpile areas as required to meet market demands.
- Construct a coal preparation plant (CPP) to beneficiate (wash) ROM coal.
- Transfer beneficiated coal from the CPP, using the existing and new overland conveyor systems being part of the coal handling and preparation plant (CHPP), to the product stockpile area for temporary storage prior to despatch to offsite locations.
- Construct a life of mine reject emplacement area (REA) for the emplacement of reject materials from the CPP and the underground mine.
- Continue to use the existing water storage dams at the pit top for the separation of clean and dirty water.
- Construct appropriately sized new management storage dams for the proposed life of mine REA.
- Continue to manage non-production waste in accordance with the site's Mining Operations Plan.
- Despatch ROM and product coal off site using the existing rail load out facilities for the export and domestic markets.
- Continue exploration activities, predominantly borehole drilling, to further refine the existing geological model.
- Continue to undertake existing and initiate new environmental monitoring and geological exploration programs as appropriate.
- Review and update existing environmental management plans as required.
- Operate 24 hours per day and seven days per week for 52 weeks per year.
- Provide employment to a full time workforce of up to 135 persons and 20 contractors.
- Progressively rehabilitate disturbed areas at the pit top no longer required for mining operations and exploration boreholes.
- Undertake life-of-mine rehabilitation at the pit top infrastructure disturbance areas to create final landforms commensurate with the surrounding areas.
- The Project Application Area (PAA) is shown in **Figure 2** and the proposed surface infrastructure in **Figure 3**.



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AIRLY COAL NOISE

Project Application Area

FIGURE 2

Proposed Reject Emplacement Area 1

Proposed Train Refuelling Station

Rail Loop

Water Management Facility

Proposed ROM Stockpile and CPP

Pit Top

Proposed Reject Emplacement Area 2

Proposed Security

TORBANE ROAD

GLEN DAVIS ROAD

GARDENS OF STONE NATIONAL PARK

LEGEND

- Proposed Development Consent Boundary *(Offset for Clarity)*
- ML 1331 Boundary
- A232 Boundary
- Proposed Action Areas
- Cadastre
- Railway
- National Park
- Mugii Murum-Ban State Conservation Area

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AIRLY COAL NOISE

Proposed CPP and ROM Stockpile

FIGURE 3

3.3 Hours of Operation

Airly Mine currently has consent to operate 24 hours per day, up to 7 days per week. The Project will seek to continue to operate these hours.

4 SENSITIVE RECEPTORS

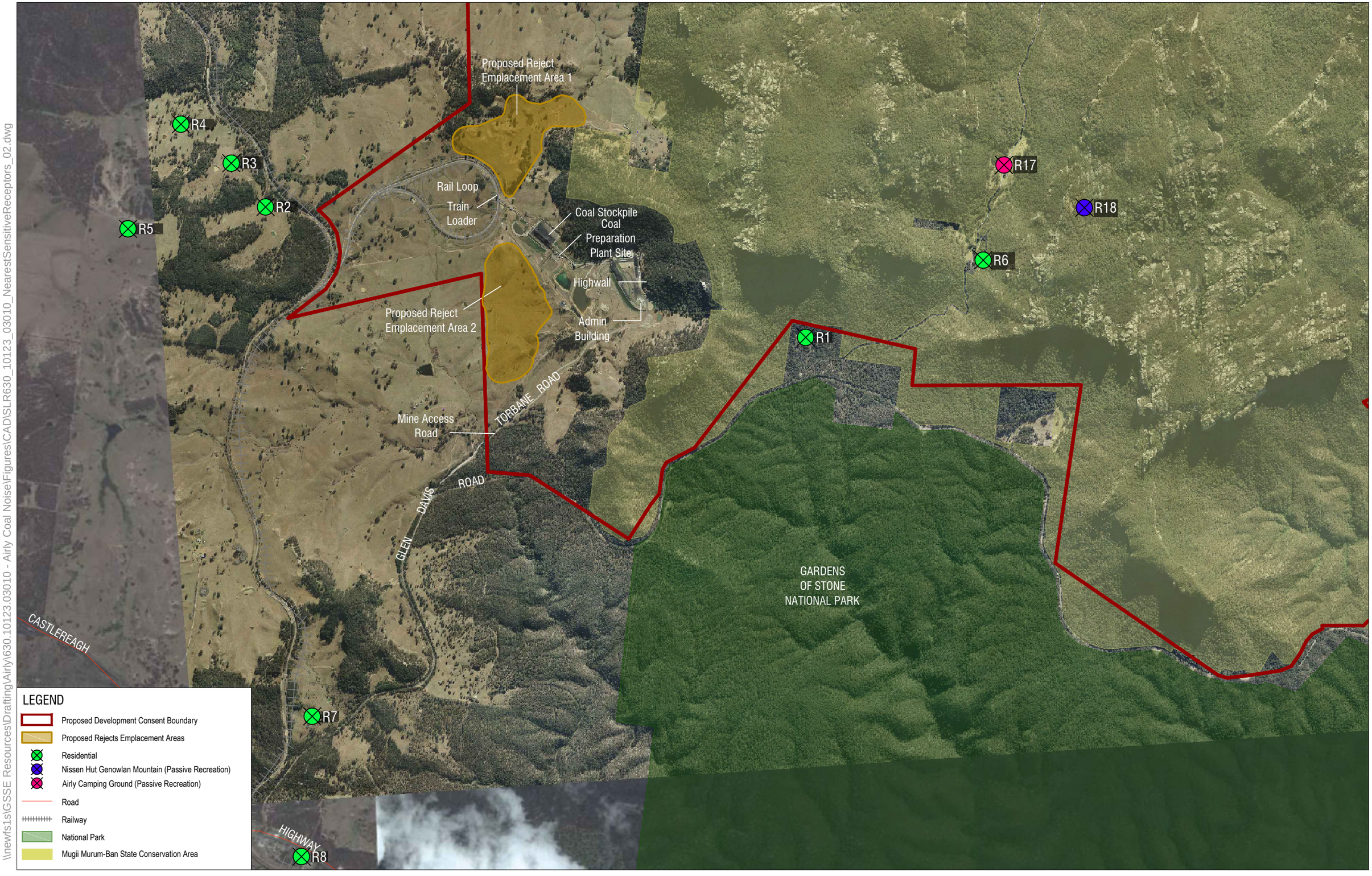
There are a number of rural/residential properties in the vicinity of the Project. Centennial maintains a substantial holding of land around the PPA. The closest effected residential receptors to the Project are shown in **Table 3** and **Figure 4**.

Table 3 Nearest Sensitive Receptors

Receptor ID	Receptor Type / Description	Receiver Location	
		Easting	Northing
R1	Residential	222595	6332095
R2	Residential	218907	6332949
R3	Residential	218648	6333227
R4	Residential	218292	6333516
R5	Residential	217893	6332797
R6	Residential / Stone Cottage Airly Gap	223867	6332572
R7	Residential	219316	6329436
R8	Residential	778894	6328246
R17	Passive Recreation / Camp Ground Airly Gap	224016	6333253
R18	Passive Recreation / Nissen Hut Genowlan Mountain	224592	6332947

Note: The receptors listed here represent the nearest noise-sensitive receptors to the Project site. Other residential properties in the area (ie R9 – R16) are further from the Project site. Receptor numbering has been chosen to be consistent with other specialist consultant studies.

It should be noted that the noise level at all residential premises outside the nearest affected receptors has been predicted and considered in producing noise contours for the site.



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AIRLY COAL NOISE

Nearest Sensitive Receptors

FIGURE 4

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5 IMPACT ASSESSMENT PROCEDURES

5.1 Operational Noise – NSW Industrial Noise Policy

Responsibility for the control of noise emission in NSW is vested in Local Government and the EPA. The INP was released in January 2000 and provides a framework and process for deriving noise criteria for consents and licences that will enable the relevant authority to regulate premises that are scheduled under the Protection of the Environment Operations Act, 1997.

The specific policy objectives are:

- To establish noise criteria that would protect the community from excessive intrusive noise and preserve amenity for specific land uses.
- To use the criteria as the basis for deriving project specific noise levels.
- To promote uniform methods to estimate and measure noise impacts, including a procedure for evaluating meteorological effects.
- To outline a range of mitigation measures that could be used to minimise noise impacts.
- To 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.
- To carry out functions relating to the prevention, minimisation and control of noise from premises scheduled under the Act.

The policy sets two separate noise criteria to meet environmental noise objectives; one to account for intrusive noise and the other to protect the amenity of particular land uses.

Assessing Intrusiveness

For assessing intrusiveness, the background noise level must be measured. The intrusiveness criterion essentially means that the equivalent continuous noise level (L_{Aeq}) of the source should not be more than five decibels above the measured background level (L_{A90}).

Assessing Amenity

The amenity assessment is based on noise criteria specific to land use (rural) and associated activities (**Table 4**). The criteria relate only to industrial-type noise and do not include road, rail or community noise. The existing noise level from industry is 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 (**Table 5**).

Table 4 Amenity Criteria Recommended L_{Aeq} Noise Levels from Industrial Noise Sources

Type of Receiver	Indicative Noise Amenity Area	Time of Day	Recommended $L_{Aeq(Period)}$ Noise Level (dBA)	
			Acceptable	Recommended Maximum
Residence	Rural	Day	50	55
		Evening	45	50
		Night	40	45
	Suburban	Day	55	60
		Evening	45	50
		Night	40	45
	Urban	Day	60	65
		Evening	50	55
		Night	45	50
	Urban/Industrial Interface (for existing situations only)	Day	65	70
		Evening	55	60
		Night	50	55
School classrooms - internal	All	Noisiest 1 hour period when in use	35	40
Hospital wards - internal - external	All	Noisiest 1 hour period	35 50	40 55
Place of worship - internal	All	When in use	40	45
Area specifically reserved for passive recreation (eg National Park)	All	When in use	50	55
Active recreation area (eg school playground, golf course)	All	When in use	55	60
Commercial premises	All	When in use	65	70
Industrial premises	All	When in use	70	75

Note: Monday - Saturday: Daytime 7.00 am to 6.00 pm; Evening 6.00 pm to 10.00 pm; Night-time 10.00 pm to 7.00 am. Sundays, Public Holidays: Daytime 8.00 am - 6.00 pm; Evening 6.00 pm - 10.00 pm; Night-time 10.00 pm - 8.00 am. The L_{Aeq} index corresponds to the level of noise equivalent to the energy average of noise levels occurring over a measurement period.

Table 5 Modification to Acceptable Noise Level (ANL)* to Account for Existing Levels of Industrial Noise

Total Existing L_{Aeq} Noise Level from Industrial Noise Sources	Maximum L_{Aeq} Noise Level for Noise from New Sources Alone, dBA
≥ Acceptable noise level plus 2 dBA	If existing noise level is *likely to decrease* in future acceptable noise level minus 10 dBA If existing noise level is *unlikely to decrease* in future existing noise level minus 10 dBA
Acceptable noise level plus 1 dBA	Acceptable noise level minus 8 dBA
Acceptable noise level	Acceptable noise level minus 8 dBA
Acceptable noise level minus 1 dBA	Acceptable noise level minus 6 dBA
Acceptable noise level minus 2 dBA	Acceptable noise level minus 4 dBA
Acceptable noise level minus 3 dBA	Acceptable noise level minus 3 dBA
Acceptable noise level minus 4 dBA	Acceptable noise level minus 2 dBA
Acceptable noise level minus 5 dBA	Acceptable noise level minus 2 dBA
Acceptable noise level minus 6 dBA	Acceptable noise level minus 1 dBA
< Acceptable noise level minus 6 dBA	Acceptable noise level

* ANL = recommended acceptable L_{Aeq} noise level for the specific receiver, area and time of day from **Table 4**

5.2 Construction Noise

The ICNG states that "*noise from industrial sources (for example, factories, quarrying, mining, and including construction associated with quarrying and mining)*" are examples of noise that is not covered by the ICNG. However, the ICNG has been referenced with regard to this assessment for the following reasons:

- some of the construction activities associated with the Project will be conducted for a relatively short duration; and
- the Project construction activity will generate noise of a very different nature to that produced during operation of the facility.

The ICNG sets out noise management levels for residential and other noise-sensitive receivers and how they are to be applied. The policy suggests restriction to the hours of construction that apply to activities that generate noise at residences above the 'highly affected' noise management level. A summary of the noise management levels is contained in **Table 6** and **Table 7**.

Table 6 ICNG: Noise at residences using quantitative method

Time of Day	Management Level $L_{Aeq(15minute)}$* (dBA)	How to Apply
Recommended standard hours Monday to Friday 7am to 6pm Saturday 8am to 1pm No work Sundays or public holidays	Noise Affected RBL** + 10 dB	The noise affected level represents the point above which **there may be some community reaction to noise**. • Where the predicted or measured $L_{Aeq(15minute)}$ is greater than the noise affected level, the proponent should apply all feasible and reasonable work practices to meet the noise affected level. • The proponent should also inform all potentially impacted residents of the nature of works to be carried out, the expected noise levels and duration, as well as contact details.
	Highly noise affected 75 dBA	The highly noise affected level represents the point above which **there may be strong community reaction to noise**. • Where noise is above this level, the relevant authority (consent, determining or regulatory) may require respite periods by restricting the hours that the very noisy activities can occur, taking into account: 1. Times identified by the community when they are less sensitive to noise (such as before and after school for works near schools, or mid-morning or mid-afternoon for works near residences. 2. If the community is prepared to accept a longer period of construction in exchange for restrictions on construction times.
Outside recommended standard hours	Noise Affected RBL** + 5 dB	• A **strong justification would typically be required for works outside the recommended standard hours**. • The proponent should apply all feasible and reasonable work practices to meet the noise affected level. • Where all feasible and reasonable practices have been applied and noise is more than 5 dB(A) above the noise affected level, the proponent should negotiate with the community. • For guidance on negotiating agreements refer to section 7.2.2 of the ICNG.

*Noise levels apply at the property boundary that is most exposed to construction noise, and at a height of 1.5m above ground level. If the property boundary is more than 30m from the residence, the location for measuring or predicting noise levels is at the most noise-affected point within 30m of the residence. Noise levels may be higher at upper floors of the noise-affected residence.
**RBL: Rating Background Level, as defined in the NSW Industrial Noise Policy (EPA, 2000).

