15 Noise and Vibration

Section 15 Noise and Vibration

15.1 Introduction

A detailed noise and vibration impact assessment for the proposed Alpha Coal Project (Mine) (the Project) has been undertaken. The subsections that follow provide a summary of the assessment findings, including a description of the existing environmental values, assessment of potential noise and vibration impacts, and proposed mitigation/management measures in accordance with the Terms of Reference (TOR) requirements of the Environmental Impact Statement (EIS). The detailed noise and vibration impact assessment report can be referred to in Volume 5, Appendix I.

This assessment includes potential construction and operational noise and vibration impacts of the mine site and associated infrastructure, but does not include the operations of the Alpha aerodrome, railway or port facilities (subject to separate noise and vibration impact assessments).

15.2 Existing Acoustic Environment

15.2.1 Noise Sensitive Receptors

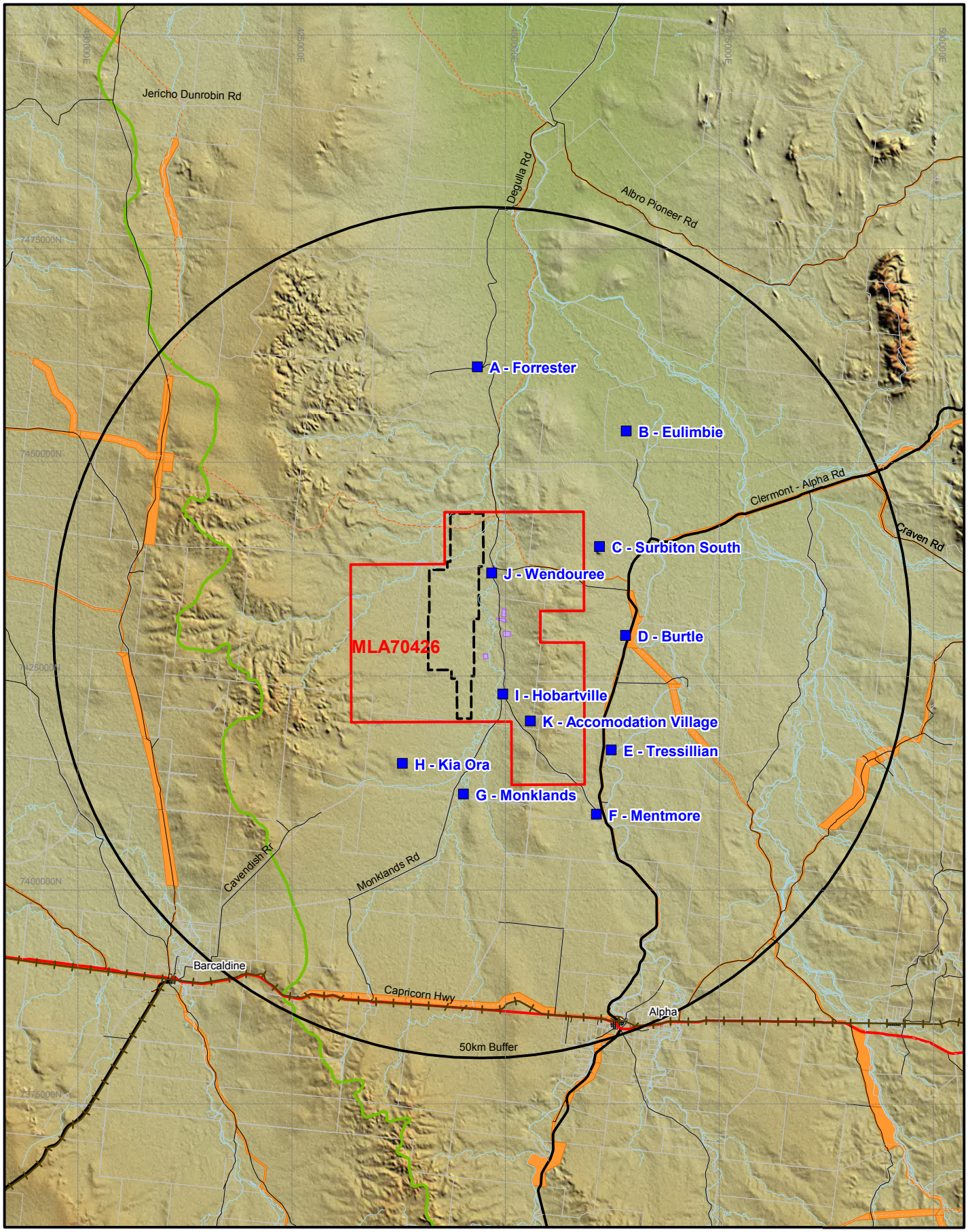
Current land use within and adjacent to the Mine Lease Application (MLA) 70426 is predominantly cattle grazing, and the site and surrounding areas are relatively flat and vegetated. Two existing dwellings, Wendouree and Hobartville, are located within the MLA 70426 boundary and a further eight dwellings located within an approximate 20 Kilometre (km) radius of the site.

Table 15-1 indicates the nearest potentially affected noise sensitive receptor locations and the respective distances from the nearest MLA 70426 boundary and the final pit extent. A site location plan indicating the identified receptor locations is shown on

Figure 15-1, whilst Figure 15-2 shows the proposed site layout, location of the pit areas and primary facilities within the Project site.