Table 7 Noise at sensitive land uses (other than residences) using quantitative assessment

Land use	Management level, LAeq(15minute) (applies when properties are being used)
Active recreation areas (characterized by sporting activities which generate their own noise or focus for participants, making them less sensitive to external noise intrusion)	External noise level 65 dB(A)
Passive recreation areas (characterized by contemplative activities that generate little noise and where benefits are compromised by external noise intrusion, for example, reading, meditation)	External noise level 60 dB(A)

5.3 Sleep Disturbance

The potential for sleep disturbance has been assessed using the guidance provided in the INP Application Notes.

The INP Application Notes (Approved in December 2010 and last updated 12 July 2012) recognises that the current $L_{A1(1minute)}$ sleep disturbance criteria of 15 dBA above the prevailing $L_{A90(15minute)}$ level is not ideal. The assessment of potential sleep disturbance is complex and poorly understood and the EPA believes that there is insufficient information to determine a suitable alternative criteria.

In the interim, the INP guideline suggests that the $L_{A1(1minute)}$ level of 15 dBA above the RBL is a suitable screening criteria for sleep disturbance for the night-time period.

Guidance regarding potential for sleep disturbance is also provided in the RNP. The RNP calls upon a number of studies that have been conducted into the effect of maximum noise levels on sleep. The RNP acknowledges that, at the current level of understanding, it is not possible to establish absolute noise level criteria that would correlate to an acceptable level of sleep disturbance. However, the RNP provides the following conclusions from the research on sleep disturbance:

- maximum internal noise levels below 50 - 55 dBA are unlikely to awaken people
- one or two noise events per night, with maximum internal noise levels of 65 - 70 dBA, are not likely to affect health and well-being significantly.

5.4 Road Traffic Noise

The RNP sets out noise criteria applicable to particular types of projects, road category and land use for the purpose of defining traffic noise impacts as well as guidelines for assessing noise impacts from off-site road traffic.

Table 8 presents the most relevant RNP criteria for residential land uses affected by noise from a freeway, arterial, sub-arterial or local road. Noise levels provided in **Table 8** are external noise levels and refer only to road traffic noise; they do not include ambient noise from other sources. Furthermore, the RNP provides criteria for non-residential land uses affected by proposed road projects and traffic generating developments and are presented in **Table 9**.

Table 8 Road Traffic Noise Assessment Criteria for Residential Land Uses

Road category	Type of project/land use	Assessment criteria – dBA	
		Day (7 a.m.–10 p.m.)	Night (10 p.m.–7 a.m.)
Freeway/ arterial/ sub-arterial roads	1. Existing residences affected by noise from new freeway/arterial/sub-arterial road corridors	LAeq, (15 hour) 55 (external)	LAeq, (9 hour) 50 (external)
	2. Existing residences affected by noise from redevelopment of existing freeway/arterial/sub-arterial Roads 3. Existing residences affected by additional traffic on existing freeways/arterial/sub-arterial roads generated by land use developments	LAeq, (15 hour) 60 (external)	LAeq, (9 hour) 55 (external)
Local roads	4. Existing residences affected by noise from new local road corridors 5. Existing residences affected by noise from redevelopment of existing local roads 6. Existing residences affected by additional traffic on existing local roads generated by land use developments	LAeq, (1 hour) 55 (external)	LAeq, (1 hour) 50 (external)

Note: Land use developers must meet internal noise goals in the State Environmental Planning Policy (Infrastructure) 2007 for sensitive developments near busy roads (see **Appendix C10** of the RNP for details).

Table 9 Road Traffic Noise Assessment Criteria for Non-residential Land Uses Affected by Proposed Road Projects and Traffic Generating Developments

Existing sensitive land Use	Assessment criteria – dB(A)		Additional considerations
	Day (7 a.m.–10 p.m.)	Night (10 p m.–7 a.m.)	
1.School classrooms	LAeq, (1 hour) 40 (internal) when in use	-	In the case of buildings used for education or health care, noise level criteria for spaces other than classrooms and wards may be obtained by interpolation from the 'maximum' levels shown in Australian Standard 2107:2000 (Standards Australia 2000).

Note: Land use developers must meet internal noise goals in the Infrastructure SEPP (Department of Planning NSW 2007) for sensitive developments near busy roads. See **Appendix C10** of the RNP for details.

The RNP states that where existing road traffic noise levels exceed the relevant criteria any increase in the total traffic noise level should be limited to 2dB above that of the corresponding 'no build option' (ie Airly Mine not in operation).

The RNP provides the following with regard to assessment of private haul roads:

Noise from vehicles travelling on private roads associated with an industrial activity, such as a mine or quarry, is to be assessed as an industrial noise source under the NSW Industrial Noise Policy (Environment Protection Authority 2000). Further guidance on this approach is provided in the 'Application Notes' to the policy.

5.5 Rail Traffic Noise

5.5.1 EPA Rail Infrastructure Noise Guideline

The EPA released *Rail Infrastructure Noise Guideline* (RING) in May 2013. The Guideline provides requirements in Appendix 2 for rail traffic-generating developments and are reproduced as follows:

Land-use developments other than rail projects that are likely to generate additional rail traffic on an existing rail network should be assessed against the following requirements:

- *Identify the typical offset distance/s of sensitive receivers from the rail line/s that are likely to be affected by increased rail movements.*
- *Quantify the existing level of rail noise at the offset distance/s identified above using the noise descriptors $L_{Aeq,15/9hr}$ and L_{Amax} (95th percentile) dB(A).*
- *Predict the cumulative rail noise level (i.e. from the existing and proposed rail movements) using a calibrated noise model (based on predicted increased rail movements) at the offset distances identified above.*
- *Compare the cumulative noise level with the rail noise assessment trigger levels: $L_{Aeq,15hr}$ 65 dB(A), $L_{Aeq,9hr}$ 60 dB(A), and L_{Amax} (95th percentile) 85 dB(A).*
- *Implement all feasible and reasonable noise mitigation measures where the cumulative noise level exceeds the noise assessment trigger levels and project-related noise increases are predicted.*
- *Where the L_{Aeq} noise level increases are more than 2 dB(A), which is equivalent to approximately 60 per cent of the total line or corridor rail traffic, and exceeds the relevant noise assessment trigger level, strong justification should be provided as to why it is not feasible or reasonable to reduce the increase.*

Notes

1 *A project-related noise increase is an increase of more than 0.5 dB over the day or night periods.*

2 *The geographical extent of the rail noise assessment ideally should be where project-related rail noise increases are less than 0.5 dB. This roughly equates to where project-related rail traffic represents less than 10 per cent of the total line or corridor rail traffic.*

3 *Guidance on the concept of 'feasible and reasonable' is outlined in Appendix 6.*

Mitigating noise from rail traffic-generating developments

For a traffic-generating development like a coal mine, the proponent would not have control over the public rail infrastructure. Consequently they would have limited opportunities to implement mitigation, such as noise barriers. In such cases, control of noise and vibration at the source is the most effective means of mitigation. However, the land-use developer responsible for the additional rail traffic (such as a mine, quarry or industrial site) could contract to a rail service provider who would use best practice rolling stock, including locomotives approved to operate on the NSW rail network in accordance with environment protection licences issued by the EPA. At property (architectural) treatments should be considered for affected receivers, if reasonable.

5.6 Assessing Vibration

5.6.1 Human Response

The EPA released *Assessing Vibration: a technical guideline* (the Guideline) in February 2006. The Guideline presents preferred and maximum vibration values for use in assessing human responses to vibration and provides recommendations for measurement and evaluation techniques. The Guideline is based on British Standard BS 6472-1992 *Evaluation of human exposure to vibration in buildings (1-80 Hz)* and was updated in 2008. The criteria presented in the Guideline are non-mandatory. Where all feasible and reasonable mitigation measures have been applied and vibration values are still beyond the maximum value, the operator would need to negotiate directly with the affected community.

Section 2.4 of the Guideline provides acceptable values for intermittent vibration in terms of vibration dose values (VDV) which requires the measurement of the overall weighted root mean square (rms) acceleration over the frequency range 1 Hz to 80 H. To calculate VDV the following formula is used:

$$VDV = \left[\int_0^T a^4(t)dt \right]^{0.25}$$

where VDV is the vibration dose value in $m/s^{1.75}$, *a(t)* is the frequency-weighted acceleration in m/s^2 and *T* is the total period of the day (in seconds) during which vibration may occur.

The acceptable VDV are reproduced here in **Table 10**.

Table 10 Acceptable Vibration Dose Values for Intermittent Vibration

Location	Daytime		Night-time	
	Preferred Value	Maximum Value	Preferred Value	Maximum Value
Residences	0.20 $m/s^{1.75}$	0.40 $m/s^{1.75}$	0.13 $m/s^{1.75}$	0.26 $m/s^{1.75}$

Note: Daytime is 7.00 am to 10.00 pm.

There is a low probability of adverse comment or disturbance to building occupants at vibration values below the preferred values. Adverse comment or complaints may be expected if vibration values approach the maximum values. The Guideline states that activities should be designed to meet the preferred values where an area is not already exposed to vibration.

5.6.2 Human Perception

The human perception intermittent vibration dose levels at residences for the Project are provided in **Table 11** from the *British Standard BS 6472:1992*.

Table 11 Human Perception Values for Intermittent Vibration

Vibration dose values ($m/s^{1.75}$) above which various degrees of adverse comment may be expected in residential buildings			
Place	**Low probability of adverse comment**	**Adverse comment possible**	**Adverse comment probable**
Residential building 16 hours day*	0.2 to 0.4[1]	0.4 to 0.8	0.8 to 1.6[2]
Residential building 8 hours night	0.13[1]	0.26	0.51[2]

Note: *Daytime is 7.00 am to 10.00 pm.

1. Below these ranges adverse comment is not expected.
2. Above these ranges adverse comment is very likely.

5.6.3 Building Response

British Standard 7385: Part 2-1993 "*Evaluation and measurement for vibration in buildings Part 2*" provides criteria against which the likelihood of building damage from ground vibration can be assessed.

Sources of vibration which are considered in the standard include blasting (carried out during mineral extractions or construction excavation), demolition, piling, ground treatments (compaction), construction equipment, tunnelling, road and rail traffic and industrial machinery.

The standard states that the guide values relate predominantly to transient vibration which does not give rise to resonant responses in structures, and to low-rise buildings. Where the dynamic loading caused by continuous vibration is such as to give rise to dynamic magnification due to resonance, especially at the lower frequencies where lower guide values apply, then the guide values may need to be reduced by up to 50%. Since the nearest buildings could potentially experience resonance effects, a conservative level of continuous "minimal risk of cosmetic damage" criterion has been adopted here and is shown in **Table 12**.

Table 12 Transient Vibration Guide Values – Minimal Risk of Cosmetic Damage

Type of Building	Peak Component Particle Velocity in Frequency Range of Predominant Pulse	
	4 Hz to 15 Hz	15 Hz and Above
Reinforced or framed structures - Industrial and heavy commercial buildings	25 mm/s at 4 Hz and above	
Unreinforced or light framed structures - Residential or light commercial type buildings	7.5 mm/s at 4 Hz increasing to 10 mm/s at 15 Hz	10 mm/s at 15 Hz increasing to 25 mm/s at 40 Hz and above

Note: Values referred to are at the base of the building being considered.

Furthermore, **Table 13** outlines the adopted structural damage vibration limits for residential dwellings from the German Standard *DIN 4150: Part 3-1999* for the proposed development.

Table 13 Adopted Long-term Structural Vibration Velocity limits on Structures

Line	Type of Structure	Guideline values for velocity, v_i, in mm/s, of vibration in horizontal plane of highest floor, at all frequencies
1	Building used for commercial purposes, industrial buildings, and buildings of similar design	10
2	Dwellings and buildings of similar design and/or occupancy	5
3	Structures that, because of their particular sensitivity to vibration, cannot be classified under lines 1 and 2 and are great intrinsic value (e.g. listed buildings under preservation order)	2.5

6 EXISTING ACOUSTICAL ENVIRONMENT

6.1 Methodology

Prior to operation of Airly Mine SLR conducted a series of short-term operator-attended and long-term unattended noise background monitoring surveys at locations representative of the nearest potentially affected residential properties to the Project.

The objective of the background noise survey was to measure $L_{A90(period)}$ and $L_{Aeq(15minute)}$ noise levels at the nearest potentially affected residential locations during the day, evening and night-time periods to enable the determination of relevant noise criteria for the proposed Project.

All acoustic instrumentation employed throughout the monitoring programme was designed to comply with the requirements of AS 1259.2-1990, "*Sound Level Meters*" and carries current National Association of Testing Authorities (NATA) or manufacturer calibration certificates. Instrument calibration was checked before and after each measurement survey, with the variation in calibrated levels not exceeding ±0.5 dB.

SLR has subsequently conducted annual noise compliance monitoring at the site since 2009.

6.2 Unattended Noise Monitoring

Background noise levels were monitored by SLR at four (4) locations, considered to be representative of the nearest potentially affected receivers. The noise loggers were set to record statistical indices over 15-minute intervals including L_{Amax}, L_{A1}, L_{A10}, L_{A90} and L_{Aeq} noise levels.

The $L_{A90(15minute)}$ background noise levels, as presented in the Heggies (now SLR) report *Airly Coal Project, Existing Information Review and Gap Analysis* dated 31 March 2009, are summarised in **Table 14**.

Table 14 Pre-Mine Rating Background Levels (February/March 2009)

Receiver Identification	Daytime $L_{A90(15minute)}$ (0700-1800 hours)	Evening $L_{A90(15minute)}$ (1800-2200 hours)	Night-time $L_{A90(15minute)}$ (2200-0700 hours)
Location A - Glen Davis Road	30 dBA	30 dBA	30 dBA
Location B - Parr Residence (R2)	30 dBA	30 dBA	30 dBA
Location C - Rail Loop	30 dBA	30 dBA	30 dBA
Location D - Near Leishman Residence (R7)	30 dBA	30 dBA	30 dBA

Note: Background noise levels were measured at equal to or less than 30 dBA. When noise levels are less than 30 dBA, the INP nominates that the Rating Background Level should be assumed to be 30 dBA.

6.3 Attended Noise Monitoring

Operator attended noise measurements were conducted during the daytime period in 2009 at five (5) locations surrounding the site.

Each noise survey was conducted over a 15 minute period using a Brüel & Kjær 2250 integrating sound level meter (serial number 2600507). The results of the operator attended noise measurements conducted in 2009 are given in **Table 15.** Ambient noise levels given in the table include all noise sources such as road, insects, birds etc.

Table 15 Operator Attended Noise Survey Results (Feb/March 2009)

Location	Date/ Start time/ Period/ Weather	Primary Noise Descriptor (dBA re 20 Pa)					Description of Noise Emission Typical Maximum Levels (LAmax)
		LAmax	LA1	LA10	LA90	LAeq	
Location A Glen Davis Road	23/02/2009 Day 14:15 Wind N 1-2m/s Temp 27°C	70	60	51	29	47	Birds 35 to 44 dBA Traffic on Glen Davis Road up to 70 dBA Wind in trees 30 to 38 dBA
Location B Parr Residence (R2)	23/02/2009 Day 14:40 Wind N 0-2m/s Temp 29°C	65	54	41	28	42	Birds 35 to 55 dBA Traffic on Glen Davis Road up to 38 dBA Wind in trees 30 to 38 dBA Resident noise 38 dBA Insects 34 to 36 dBA
Location C Rail Loop	23/02/2009 Day 13:00 Wind N <1m/s Temp 27°C	56	49	43	28	39	Birds 31 to 56 dBA Cow up to 46 dBA Wind in trees 32 to 41 dBA
Location D Near Leishman Residence (R7)	23/02/2009 Day 13:40 Wind N 1-2m/s Temp 27°C	66	51	45	30	42	Birds 30 to 46 dBA Wind in trees 32 to 49 dBA
Location E Airly Property	23/02/2009 Day 12:25 Wind N <1m/s Temp 27°C	65	48	39	29	38	Birds 31 to 51 dBA Wind in trees 25 to 36 dBA Resident Noise up to 65 dBA

Results of the operator attended noise survey indicate that the noise character is typical of a rural residential area at the nearest residential receivers.

No significant industrial development, other than Airly Mine, has occurred in the vicinity of these residences, hence, results of previous noise monitoring are considered to be relevant to the current assessment.

7 EFFECTS OF METEOROLOGY ON NOISE LEVELS

7.1 Wind

Wind has the potential to increase noise at a receiver when it is light and stable and blows from the direction of the source of the noise. As the strength of the wind increases the noise produced by the wind will obscure noise from most industrial and transport sources.

As per the INP, wind effects need to be considered when wind is a feature of the area under consideration. Where wind blows from the source to the receiver at speeds up to 3 m/s for more than 30% of the time in any period (day, evening, night) of any season, then wind is considered to be a feature of the area and noise level predictions must be made under these conditions.

The INP provides two methods to assess wind effects; analysis of relevant weather data to determine whether wind is a feature based on the frequency of occurrence and wind speed (*detailed approach*) or simply assume that wind is a feature of the area (*simple approach*).

The simple approach has been used for this assessment and therefore a worst case source to receiver wind has been considered for noise predictions.

7.2 Temperature Inversion

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 approximately 30% of the total night-time during winter, or about two nights per week.

A simple approach which assumes default temperature inversion values and associated drainage-flow wind, as defined in the INP, has been used for this assessment. This provides a conservative approach for the assessment.

8 PROJECT SPECIFIC NOISE CRITERIA

8.1 Operational Noise Criteria

The noise emission design criteria for the Project have been established with reference to the INP outlined in **Section 5.1**.

The amenity criteria have been established using the results of ambient noise measurements taken pre-mine in 2009. Existing industrial noise was not found to be a significant contributor to ambient noise levels at any of the monitoring locations.

The background noise levels adopted for residential receptors are the minimum background noise levels recommended by the INP. The camp ground at Airly Gap and the Nissen Hut have been assessed as Passive Recreation areas in accordance with the INP.

The project specific noise levels for all assessed receptors are contained within **Table 16**.

Table 16 Project Specific Noise Criteria

Location	Period	Adopted RBL	Intrusive Criteria $L_{Aeq(15minute)}$ dBA	Amenity Criteria $L_{Aeq(period)}$ dBA	Project Specific Noise Criteria $L_{Aeq(15minute)}$ dBA
R1 to R8	Day	30	35	50	35
	Evening	30	35	45	35
	Night	30	35	40	35
R17 and R18	When in use	N/A	N/A	N/A	50

8.2 Sleep Disturbance Criteria

The relevant sleep disturbance noise goal for receptors surrounding the Project is contained in **Table 17**. As previously stated the sleep disturbance goal will be used as a screening level at or below which sleep disturbance is unlikely to occur. Since there is potential for people to stay temporarily at both the camp ground and the Nissen Hut, sleep disturbance has also been assessed at these locations.

Table 17 Sleep Disturbance Noise Goals

Location	Period	Adopted RBL	Sleep Disturbance Noise Goal $L_{A1(1minute)}$ (dBA)
R1 to R8, R17, R18	Night	30	45

8.3 Road Traffic Noise Goals

Section 5.4 provides the relevant project specific operational and construction road traffic noise goals that are applicable for the Project.

8.4 Construction Noise Goals

Construction noise goals have been set with reference to the ICNG. **Table 18** presents the noise goals for construction associated with the Project.

Table 18 Construction Noise Goals

Location	Period	Adopted RBL	Management Level $L_{Aeq(15minute)}$ (dBA)	
			Noise Affected	Highly Noise Affected
R1 to R8	Day	30	40	75
R17, R18	When in use	n/a	60	n/a

Construction may only occur between the hours of 7.00 am and 6.00 pm Monday to Friday and 8.00 am to 1.00 pm on Saturdays. No construction work is to take place on Sundays or Public Holidays.

8.5 Rail Noise Goals

Table 19 provides the relevant project specific off site rail noise goals.

Table 19 Rail Noise Assessment Trigger Levels for Rail Traffic Generating Developments

Descriptor	Residential noise trigger levels (dBA)
LAeq(15hour)	60 dBA
LAeq(9hour)	55 dBA
Maximum Passby Lamax (95th percentile)	80 dBA

Note: 95th percentile equates to the 5% exceedance value.
A project-related noise increase is an increase of more than 0.5 dB over the day or night periods

8.6 Operational Vibration Goals

Table 10 and **Table 13** provide the relevant project specific operational vibration goals that are applicable for the Project Site.

9 ACOUSTICALLY SIGNIFICANT SOURCES

9.1 Airly Mine

Since Airly Mine is currently under Care and Maintenance, noise measurements of acoustically significant plant and equipment utilised during operations at the surface facilities have not been undertaken. Sound power levels of onsite plant have been sourced from similar equipment at other Centennial sites and utilised for the purpose of this NVIA. Where on-site measurements could not be sourced from other Centennial sites, sound power levels have been obtained from a SLR database of similar equipment. The relevant acoustically significant plant and equipment and the associated sound power levels are provided in **Table 20** and details of these levels are given in **Appendix B**.

Table 20 Acoustically Significant Plant and Equipment

Plant and Equipment	Sound Power Level dBA
Rotary Crusher	111[2]
Surface conveyors (per m)	78[2]
Sub Station 1	84[3]
Sub Station 2	84[3]
2 x Ventilation Fans (360 RPM)	122 per fan[2]
Compressor Shed	102[4]
3 x onsite Light utility vehicles	97 per vehicle[3]
1 x Water Cart	105[5]
Workshop	
Grinding	101[3]
Dams	
2 x Diesel Pumps	95[3]
Workshop, Stores and Laydown Area	
4 x PJB	105 per Vehicle[4]
3 x Eimco	105 per Vehicle[4]
1 x Forklift	99[3]
1 x Telehandler	107[3]
Coal Handling Preparation Plant	
CHPP	94 Internal[5]
1 x 40 t dump Truck filling at Reject Bin	104[6]
Washed Coal Stockpile	
1 x Dozer D10[1]	111[3]
ROM Stockpile	
1 x Dozer D10[1]	111[3]
Reject Emplacement Area 1	
1 x Dozer D10[1]	111[3]
1 x 40 t dump Truck dumping reject	105[6]
Reject Emplacement Area 2	
1 x Dozer D10[1]	111[3]
1 x 40 t dump Truck dumping reject	105[6]
Rail loop	

Plant and Equipment	Sound Power Level dBA
4 x Locomotives (notch 2 setting)	111[5]
Coal Wagons	92[6]
Automatic Coal Train Loader	107[6]
Train Refuelling Station	
1 x pump	95[3]
Water Treatment Plant	
3 x pumps	95[3] per pump

Note: 1. Only one dozer onsite and can only operate in one area at any given time.
2. Source Cooranbong Colliery
3. Source SLR database
4. Source Mandalong Colliery
5. Source Newstan Colliery
6. Source Clarence Colliery

It is relevant to note that all noise sources presented in **Table 20** do not contain a tonal, impulsive or low frequency component as defined in the INP and therefore the INP modifying adjustments do not apply.

Table 21 provides the daily and hourly road vehicle movements associated with Airly Mine.

Table 21 Airly Mine-Related Vehicle Movements

Road	Vehicles Movements per Day	Vehicles Movements per Hour
Glen Davis Road - Approved Operation	240	60
Glen Davis Road - Proposed Operation	310	78

Note: Traffic Vehicle movements associated with Airly Mine have been sourced from Barnson report '*Traffic and Rail Impact Assessment Airly Mine Extension Project'* dated October 2013.

Figure 5 illustrates the location of the plant and equipment associated with the existing and proposed operations.

It should be noted that the plant and equipment utilised underground is not anticipated to influence noise levels experienced at the nearest sensitive receivers and therefore plant and equipment underground have not been considered as part of this NVIA.

Dozer REA 1
Haul Truck Tipping Coal
Train Refuelling Station
Automatic Train Loader
Train Loader
Dam
Product Coal Stockpile
Dozer
7ML Dam
Coal Preparation Plant Site
Coal
Crusher
Surface Conveyor
Vent Fan 2
Vent Fan 1
Substation 2
CHPP
Crushing Station
Water Management Facility
PROPOSED REJECT
EMPLACEMENT AREA 2
Reject Bin
Process Water Pump
Emergency
Stockpile
Dozer
Forklift
Grinder
Telehandler
Compressor Shed
Dozer REA 2
Pump (Dirty Water Dam)
Haul Truck Tipping Coal
35ML Discharge Dam
PJB, Eimco and water cart
Admin Offices
(Existing)
109ML Dirty Water Dam
Settling Pond
Substation 1
Admin Offices
Water cart and Employee Vehicles
Torbane Road
Car Park
Settling Pond
Water cart

LEGEND

- Proposed Development Consent Boundary *(Offset for Clarity)*
- ML 1331 Boundary
- A232 Boundary
- Proposed Rejects Emplacement Areas
- Plant Equipment Location
- Railway
- NPWS Reserves
- Mugii Murum-Ban State Conservation Area

SLR630_10123_03010_PlantandEquipment_05.dwg

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Project No:	630.10123.03010
Date:	30.01.2014
Drawn by:	LH
Scale:	1:5000
Sheet Size:	A3
Projection:	(GDA94) MGA Zone 56

N

0.0 100 200 m

Centennial Airly Pty Limited

AIRLY COAL NOISE

Location of Plant and Equipment

FIGURE 5

10 OPERATIONAL NOISE IMPACT ASSESSMENT

10.1 Operational Noise Modelling

The Conservation of Clean Air and Water Europe (CONCAWE) prediction methodology was utilised within SoundPLAN 3D modelling software (Version 7.1), developed by Braunstein and Berndt Gmbh in Germany, to predict noise emissions from operation of the Project. A three-dimensional digital terrain map giving all relevant topographic information was used in the modelling process. The model used this map, together with noise source data, ground cover, shielding by barriers and/or adjacent buildings and atmospheric information to predict noise levels at the nearest potentially affected receivers.

Topographic contours and operational plans were supplied by Centennial Airly for the purpose of modelling noise from the mine site. Prediction of noise emission levels was carried out under calm and worst-case atmospheric conditions. Atmospheric parameters under which noise predictions were made are given in **Table 22**.

Table 22 Meteorological Parameters Considered for Noise Predictions

	Temperature (^{o}C)	Humidity (%)	Wind Speed	Wind Direction	Temperature Inversion
Day (calm)	16	68	n/a	n/a	n/a
Evening (calm)	13	77	n/a	n/a	n/a
Night (calm)	9	89	n/a	n/a	n/a
Prevailing Winds (Day)	16	68	3 m/s	Worst-case in any direction	n/a
Prevailing Winds (evening)	13	77	3 m/s	Worst-case in any direction	n/a
Prevailing Winds (Night)	9	89	3 m/s	Worst-case in any direction	n/a
Night-time Temperature Inversion	9	89	n/a	n/a	Class F Stability Category

Note: The temperature and humidity parameters have been chosen based on averages of actual meteorological data from Airly Mine. Wind speed, direction and temperature inversion parameters have been based on default parameters provided in the NSW INP.

Assumptions made in modelling noise emissions from the mine site include the following:

- All acoustically significant plant and equipment operates simultaneously.
- Mobile noise sources were modelled at typical locations and assumed to operate in repetitive cycles.

10.2 Operational Scenario – Noise Model Summary

Noise levels were predicted at all nearest potentially affected residential locations (as presented in **Section 4**) from the approved (DA 162/91) and proposed operation of the Airly Mine. The following scenarios were modelled:

Scenario 1

- Existing Airly Mine operations excluding any reject emplacement activities.

Scenario 2

- Approved Airly Mine operations including reject emplacement at REA 1 (refer **Figure 5**).

Scenario 3

- Proposed Airly Mine operations including reject emplacement at REA 2 (refer **Figure 5**).

Furthermore, the operational scenario modelled during each period is summarised in **Table 23**. A tick (✓) indicates that the equipment is in operation during the relevant period. A cross (×) indicates that the equipment is not in operation during the relevant period. It should be noted that the operational scenario modelled is likely to represent an acoustically worst-case scenario.

Table 23 Operational Scenarios Considered in Noise Model – Airly Mine

Plant and Equipment	Scenario 1 (excluding reject emplacement)			Scenario 2 (including REA 1)			Scenario 3 (including REA 2)		
	Day	Evening	Night	Day	Evening	Night	Day	Evening	Night
Crusher Station	✓	✓	✓	✓	✓	✓	✓	✓	✓
Surface conveyors	✓	✓	✓	✓	✓	✓	✓	✓	✓
Sub Station 1	✓	✓	✓	✓	✓	✓	✓	✓	✓
Sub Station 2	✓	✓	✓	✓	✓	✓	✓	✓	✓
2 x Ventilation Fans	✓	✓	✓	✓	✓	✓	✓	✓	✓
Compressor Shed	✓	✓	✓	✓	✓	✓	✓	✓	✓
3 x onsite Light utility vehicles	✓	✓	✓	✓	✓	✓	✓	✓	✓
1 x Water Cart	✓	×	×	✓	×	×	✓	×	×
Workshop									
Grinding	✓	✓	✓	✓	✓	✓	✓	✓	✓
Dams									
2 x Diesel Pumps	✓	×	×	✓	×	×	✓	×	×
Workshop, Stores and Laydown Area									
4 x PJB	✓	✓	✓	✓	✓	✓	✓	✓	✓
3 x Eimco	✓	✓	✓	✓	✓	✓	✓	✓	✓
1 x Forklift	✓	✓	✓	✓	✓	✓	✓	✓	✓
1 x Telehandler	✓	✓	✓	✓	✓	✓	✓	✓	✓
Coal Handling Preparation Plant									
CHPP	×	×	×	✓	✓	✓	✓	✓	✓
1 x 40 t dump Truck filling at Reject Bin	×	×	×	✓	✓	✓	✓	✓	✓

Plant and Equipment	Scenario 1 (excluding reject emplacement)			Scenario 2 (including REA 1)			Scenario 3 (including REA 2)		
	Day	Evening	Night	Day	Evening	Night	Day	Evening	Night
Product Coal Stockpile									
1 x Dozer D10[1]	✓	✓	✓	✓	✓	✓	✓	✓	✓
ROM Stockpile									
1 x Dozer D10[1]	✓	✓	✓	✓	✓	✓	✓	✓	✓
Reject Emplacement Area 1									
1 x Dozer D10[1]	×	×	×	✓	✓	✓	×	×	×
1 x 40 t dump Truck dumping reject	×	×	×	✓	✓	✓	×	×	×
Reject Emplacement Area 2									
1 x Dozer D10[1]	×	×	×	×	×	×	✓	✓	✓
1 x 40 t dump Truck dumping reject	×	×	×	×	×	×	✓	✓	✓
Rail loop									
4 x Locomotives (notch 2 setting)	✓	✓	✓	✓	✓	✓	✓	✓	✓
Coal Wagons	✓	✓	✓	✓	✓	✓	✓	✓	✓
Automatic Coal Train Loader	✓	✓	✓	✓	✓	✓	✓	✓	✓
Train Refuelling Station									
1 x pump	×	×	×	✓	✓	✓	✓	✓	✓
Water Treatment Plant									
3 x pumps	×	×	×	✓	✓	✓	✓	✓	✓

Note: Daytime 7.00 am to 6.00 pm; Evening 6.00 pm to 10.00 pm; Night-time 10.00 pm to 7.00 am
Morning Shoulder 6.00 am to 7.00 am

1. Only one dozer has been assumed to operate on the site at any given time. All potential locations were modelled and only the worst-case predicted dozer noise emission levels have been included in the overall noise predictions.

10.3 Operational Noise Modelling Results and Discussion

Noise emission levels were predicted from the proposed development for the operational scenarios described in **Section 10.2.**

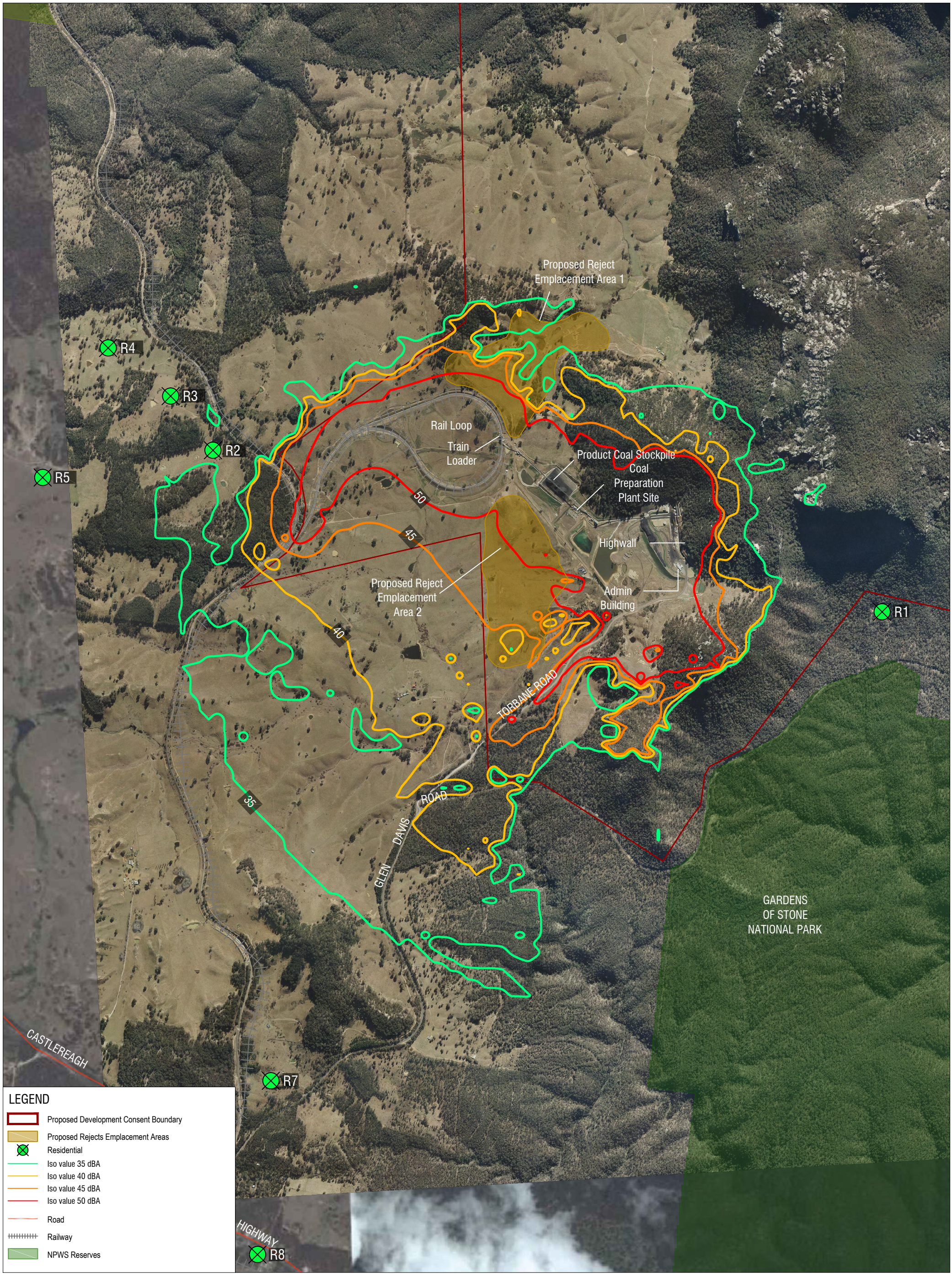
Predicted noise levels are provided in **Table 24**. Levels shown in **Bold** are those that are predicted to exceed the project specific noise criteria.

Noise contour maps representing each modelled scenario are provided in **Figure 6, Figure 7** and **Figure 8** for worst case meteorological scenarios (source to receiver winds during night-time period).

Table 24 Predicted Noise Levels for the Project

Location	Period	Predicted Noise Level $L_{Aeq(15minute)}$ (dBA)									Project Specific Noise criteria
		Scenario 1 (excluding reject emplacement)			Scenario 2 (including REA 1)			Scenario 3 (including REA 2)			
		Calm	Temp Inv.	Prev. winds	Calm	Temp Inv.	Prev. winds	Calm	Temp Inv.	Prev. winds	
R1	Day	<35	N/A	<35	<35	N/A	<35	<35	N/A	<35	35 dBA
	Evening	<35	N/A	<35	<35	N/A	<35	<35	N/A	<35	35 dBA
	Night	<35	<35	<35	<35	<35	<35	<35	<35	<35	35 dBA
R2	Day	<35	N/A	<35	<35	N/A	35	<35	N/A	35	35 dBA
	Evening	<35	N/A	<35	<35	N/A	35	<35	N/A	35	35 dBA
	Night	<35	<35	<35	<35	35	35	<35	35	35	35 dBA
R3	Day	<35	N/A	<35	<35	N/A	<35	<35	N/A	<35	35 dBA
	Evening	<35	N/A	<35	<35	N/A	<35	<35	N/A	<35	35 dBA
	Night	<35	<35	<35	<35	<35	<35	<35	<35	<35	35 dBA
R4	Day	<35	N/A	<35	<35	N/A	<35	<35	N/A	<35	35 dBA
	Evening	<35	N/A	<35	<35	N/A	<35	<35	N/A	<35	35 dBA
	Night	<35	<35	<35	<35	<35	<35	<35	<35	<35	35 dBA
R5	Day	<35	N/A	<35	<35	N/A	<35	<35	N/A	<35	35 dBA
	Evening	<35	N/A	<35	<35	N/A	<35	<35	N/A	<35	35 dBA
	Night	<35	<35	<35	<35	<35	<35	<35	<35	<35	35 dBA
R6	Day	<35	N/A	<35	<35	N/A	<35	<35	N/A	<35	35 dBA
	Evening	<35	N/A	<35	<35	N/A	<35	<35	N/A	<35	35 dBA
	Night	<35	<35	<35	<35	<35	<35	<35	<35	<35	35 dBA
R7	Day	<35	N/A	<35	<35	N/A	<35	<35	N/A	<35	35 dBA
	Evening	<35	N/A	<35	<35	N/A	<35	<35	N/A	<35	35 dBA
	Night	<35	<35	<35	<35	<35	<35	<35	<35	<35	35 dBA
R8	Day	<35	N/A	<35	<35	N/A	<35	<35	N/A	<35	35 dBA
	Evening	<35	N/A	<35	<35	N/A	<35	<35	N/A	<35	35 dBA
	Night	<35	<35	<35	<35	<35	<35	<35	<35	<35	35 dBA
R17	Day	<35	N/A	<35	<35	N/A	<35	<35	N/A	<35	50 dBA when in use
	Evening	<35	N/A	<35	<35	N/A	<35	<35	N/A	<35	
	Night	<35	<35	<35	<35	<35	<35	<35	<35	<35	
R18	Day	<35	N/A	<35	<35	N/A	<35	<35	N/A	<35	50 dBA when in use
	Evening	<35	N/A	<35	<35	N/A	<35	<35	N/A	<35	
	Night	<35	<35	<35	<35	<35	<35	<35	<35	<35	

Note: Daytime 7.00 am to 6.00 pm; Evening 6.00 pm to 10.00 pm; Night-time 10.00 pm to 7.00 am



SLR630_10123_03010_PredictedLAeq15min_03.dwg

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Sheet Size:	A3
Projection:	(GDA94) MGA Zone 56

N

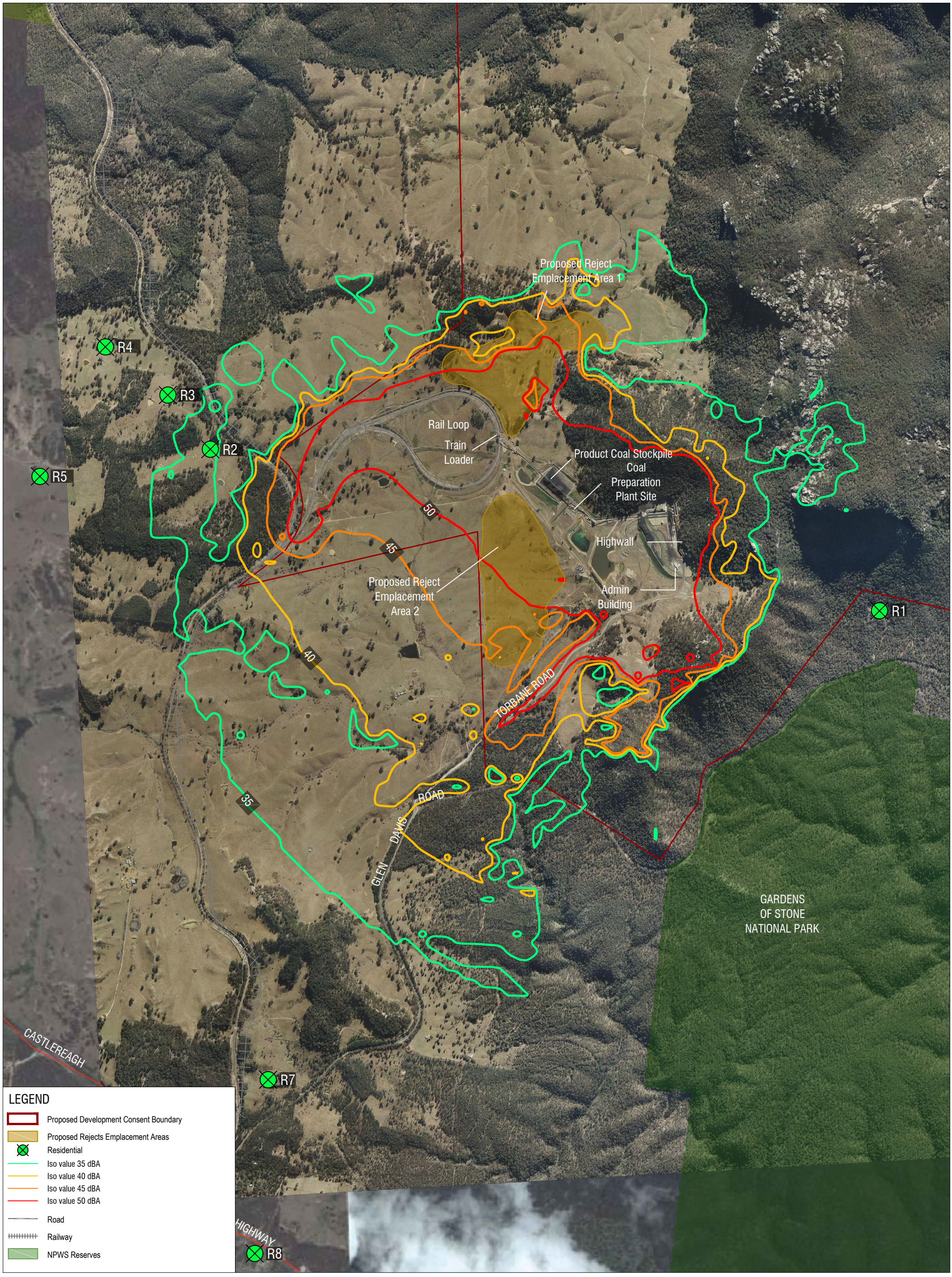
0.0 100 200 m

Centennial Airly Pty Limited

AIRLY COAL NVIA
AIRLY COAL SURFACE SITE

Predicted LAeq(15min) - Scenario 1 (Excluding Reject Emplacement) Night-time Prevailing Winds

FIGURE 6



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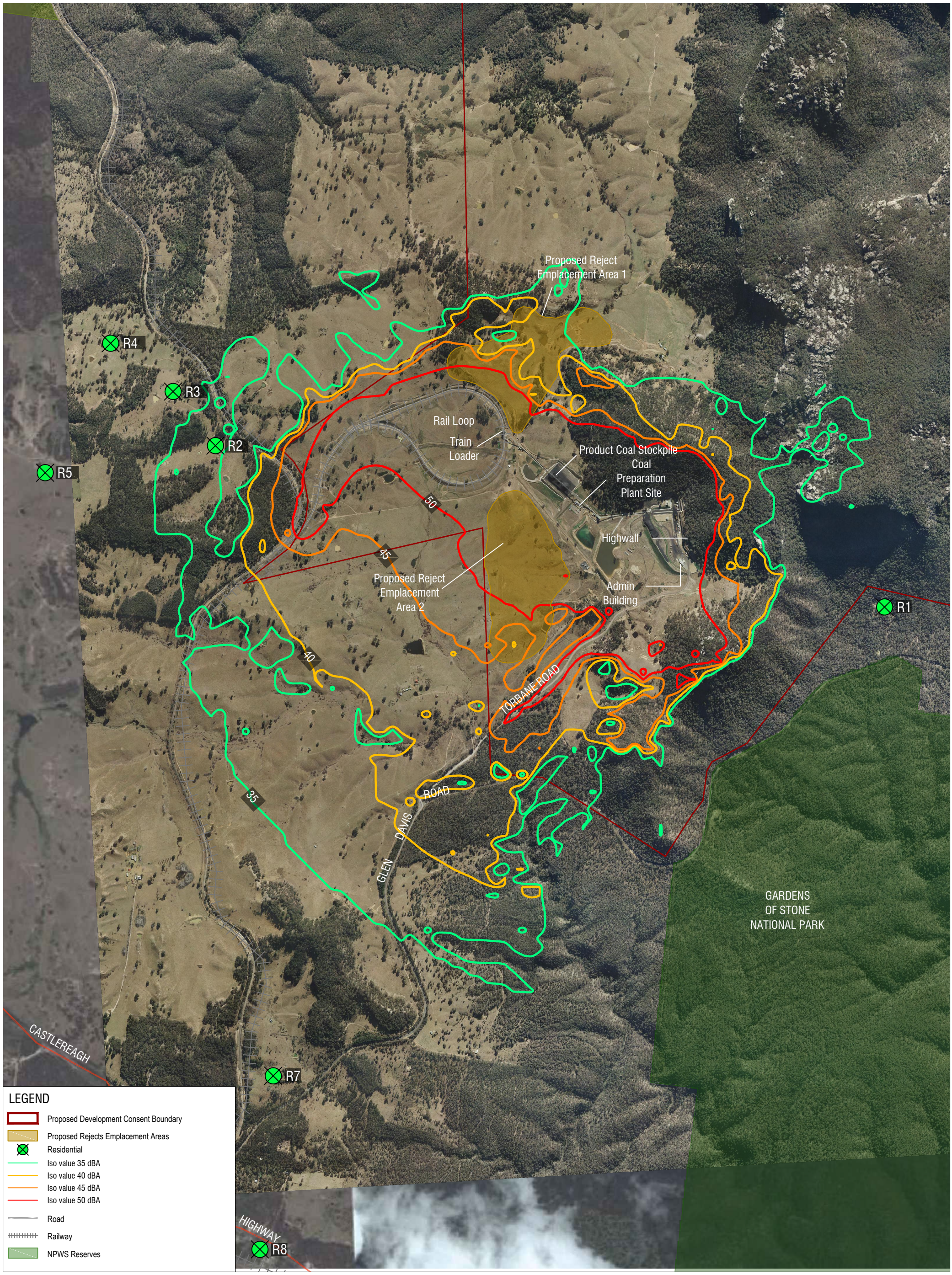
Predicted LAeq(15min) - Scenario 2 (Including REA1) Night-time Prevailing Winds

FIGURE 7



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N

0.0 100 200 m

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AIRLY COAL NVIA
AIRLY COAL SURFACE SITE

Predicted LAeq(15min)- Scenario 3 (Including REA 2) - Night-time Prevailing Winds

FIGURE 8

Results presented in **Table 24** (and the associated noise contour plots) indicate that noise levels from the modelled operational scenarios are predicted to be below the project specific noise criteria at all privately owned residential assessment locations under all considered meteorological conditions.

Operational noise levels are also predicted to comply with the project specific noise criteria at Airly Gap and the Nissen Hut.

10.4 Sleep Disturbance Analysis

In assessing sleep disturbance, L_{Amax} noise levels of acoustically significantly plant and equipment for the Project (refer to **Table 25**) were used as input to the noise model. Details of these levels are given in **Appendix B**. The use of the LAmax noise level provides a worst-case prediction since the $L_{A1(1minute)}$ noise level of a noise event is likely to be equal to or less than the L_{Amax}.

L_{Amax} noise level predictions were made at the nearest residential locations surrounding the Project under adverse weather conditions at night and the results are presented in **Table 26**.

Table 25 L_{Amax} Sound Power Levels

Plant and Equipment	Sound Power Level dBA
Crushing Station	120[2]
Surface conveyors (per m)	97[2]
Sub Station 1	89[3]
Sub Station 2	89[3]
2 x Ventilation Fans (360 RPM)	123 per fan[2]
Compressor Shed	102[4]
3 x onsite Light utility vehicles	102 per vehicle[3]
Workshop	
Grinding	110[3]
Workshop, Stores and Laydown Area	
4 x PJB	110 per Vehicle[4]
3 x Eimco	110 per Vehicle[4]
1 x Forklift	104[3]
1 x Telehandler	110[3]
Coal Handling Preparation Plant	
CHPP	98 Internal[5]
1 x 40 t dump Truck filling at Reject Bin	120[6]
Washed Coal Stockpile	
1 x Dozer D10[1]	120[3]
ROM Stockpile	
1 x Dozer D10[1]	120[3]
Reject Emplacement Area 1	
1 x Dozer D10[1]	120[3]
1 x 40 t dump Truck dumping reject	111[6]
Reject Emplacement Area 2	
1 x Dozer D10[1]	120[3]
1 x 40 t dump Truck dumping reject	111[6]
Rail loop	
4 x Locomotives (notch 2 setting)	112[5]
Coal Wagons	109[6]
Automatic Coal Train Loader	124[6]
Train Refuelling Station	
1 x pump	101[3]
Water Treatment Plant	
3 x pumps	101[3] per pump

Note: 1. Only one dozer has been assumed to operate on the site at any given time. All potential locations were modelled and only the worst-case predicted dozer noise emission levels have been included in the overall noise predictions.
2. Source Cooranbong Colliery
3. Source SLR Data Base
4. Source Mandalong Colliery
5. Source Newstan Colliery
6. Source Clarence Colliery

Table 26 Predicted Sleep Disturbance Noise Levels – Airly Mine

Location	Period	Scenario 1 (excluding reject emplacement)	Scenario 2 (including REA 1)	Scenario 3 (including REA 2)	Project Specific Noise Goal
R1	Night	<45	<45	<45	**45 dBA**
R2		<45	<45	<45	
R3		<45	<45	<45	
R4		<45	<45	<45	
R5		<45	<45	<45	
R6		<45	<45	<45	
R7		<45	<45	<45	
R8		<45	<45	<45	
R17		<45	<45	<45	
R18		<45	<45	<45	

The predicted L_{Amax} noise levels in **Table 26** are below the project specific sleep disturbance goal for night-time during all modelled operational scenarios under prevailing (worst case) weather conditions at all assessed receptors.

11 ROAD TRAFFIC NOISE IMPACT ASSESSMENT

11.1 Methodology and Assumptions

The noise impact assessment of the mine-related road traffic on the respective public roads was conducted via the prediction of the existing and future traffic noise levels on the subject roads.

The US Environment Protection Agency's method was used for the prediction of the L_{Aeq} traffic noise levels for the offset distances of the closest residences adjacent to the access roads.

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.

The calculation algorithms are generally considered to be mathematically more rigorous than those of the CoRTN method, leading to greater accuracy and a wider range of validity at low traffic flows.

All reported noise levels are "facade-corrected". This means that the predicted noise levels have been adjusted upwards to include a notional 2.5 dBA reflection within the noise model computation.

The predicted levels are for receiver points 1.5 m above the external ground level.

In accordance with RNP methodology, the relative increase in road traffic noise due to additional traffic on existing roads is to be determined. Hence, three (3) scenarios were modelled for the purposes of this road traffic noise impact assessment:

- Scenario 1 – assumes existing 2013 traffic volumes without vehicle movements associated with Airly Mine.
- Scenario 2 – assumes existing 2013 traffic volumes including vehicle movements associated with approved Airly Mine operation.
- Scenario 3 – assumes existing 2013 traffic volumes including vehicle movements associated with the Project.

It is relevant to note that the existing number of Airly Mine-related vehicle movements (both directions) on Castlereagh Highway and Glen Davis Road is 240 vehicles per day (up to 60 vehicles per hour). The proposed vehicle movements associated with the Project is an additional 70 vehicles per day and up to 18 vehicles per hour; this corresponds to a proposed total of 310 vehicles per day and up to 78 vehicles per hour.

11.1.1 Operational Road Traffic Parameters

Existing and additional employee traffic to and from the site associated with operation of the Project will use the following roads:

- Castlereagh Highway
- Glen Davis Road

Road traffic volume information was provided by Barnson and reference has been made to the *Traffic And Rail Impact Assessment – Airly Mine Extension Project October 2013*.

Details of parameters utilised in the noise model are provided in **Table 27**.

Table 27 Road Traffic Volumes Utilised in Noise Model

Year	Road Description	Road Traffic Speed km/h	Peak Hour Vehicle Movements	AADT	Day (15 hour) Traffic Flow 7am to 10pm	Night (9 hour) Traffic Flow 10pm to 7am	Heavy Vehicle %	
							Day 7am to 10pm	Night 10pm to 7am
Scenario 1 2013 Existing Traffic Volumes without Airly Mine (two way traffic)	Castlereagh Highway	40/50	248	2480	2331	149	10	10
	Glen Davis Road	50	144	14	135	9	10	10
		100						
Scenario 2 2013 Existing Traffic Volumes with Approved Airly Mine (two way traffic)	Castlereagh Highway	40/50	308	2720	2557	163	10	10
	Glen Davis Road	50	74	384	361	23	10	10
		100						
Scenario 3 2013 Existing Traffic Volumes with proposed Airly Mine Operations (two way traffic)	Castlereagh Highway	40/50	326	2790	2623	167	10	10
	Glen Davis Road	50	92	454	427	27	10	10
		100						

Note: 1 Existing Daily volumes without Airly Mine are based on the assumption that the peak hour volume is approximately 10% of the total daily volume.
2 Daytime (15 hour) traffic volumes based on the assumption of 94% of the AADT.

11.1.2 Road Traffic Noise Prediction Results

Table 28 provides the modelling results for the operational road traffic noise levels associated with the Modification.

Table 28 Operational Road Traffic Noise Prediction Results

Receiver Type	Road Description	Road Traffic Speed km/h	Approx. Distance from Road edge (m)	Prediction Results, L_{Aeq} (dBA)		Criteria, L_{Aeq} (dBA)	
				Day (15 hour) 7am to 10pm	Night (9 hour) 7am to 10pm	Day (15 hour) 7am to 10pm	Night (9 hour) 7am to 10pm
Scenario 1 - 2013 Existing Traffic Volumes without Airly Mine (two way traffic)							
Residential	Castlereagh Highway	50	10	55.5	45.4	60	55
School	Castlereagh Highway	40	26	52.2 external <40 Internal[1]	N/A	40 (internal) when in use	1 hour
		50	26	53.3 external <40 Internal[1]			
Residential	Glen Davis Road	50	10	43.1	42.8	55	50
		100	150	<35	<35		
Scenario 2 - 2013 Existing Traffic Volumes with Airly Mine (two way traffic)							
Residential	Castlereagh Highway	50	10	55.9	46.3	60	55
School	Castlereagh Highway	40	26	53.2 external <40 Internal[1]	N/A	40 (internal) when in use	1 hour
		50	26	54.3 external <40 Internal[1]			
Residential	Glen Davis Road	50	10	47.4	42.9	55	50
		100	150	<35	<35		
Scenario 3 - 2013 Existing Traffic Volumes with proposed Airly Mine Operations (two way traffic)							
Residential	Castlereagh Highway	50	10	56.0	46.3	60	55
School	Castlereagh Highway	40	26	53.4 external <40 Internal[1]	N/A	40 (internal) when in use	1 hour
		50	26	54.5 external <40 Internal[1]			
Residential	Glen Davis Road	50	10	48.1	43.0	55	50
		100	150	<35	<35		

1. As a conservative estimate, the difference between external to internal noise levels of a building comprising of standard construction and windows closed is 25 dB.

All reported noise levels are “facade-corrected”. The predicted noise levels have been adjusted upwards to include a notional 2.5 dBA reflection within the noise model computation.

The day time and night time operational road traffic noise levels presented in **Table 28** are predicted to meet the criteria detailed in the RNP under all prediction scenarios at the nearest roadside receptors.

12 CONSTRUCTION NOISE IMPACT ASSESSMENT

12.1 Construction Equipment Sound Power Levels

The sound power levels of the major noise generating plant that has been assumed for the construction of the Project are given in **Table 29**. Sound power levels for equipment used in the assessment have been obtained from a SLR database of similar equipment. Details of these levels are given in **Appendix B**.

Table 29 Acoustically Significant Equipment Sound Power Levels

Construction Activity	Plant Equipment	Quantity	dBA
REA 1	Dozer	1	111
	Water cart	1	105
REA 2	Dozer	1	111
	Water cart	1	105
CHPP	Concrete Boom Pump	1	108
	Concrete Vibrators	1	106
	Concrete Truck	1	107
	Mobile Crane	2	102
	Compressors	1	107
	Diesel Electric Generators	1	102
	Angle Grinder	1	110
	Impact/Rattle Gun	1	106
Exploration activity	Drill Rig	1	104

12.2 Construction Noise Modelling Results

12.2.1 Reject Emplacement Areas and CPP

Noise levels generated from the proposed construction activities associated with the reject emplacement areas and CPP were predicted at all potentially affected residential receptor locations surrounding the site. A summary of the results of these predictions is contained within **Table 30**.

Table 30 Predicted Construction Noise Levels at Residential Receivers

Residential Receiver Location	Predicted $L_{Aeq(15minute)}$ Noise Level (dBA)	Construction Design Goal $L_{Aeq(15minute)}$ (dBA)	
		Noise Affected	Highly Noise Affected
REA 1			
R1	<40	40 dBA	75 dBA
R2	<40		
R3	<40		
R4	<40		
R5	<40		
R6	<40		
R7	<40		
R8	<40		
R17	<40	External Noise Level 60 dBA when in use	
R18	<40		
REA 2			
R1	<40	40 dBA	75 dBA
R2	<40		
R3	<40		
R4	<40		
R5	<40		
R6	<40		
R7	<40		
R8	<40		
R17	<40	External Noise Level 60 dBA when in use	
R18	<40		
CPP			
R1	<40	40 dBA	75 dBA
R2	<40		
R3	<40		
R4	<40		
R5	<40		
R6	<40		
R7	<40		
R8	<40		
R17	<40	External Noise Level 60 dBA when in use	
R18	<40		

Note: Construction may only occur between the hours of 7.00 am and 6.00 pm Monday to Friday, and 8.00 am to 1.00 pm Saturdays. No construction work is to take place on Sundays or Public Holidays

The modelling results presented in **Table 30** indicate that the predicted $L_{Aeq(15minute)}$ noise levels from proposed construction activities associated with the reject emplacement areas and CPP are below the 'Noise Affected' construction noise goal (of 40 dBA) at all residences and significantly below the noise management level of 60 dBA for each assessed recreation area.

12.2.2 Exploration Activity

Noise emission associated with exploration activities has been assessed as construction activity given the relatively short-term nature (typically less than 3 weeks) of the potential noise impacts associated with drilling activities. It has been assumed that exploration drilling would occur during the daytime only so a construction noise criteria of $L_{Aeq(15minute)}$ 40 dBA would apply. SLR has previously measured noise emission levels of exploration drilling at Centennial Mandalong and determined a sound power level of 104 dBA of such activity. Assuming a similar rig would be utilised for Airly Mine then it is unlikely that the relevant noise goal (of 40 dBA) would be exceeded if drilling occurred at a distance of greater than 665 m from noise-sensitive receptors.

Where drilling is proposed to occur within 665 m of residences it is recommended that nearby residences be notified and consulted regarding the proposed activities. Information such as the type of activities likely to occur and the timing of such activities should be provided to potentially affected residences as well as contact details of a Centennial Airly and/or drilling contractor representative. Furthermore, all feasible and reasonable work practices should be applied. Due to the nature of the drill equipment and the temporary nature of the activities, the range of feasible and reasonable noise mitigation measures that can be utilised is limited. Some possible measures to reduce the potential impact of noise from the drill rig include the following:

- Construction of temporary noise barriers.
- If the noise emission of the drill-rig is directional in nature it could be oriented in such a way that the ‘high-noise’ side is directed away from the noise sensitive receivers.
- Educate operators with regard to potential noise issues and encourage the implementation of quiet work practises.

Management responses to potential noise issues include the following:

- In consultation with potentially-affected residences it may be agreed to stagger the sequencing of the drilling program.
- Noise monitoring of drilling activities.
- Ensure a prompt response to any complaint with regard to noise.

12.3 Construction Road Traffic Noise Impact Assessment

Construction road traffic volume information was provided by Centennial Airly.

It is relevant to note that the Project construction related vehicle movements (both directions) on the Castlereagh Highway and Glen Davis Road is 16 delivery vehicles per day and 30 personnel vehicle per day.

Table 31 details the traffic movements associated with construction of the Project.

Table 31 Airly Mine Construction Vehicle Movements

Year	Road Description	Road Traffic Speed km/h	Peak Hour Vehicle Movements	AADT	Day (15 hour) Traffic Flow 7am to 10pm	Heavy Vehicle %	
						Day 7am to 10pm	Night 10pm to 7am
2013 Existing Traffic Volumes with proposed Airly Mine Construction (two way traffic)	Castlereagh Highway	40/50	354	2766	2903	10	10
		50					
		100					
	Glen Davis Road		120	430	407	10	10

12.3.1 Airly Mine Construction Road Traffic Noise Prediction Results

Construction related road traffic noise predictions are provided in **Table 32**.

Table 32 Airly Mine Construction Road Traffic Noise Prediction Results

Scenario	Receiver Type	Road Description	Speed Limit (km/h)	Approx. Distance from Road edge (m)	Prediction Results, L_{Aeq} (dBA)	Criteria, L_{Aeq} (dBA)
					Day (15 hour) 7am to 10pm	Day (15 hour) 7am to 10pm
2013 Existing Traffic Volumes including Airly Mine Construction (two way traffic)	Residential	Castlereagh Highway	50	10	56	60
	School		40	26	53.8 external <40 Internal[1]	40 (internal) 1 hour when in use
			50	26	54.9 external <40 internal[1]	
	Residential	Glen Davis Road	50	10	53.2	55
			100	150	<35	

1. As a conservative estimate, the difference between external to internal noise levels with a dwelling comprising of standard construction and windows closed is 25 dB.

All reported noise levels are "facade-corrected". The predicted noise levels have been adjusted upwards to include a notional 2.5 dBA reflection within the noise model computation.

The day time construction road traffic noise level presented in **Table 32** are predicted to meet the criteria detailed in the RNP under all prediction scenarios at the nearest roadside receptors.

13 RAIL TRAFFIC NOISE IMPACT ASSESSMENT

13.1 Methodology

The calculation of L_{Aeq} and the maximum passby levels have been conducted using the Nordic Rail Prediction Method (1994). The prediction model uses characteristic noise levels for the various sources (locomotive engine and exhaust noise as a function of throttle notch, wheel/rail noise as a function of train speed, and wagon type, etc) at a fixed reference distance. The model then makes adjustments for the train length and distance from the track (assuming no barriers). Parameters including the daytime $L_{Aeq(15hour)}$, night-time $L_{Aeq(9hour)}$, and maximum passby level (L_{Amax}) can then be determined by summing the effects of the individual noise sources and by incorporating the number of train events.

Noise from offsite rail activities associated with the Project on the main western and Gwabegar rail lines has been considered as part of the rail traffic noise impact assessment. Noise associated with operation of the onsite rail loop has been assessed as part of the operational INP assessment (in accordance with the RING).

13.2 Assumptions

Currently approved rail traffic volumes will not change as a result of the Project. Assumptions made (based on information provided by RailCorp and Centennial Airly) for the purpose of the offsite rail noise predictions are provided in **Table 33**.

Table 33 Daily Rail Traffic Volumes

Scenario / Description	Type of Train	Train Traffic (both directions)		Total Train Length	Notch Setting	Ground absorption	Speed of Train
		Day 15 Hour	Night 9 Hour				
Scenario 1							
Existing Great Western Rail network without Airly Mine	Freight/coal Train - Diesel Engine	6	7	4 x Loco - 80m Wagons – 1000m	Medium	Soft	80 km
	Passenger Trains	21	13	160m	N/A	Soft	80 km
Existing Gwabegar Rail network without Airly Mine	Freight/coal Train - Diesel Engine	1	1	4 x Loco - 80m Wagons – 1000m	Medium	Soft	80 km
Scenario 2							
Existing Great Western Rail network with Airly Mine	Freight/coal Train - Diesel Engine	6	7	4 x Loco - 80m Wagons – 1000m	Medium	Soft	80 km
	Passenger Trains	21	13	160m	N/A	Soft	80 km
	Airly Mine trains	2	3	4 x Loco - 80m Wagons – 1000m	Medium	Soft	80km
Existing Gwabegar Rail network with Airly Mine	Freight/coal Train - Diesel Engine	1	1	4 x Loco - 80m Wagons – 1000m	Medium	Soft	80 km
	Airly Mine trains	2	3	4 x Loco - 80m Wagons – 1000m	Medium	Soft	80km

It is relevant to note that it is assumed that the nearest potentially affected residential receivers are 25 m from both the great western rail line and the Gwabegar rail line.

13.3 Rail Traffic Noise Predictions

The day-time $L_{Aeq(15hour)}$, night-time $L_{Aeq(9hour)}$ and maximum (L_{Amax}) noise levels for the assumed train movements are presented in **Table 34** and **Table 35** for various set back distances from each rail line. The receiver is a residence in the vicinity of the rail corridor.

Table 34 Scenario 1 - Predicted Rail Traffic Noise Levels (without Airly Mine trains)

Distance to Receiver	Rail Line	Predicted Noise Level			Residential noise trigger levels (dBA)		
		LAeq(15hour) Daytime	LAeq(9hour) Night-time	Passby LAmax	LAeq(15hour) Daytime	LAeq(9hour) Night-time	Passby LAmax
25	Great Western Rail Line	57.3	**59.8**	**86.8**	60	55	80
50		54.2	**56.7**	**83.6**			
100		51.1	53.6	**80.2**			
150		49.4	51.9	78.1			
200		48.1	50.6	76.6			
250		47.1	49.6	75.3			
500		44.1	46.6	70.8			
1000		41.1	43.6	65.5			
25	Gwabegar	48.7	50.9	**86.8**			
50		45.5	47.8	**83.6**			
100		42.5	44.7	**80.2**			
150		40.7	42.9	78.1			
200		39.4	41.7	76.6			
250		38.5	40.7	75.3			
500		35.5	37.7	70.8			
1000		32.4	34.7	65.5			

Table 35 Scenario 2 - Predicted Rail Traffic Noise Levels (Including Approved Airly Mine Train Movements)

Distance to Receiver	Rail Line	Predicted Noise Level			Residential noise trigger levels (dBA)		
		LAeq(15hour) Daytime	LAeq(9hour) Night-time	Passby LAmax	LAeq(15hour) Daytime	LAeq(9hour) Night-time	Passby LAmax
25	Great Western Rail Line	57.8	**60.4**	**86.8**	60	55	80
50		54.7	**57.3**	**83.6**			
100		51.6	54.3	**80.2**			
150		49.8	52.5	78.1			
200		48.6	51.2	76.6			
250		47.6	50.3	75.3			
500		44.6	47.2	70.8			
1000		41.6	44.2	65.5			
25	Gwabegar	51.3	54.4	**86.8**			
50		48.1	51.2	**83.6**			
100		45.1	48.2	**80.2**			
150		43.3	46.4	78.1			
200		42.0	45.1	76.6			
250		41.1	44.2	75.3			
500		38.0	41.1	70.8			
1000		35.0	38.1	65.5			

As indicated in **Table 34** and **Table 35**, predicted rail traffic noise levels with and without Airly Mine trains comply with the $L_{Aeq(15\ hour)}$ trigger levels for residents more than 25 m from both the main western and Gwabegar rail lines. Rail traffic noise levels without Airly Mine-related trains are predicted to exceed the night-time $L_{Aeq(9\ hour)}$ trigger levels for residents at or within 50 m of the main western rail line. The maximum rail pass-by noise level is predicted to exceed the relevant trigger levels at residences within 100 m of each line.

Inclusion of Airly Mine rail traffic results in an increase to existing rail noise of 0.5 dBA and 0.6 dBA during the day and night-time periods, respectively. This negligible noise level increase would not be noticeable. Furthermore, the rail noise maximum passby noise level will not increase as a result of the Project.

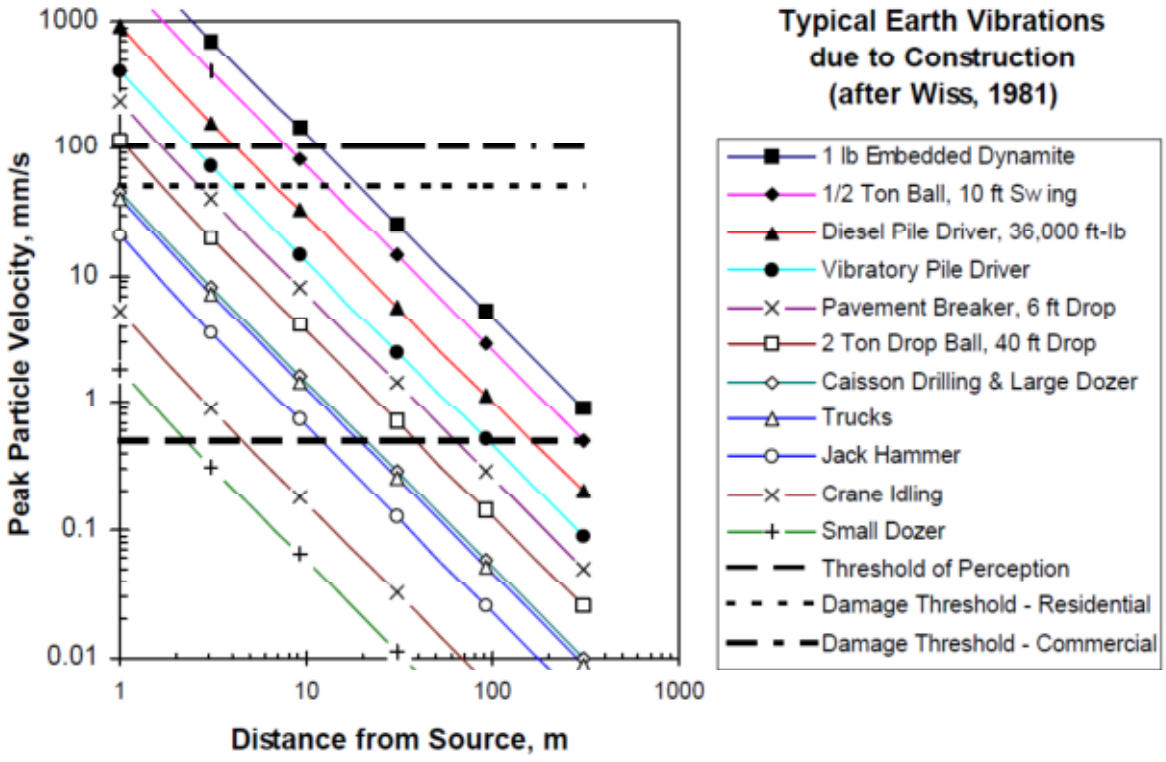
It is relevant to note that approved rail traffic volumes will not change as a result of the Project.

14 VIBRATION IMPACT ASSESSMENT

The main vibration generating equipment to be used at the site will include trucks and dozers during both construction and operation of the Project.

The amplitude of vibrations from construction equipment diminishes with distance from the source. This attenuation of vibration is due to both geometrical spreading and dissipation of energy within the ground. *Construction Vibrations and Their Impact on Vibration-Sensitive Facilities* (Amick & Gendreau, ASCE, 2000) provides a common generic model of vibrations as a function of distance developed by Wiss (1981), as shown in **Figure 9**.

Figure 9 Construction vibrations as a function of distance, after Wiss (1981)



Source: *Construction Vibrations and Their Impact on Vibration-Sensitive Facilities* (Amick & Gendreau, ASCE, 2000)

Although not explicitly shown in **Figure 9** vibration generated by underground mining equipment (eg continuous miners) is likely to be less than that shown for a “2 Ton Drop Ball, 40 ft Drop”.

Airly mine is not proposing to practice any mining methods that will cause large scale fracturing and collapse of the Triassic sandstone in the overburden. The *Subsidence Predictions and Impact Assessment for Airly Mine* (Golder, 2013, Report No. 127621105-003-R-Rev1) states that rock mass movements are predicted to remain within the highly friable Permian strata and be limited in extent. Also, there is no blasting proposed at the site.

Given the separation distance between the Project site and the nearest potentially affected residential locations (greater than 1000 m between the REA's and the nearest residence) vibration levels from activities at the Project site are predicted to be negligible and below levels of human perception at the nearest residences. Consequently, vibration generated at the Project site will be significantly below the criteria for "minimal risk of cosmetic damage" at the nearest residences.

15 NOISE MANAGEMENT AND MITIGATION

15.1 Operational

Additional specific noise mitigation and management measures have not been considered for the operational phase of the Project since predicted noise emission levels are below the relevant criteria at the nearest residential locations. Operator-attended noise monitoring at and around the site is recommended to be undertaken to confirm the noise levels predicted in this assessment.

15.2 Construction

During the construction phase of the Project all feasible and reasonable work practices should be implemented with the aim of minimising construction noise at potentially affected residences. Although the construction noise levels are predicted to meet the relevant guidelines the following recommendations are provided with the aim of minimising noise impacts from construction activities:

- Noise mitigation
    - Minimise the sound power level of construction equipment via equipment selection, where possible.
    - Noise emissions of some construction plant and equipment can be directional in nature; such equipment should be oriented in such a way that the 'high-noise' side is directed away from the noise sensitive receivers where possible.
    - Educate operators/contractors with regard to potential noise issues and encourage the implementation of quiet work practises.
    - Arrange traffic flow at the site to minimise the need for reversing.
    - Operators/contractors monitored to avoid use of PA systems and loud stereos outside.
    - Turn off trucks and construction plant when not in use.
    - Tipping actions and stockpiles positioned as far away from neighbours as possible.
- Noise management
    - Restrict high noise activities to between the hours of 8.00 am and 4.00 pm Monday to Friday and between 9.00 am and 1.00 pm Saturday.
    - Consultation with potentially-affected residences regarding the timing of acoustically significant events. This could result in conducting the noisiest activities during the least sensitive times of the day.
    - Ensure a prompt response to any complaint with regard to noise.
    - Noise monitoring on site and within the community.

All potentially affected residents should be informed of the following prior to the commencement of acoustically significant construction activities for the Project:

- The nature and duration of the works to be carried out.
- The expected noise levels.
- Relevant contact details for site personnel.

15.2.1 Exploration Activity

Where drilling is proposed to occur within 665 m of residences it is recommended that nearby residences be notified and consulted regarding the proposed activities. Information such as the type of activities likely to occur and the timing of such activities should be provided to potentially affected residences as well as contact details of a Centennial Airly and/or drilling contractor representative. Furthermore, all feasible and reasonable work practices should be applied. Due to the nature of the drill equipment and the temporary nature of the activities, the range of feasible and reasonable noise mitigation measures that can be utilised is limited. Some possible measures to reduce the potential impact of noise from the drill rig include the following:

- Construction of temporary noise barriers.
- If the noise emission of the drill-rig is directional in nature it could be oriented in such a way that the 'high-noise' side is directed away from the noise sensitive receivers.
- Educate operators with regard to potential noise issues and encourage the implementation of quiet work practises.

Management responses to potential noise issues include the following:

- In consultation with potentially-affected residences it may be agreed to stagger the sequencing of the drilling program.
- Noise monitoring of drilling activities.
- Ensure a prompt response to any complaint with regard to noise.

15.3 Noise Monitoring

Airly Mine currently undertakes annual operator-attended and short-term (ie seven (7) days) of continuous unattended noise monitoring as part of its environmental management system. If the Project is approved, the associated Noise Monitoring Program will be updated, taking into consideration the results of this NVIA and will consider the need for additional monitoring and management measures.

16 CUMULATIVE NOISE ASSESSMENT

16.1.1 Existing Industry and Mining Operations

The INP prescribes detailed calculation routines for establishing "Project-specific" $L_{Aeq(15minute)}$ intrusive criteria and $L_{Aeq(period)}$ amenity criteria at potentially affected receivers for a development (in isolation).

Potential cumulative noise impacts from existing and successive developments are embraced by the INP procedures by ensuring that the appropriate noise emission criteria (and consent limits) are established with a view to maintaining acceptable noise amenity levels for residences.

A potential source of industrial noise in the vicinity of the Project has been identified as the Excelsior limestone quarry. Excelsior limestone quarry is approximately 5.5 km NW of the Project.

During the operator-attended noise surveys at the Project, no contribution was detected from the Excelsior limestone quarry. The Excelsior limestone quarry is significantly distanced from the area and was inaudible during the operator attended noise surveys.

Therefore, the cumulative noise impacts of the site with existing industrial noise sources has been assessed in the determination of the amenity levels.

17 CONCLUSION

17.1 Operational Noise Assessment

Operational noise predictions indicate that noise levels from existing, approved and proposed operations will be below the project specific noise criteria at all privately owned residential assessment locations under all considered meteorological conditions. The predicted operational noise level will meet the project specific noise level at the Airly Camp Ground.

17.2 Sleep Disturbance Assessment

The L_{Amax} noise levels are predicted to be below the project specific sleep disturbance goals for night-time during existing, approved and proposed operations at the Project Site under prevailing weather conditions (worst case scenario) at all privately owned residential receptors.

17.3 Road Traffic Noise Assessment

The calculated day time and night time operational road traffic noise level presented in **Table 28** are predicted to meet the criteria detailed in the RNP under all prediction scenarios at the nearest roadside receivers.

17.4 Construction Noise Assessment

The modelling results in **Table 30** indicate that the predicted $L_{Aeq(15minute)}$ noise levels from proposed construction activities are below the 'Noise Affected' construction noise goals at all residences.

Where drilling is proposed to occur within 665 m of residences it is recommended that nearby residences be notified and consulted regarding the proposed activities. Information such as the type of activities likely to occur and the timing of such activities should be provided to potentially affected residences as well as contact details of a Centennial Airly and/or drilling contractor representative. Furthermore, all feasible and reasonable work practices should be applied. Due to the nature of the drill equipment and the temporary nature of the activities, the range of feasible and reasonable noise mitigation measures that can be utilised is limited. Some possible measures to reduce the potential impact of noise from the drill rig are provided in **Section 12.2.2**.

17.4.1 Construction Road Traffic Noise Impact Assessment

The calculated day time construction road traffic noise level presented in **Table 32** are predicted to meet the criteria detailed in the RNP under all prediction scenarios at the nearest roadside receivers.

17.5 Rail Noise assessment

As indicated in **Table 34** and **Table 35**, predicted existing rail traffic noise levels with and without Airly Mine comply with the $L_{Aeq(15\ hour)}$ trigger levels for residents more than 25m from the rail line. However, existing rail traffic noise levels without Airly Mine-related trains already exceed the night-time $L_{Aeq(9\ hour)}$ trigger levels for residents within 50m of the rail line. Furthermore, the existing rail noise maximum passby noise level is predicted to exceed the relevant trigger levels at residences within 100m of the rail line.

Inclusion of Airly Mine rail traffic results in an increase to existing rail noise of 0.5 dBA and 0.6dBA during the day and night respectively. This negligible noise level increase would not be noticeable. Furthermore, the rail noise maximum passby noise level will not increase as a result of the Project.

It is relevant to note that rail traffic volumes will not change as a result of the proposed modification. Hence, rail traffic noise levels currently experienced by residences in the vicinity of the rail corridor will not increase or change as a result of the modification.

17.6 Vibration Assessment

Given the separation distance between the Project site and the nearest potentially affected residential locations (greater than 1000 m between the REA's and the nearest residence) vibration levels from activities at the Project site are predicted to be negligible and below levels of human perception at the nearest residences. Consequently, vibration generated at the Project site from both construction and operational activity will be significantly below the criteria for "minimal risk of cosmetic damage" at the nearest residences.

Acoustic Terminology

1 Sound Level or Noise Level

The terms "sound" and "noise" are almost interchangeable, except that in common usage "noise" is often used to refer to unwanted sound.

Sound (or noise) consists of minute fluctuations in atmospheric pressure capable of evoking the sense of hearing. The human ear responds to changes in sound pressure over a very wide range. The loudest sound pressure to which the human ear responds is ten million times greater than the softest. The decibel (abbreviated as dB) scale reduces this ratio to a more manageable size by the use of logarithms.

The symbols SPL, L or L_P are commonly used to represent Sound Pressure Level. The symbol L_A represents A-weighted Sound Pressure Level. The standard reference unit for Sound Pressure Levels expressed in decibels is 2E-5 Pa.

2 "A" Weighted Sound Pressure Level

The overall level of a sound is usually expressed in terms of dBA, which is measured using a sound level meter with an "A-weighting" filter. This is an electronic filter having a frequency response corresponding approximately to that of human hearing.

People's hearing is most sensitive to sounds at mid frequencies (500 Hz to 4000 Hz), and less sensitive at lower and higher frequencies. Thus, the level of a sound in dBA is a good measure of the loudness of that sound. Different sources having the same dBA level generally sound about equally loud.

A change of 1 dBA or 2 dBA in the level of a sound is difficult for most people to detect, whilst a 3 dBA to 5 dBA change corresponds to a small but noticeable change in loudness. A 10 dBA change corresponds to an approximate doubling or halving in loudness. The table below lists examples of typical noise levels

Sound Pressure Level (dBA)	Typical Source	Subjective Evaluation
130	Threshold of pain	Intolerable
120 110	Heavy rock concert Grinding on steel	Extremely noisy
100 90	Loud car horn at 3 m Construction site with pneumatic hammering	Very noisy
80 70	Kerbside of busy street Loud radio or television	Loud
60 50	Department store General Office	Moderate to quiet
40 30	Inside private office Inside bedroom	Quiet to very quiet
20	Unoccupied recording studio	Almost silent

Other weightings (eg B, C and D) are less commonly used than A-weighting. Sound Levels measured without any weighting are referred to as "linear", and the units are expressed as dB(lin) or dB.

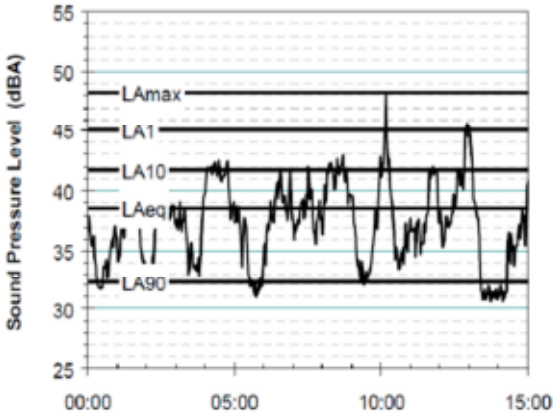
3 Sound Power Level

The Sound Power of a source is the rate at which it emits acoustic energy. As with Sound Pressure Levels, Sound Power Levels are expressed in decibel units (dB or dBA), but may be identified by the symbols SWL or LW, or by the reference unit 1E-12 W.
The relationship between Sound Power and Sound Pressure may be likened to an electric radiator, which is characterised by a power rating, but has an effect on the surrounding environment that can be measured in terms of a different parameter, temperature.

4 Statistical Noise Levels

Sounds that vary in level over time, such as road traffic noise and most community noise, are commonly described in terms of the statistical exceedance levels L_{AN}, where L_{AN} is the A-weighted sound pressure level exceeded for N% of a given measurement period. For example, the L_{A1} is the noise level exceeded for 1% of the time, L_{A10} the noise exceeded for 10% of the time, and so on.

The following figure presents a hypothetical 15 minute noise survey, illustrating various common statistical indices of interest.



Of particular relevance, are:

L_{A1} The noise level exceeded for 1% of the 15 minute interval.

L_{A10} The noise level exceed for 10% of the 15 minute interval. This is commonly referred to as the average maximum noise level.

L_{A90} The noise level exceeded for 90% of the sample period. This noise level is described as the average minimum background sound level (in the absence of the source under consideration), or simply the background level.

L_{Aeq} The A-weighted equivalent noise level (basically the average noise level). It is defined as the steady sound level that contains the same amount of acoustical energy as the corresponding time-varying sound.

When dealing with numerous days of statistical noise data, it is sometimes necessary to define the typical noise levels at a given monitoring location for a particular time of day. A standardised method is available for determining these representative levels.

This method produces a level representing the "repeatable minimum" L_{A90} noise level over the daytime and night-time measurement periods, as required by the EPA. In addition the method produces mean or "average" levels representative of the other descriptors (L_{Aeq}, L_{A10}, etc).

5 Tonality

Tonal noise contains one or more prominent tones (ie distinct frequency components), and is normally regarded as more offensive than "broad band" noise.

6 Impulsiveness

An impulsive noise is characterised by one or more short sharp peaks in the time domain, such as occurs during hammering.

7 Frequency Analysis

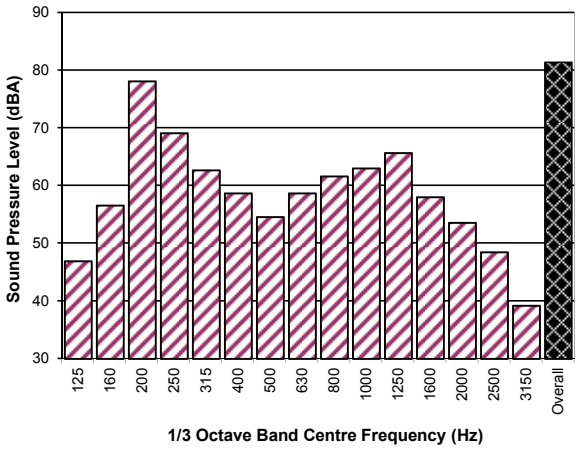
Frequency analysis is the process used to examine the tones (or frequency components) which make up the overall noise or vibration signal. This analysis was traditionally carried out using analogue electronic filters, but is now normally carried out using Fast Fourier Transform (FFT) analysers.

The units for frequency are Hertz (Hz), which represent the number of cycles per second.

Frequency analysis can be in:

- Octave bands (where the centre frequency and width of each band is double the previous band)
- 1/3 octave bands (3 bands in each octave band)
- Narrow band (where the spectrum is divided into 400 or more bands of equal width)

The following figure shows a 1/3 octave band frequency analysis where the noise is dominated by the 200 Hz band. Note that the indicated level of each individual band is less than the overall level, which is the logarithmic sum of the bands.



8 Vibration

Vibration may be defined as cyclic or transient motion. This motion can be measured in terms of its displacement, velocity or acceleration. Most assessments of human response to vibration or the risk of damage to buildings use measurements of vibration velocity. These may be expressed in terms of "peak" velocity or "rms" velocity.

The former is the maximum instantaneous velocity, without any averaging, and is sometimes referred to as "peak particle velocity", or PPV. The latter incorporates "root mean squared" averaging over some defined time period.

Vibration measurements may be carried out in a single axis or alternatively as triaxial measurements. Where triaxial measurements are used, the axes are commonly designated vertical, longitudinal (aligned toward the source) and transverse.

The common units for velocity are millimetres per second (mm/s). As with noise, decibel units can also be used, in which case the reference level should always be stated. A vibration level V, expressed in mm/s can be converted to decibels by the formula 20 log (V/V_o), where V_o is the reference level (1E-6 mm/s). Care is required in this regard, as other reference levels are used by some organizations.

9 Human Perception of Vibration

People are able to "feel" vibration at levels lower than those required to cause even superficial damage to the most susceptible classes of building (even though they may not be disturbed by the motion). An individual's perception of motion or response to vibration depends very strongly on previous experience and expectations, and on other connotations associated with the perceived source of the vibration. For example, the vibration that a person responds to as "normal" in a car, bus or train is considerably higher than what is perceived as "normal" in a shop, office or dwelling.

10 Over-Pressure

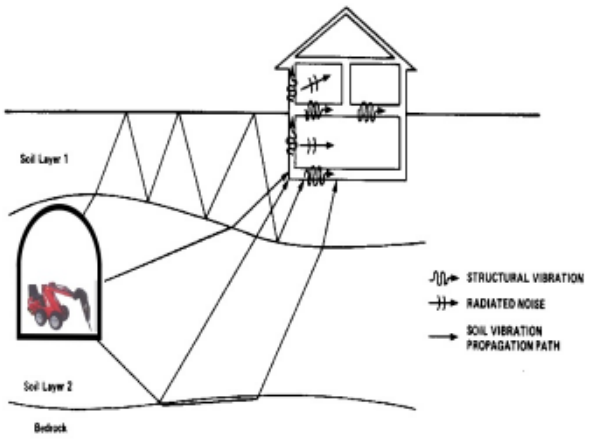
The term "over-pressure" is used to describe the air pressure pulse emitted during blasting or similar events. The peak level of an event is normally measured using a microphone in the same manner as linear noise (ie unweighted), at frequencies both in and below the audible range.

11 Regenerated Noise

Noise that propagates through a structure as vibration and is radiated by vibrating wall and floor surfaces is termed "regenerated noise", "structure-borne noise", or sometimes "ground-borne noise". Regenerated noise originates as vibration and propagates between the source and receiver through the ground and/or building structural elements, rather than through the air.

Typical sources of regenerated noise include tunnelling works, underground railways, excavation plant (eg rockbreakers), and building services plant (eg fans, compressors and generators).

The following figure presents the various paths by which vibration and regenerated noise may be transmitted between a source and receiver for construction activities occurring within a tunnel.



The term "regenerated noise" is also used to describe other types of noise that are emitted from the primary source as a different form of energy. One example would be a fan with a silencer, where the fan is the energy source and primary noise source. The silencer may effectively reduce the fan noise, but some additional noise may be created by the aerodynamic effect of the silencer in the airstream. This "secondary" noise may be referred to as regenerated noise.

Operational, Sleep disturbance and Construction Sound Power Levels

Plant/Equipment	Operational Octave Band Sound Power Level (dB)											
	31Hz	63Hz	125Hz	250Hz	500Hz	1kHz	2kHz	4kHz	8kHz	16kHz	Total dB	Total dBA
Crusher Station	106	101	106	107	107	108	105	96	88	70	115	111
Surface conveyors (per m)	78	78	84	80	77	72	66	60	51	39	87	78
Sub Station 1	80	78	94	90	77	69	64	61	54	47	96	84
Sub Station 2	80	78	94	90	77	69	64	61	54	47	96	84
2 x Ventilation Fans (360 RPM)	132	130	128	120	122	114	110	106	103	-	135	122
Compressor Shed	113	100	107	105	100	94	91	82	74	-	115	102
3 x onsite Light utility vehicles	106	102	103	92	90	90	93	85	80	74	109	97
1 x Water Cart	105	105	102	104	101	99	98	91	86	86	111	105
Workshop												
Grinding	92	105	97	94	94	95	96	91	86	77	107	101
Dams												
2 x Diesel Pumps	70	78	91	88	89	91	90	80	66	-	97	95
Workshop, Stores and Laydown Area												
4 x PJB	71	96	106	103	101	101	97	91	82	-	110	105
3 x Eimco	96	96	99	108	101	100	97	92	84	-	110	105
1 x Forklift	104	104	99	95	95	95	91	84	77	-	108	99
1 x Telehandler	-	107	101	94	93	106	94	82	75	-	110	107
Coal Handling Preparation Plant												
CHPP	99	97	90	90	90	90	88	83	78	68	103	94
1 x 40 t dump Truck filling at Reject Bin	105	104	105	99	99	99	97	94	85	73	111	104
Washed Coal Stockpile												
1 x Dozer D10	113	119	113	110	109	106	103	99	91	91	122	111
ROM Stockpile												
1 x Dozer D10	113	119	113	110	109	106	103	99	91	91	122	111
Reject Emplacement Area 1												
1 x Dozer D10	113	119	113	110	109	106	103	99	91	91	122	111
1 x 40 t dump Truck dumping reject	120	118	106	99	100	99	97	96	93	87	122	105

Reject Emplacement Area 2												
1 x Dozer D10	113	119	113	110	109	106	103	99	91	91	122	111
1 x 40 t dump Truck dumping reject	120	118	106	99	100	99	97	96	93	87	122	105
Rail loop												
4 x Locomotives (notch 2 setting)	121	121	109	105	109	108	101	93	85	-	125	111
Coal Wagons	101	95	93	90	90	85	83	76	82	56	103	92
Automatic Coal Train Loader	110	105	107	104	104	101	99	99	90	81	114	107
Train Refuelling Station												
1 x pump	70	78	91	88	89	91	90	80	66	-	97	95
Water Treatment Plant												
3 x pumps	70	78	91	88	89	91	90	80	66	-	97	95

Plant/Equipment	**Sleep Disturbance Octave Band Sound Power Level (Lmax) dB**											
	31Hz	**63Hz**	**125Hz**	**250Hz**	**500Hz**	**1kHz**	**2kHz**	**4kHz**	**8kHz**	**16kHz**	**Total dB**	**Total dBA**
Crushing Station	115	110	114	116	116	116	113	104	97	79	123	120
Surface conveyors (per m)	97	97	103	99	96	91	85	79	70	58	106	97
Sub Station 1	85	83	99	95	82	74	69	66	59	52	101	89
Sub Station 2	85	83	99	95	82	74	69	66	59	52	101	89
2 x Ventilation Fans (360 RPM)	133	131	129	121	123	115	111	107	104	-	137	123
Compressor Shed	113	100	107	105	100	94	91	82	74	-	115	102
3 x onsite Light utility vehicles	111	107	108	97	95	95	98	90	85	79	114	102
Workshop												
Grinding	101	114	106	103	103	104	105	100	95	86	116	110
Workshop, Stores and Laydown Area												
4 x PJB	76	101	111	108	106	106	102	96	87	-	115	110
3 x Eimco	101	101	104	113	106	105	102	97	89	-	115	110
1 x Forklift	109	109	104	100	100	100	96	89	82	-	114	104
1 x Telehandler	-	110	104	97	96	109	97	85	78	-	114	110

Operational, Sleep disturbance and Construction Sound Power Levels

Coal Handling Preparation Plant												
CHPP	103	101	94	94	94	94	92	87	82	72	106	98
1 x 40 t dump Truck filling at Reject Bin	121	120	121	115	115	115	113	110	101	89	127	120
Washed Coal Stockpile												
1 x Dozer D10[1]	122	128	122	119	118	115	112	108	100	100	130	120
ROM Stockpile												
1 x Dozer D10[1]	122	128	122	119	118	115	112	108	100	100	130	120
Reject Emplacement Area 1												
1 x Dozer D10[1]	122	128	122	119	118	115	112	108	100	100	130	120
1 x 40 t dump Truck dumping reject	126	124	112	105	106	105	103	102	99	93	129	111
Reject Emplacement Area 2												
1 x Dozer D10[1]	122	128	122	119	118	115	112	108	100	100	130	120
1 x 40 t dump Truck dumping reject	126	124	112	105	106	105	103	102	99	93	129	111
Rail loop												
4 x Locomotives (notch 2 setting)	122	122	110	106	110	109	101	94	85	-	125	112
Coal Wagons	118	112	110	107	107	102	100	93	99	73	121	109
Automatic Coal Train Loader	127	122	124	121	121	118	116	116	107	98	131	124
Train Refuelling Station												
1 x pump	76	84	97	94	95	97	96	86	72	-	103	101
Water Treatment Plant												
3 x pumps	76	84	97	94	95	97	96	86	72	-	103	101

Plant/Equipment	Construction Octave band sound Power Level Leq dB											
	31Hz	63Hz	125Hz	250Hz	500Hz	1kHz	2kHz	4kHz	8kHz	16kHz	Total dB	Total dBA
Construction Operations												
Excavator	97	112	106	102	102	101	97	87	77	-	114	104
Dozer	117	120	119	115	111	109	107	100	95	79	125	114
Dump Truck	103	110	101	97	96	94	90	82	74	64	111	98
REA 1 -Construction Operations												
Dozer	113	119	113	110	109	106	103	99	91	91	122	111
Water Cart	105	105	102	104	101	99	98	91	86	86	111	105
REA 2 -Construction Operations												
Dozer	113	119	113	110	109	106	103	99	91	91	122	111
Water Cart	105	105	102	104	101	99	98	91	86	86	111	105
CPP -Construction Operations												
Concrete Boom Pump	66	66	64	83	89	100	101	101	102	97	112	108
Concrete Vibrators	64	64	62	81	87	98	99	99	100	95	112	106
Concrete Truck	105	112	102	102	105	103	99	95	93	93	109	107
Mobile Cranes	100	107	97	97	100	98	94	90	88	88	109	102
Compressors	120	116	112	107	104	100	100	93	87	87	108	107
Diesel Electric Generators	77	82	90	90	94	98	97	93	84	77	121	102
Angle Grinder	101	114	106	103	103	104	105	100	95	86	107	110
Impact/Rattle Gun	97	110	102	99	99	100	101	96	91	82	107	106
Exploration Activity												
Drill Rig	58	84	87	93	98	100	99	93	82	67	111	104