Table 15-1: Potential Noise Receptors

Potential Noise Receptor	Address	Approx. Distance from MLA 70426 Mining Lease Boundary, (km)	Approx. Distance from Pit Area Boundary, (km)
A	Forrester Homestead	16.7	17.2
B	Eulimbie Homestead	9.4	16.2
C	Surbiton South Station	3.7	13.6
D	Burtle Station	4.6	17.3
E	Tressillian Homestead	4.2	16.7
F	Mentmore Homestead	5.4	18.4
G	Monklands Homestead	7.9	8.8
H	Kia Ora Homestead	4.6	8.2
I	Hobartville Homestead	Within MLA 70426	3.7
J	Wendouree Homestead	Within MLA 70426	1.2
K	HPPL Accommodation Village	Within MLA 70426	6.4



Mining Lease Application (MLA70426) Boundary
Catchment Boundaries
Stock Route
Mine Pit Extent
Homestead

Source: See Copyright Details below and for full disclosure Please Refer to the EIS ***Volume 4 - References***

0 5 10 15Km
Scale 1:600 000 (A4)
Datum: GDA94, MGA Zone55

N W E S

HANCOCK PROSPECTING PTY LTD

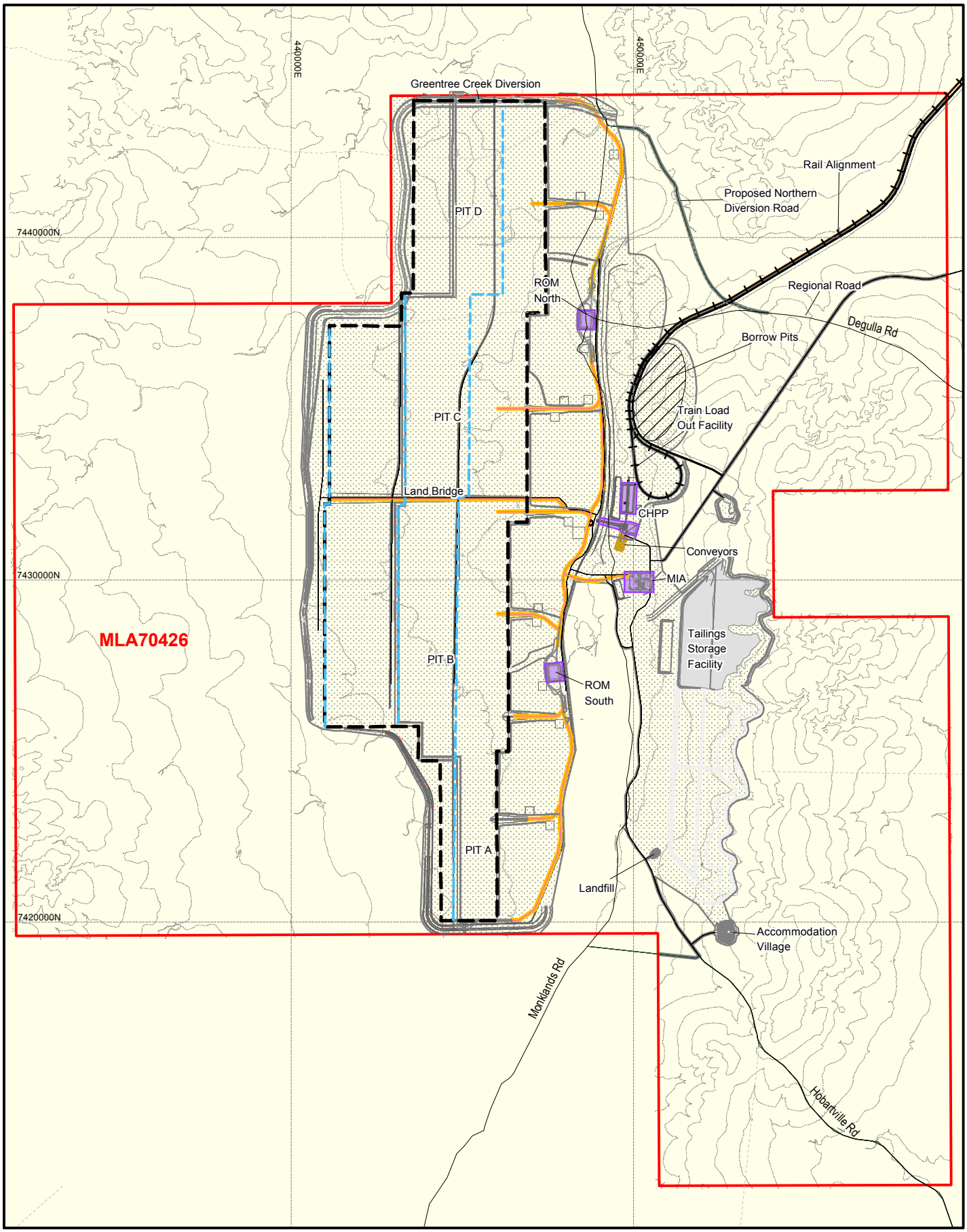
Alpha Coal Project
Environmental Impact Statement

LOCATION PLAN

Job Number	4262 6580
Revision	A
Date	24-09-2010

Figure: 15-1

File No: 42626580-g-2027.wor



Mining Lease Application (MLA70426) Boundary
Mine Pit Extent
Disturbance Area
Haul Roads
Mine Face Over Time

Source: See Copyright Details below and for full disclosure Please Refer to the EIS ***Volume 4 - References***

0 2 4Km
Scale 1:150 000 (A4)
Datum: GDA94, MGA Zone55

N W E S

HANCOCK PROSPECTING PTY LTD
Alpha Coal Project
Environmental Impact Statement

PROPOSED SITE
LAYOUT PLAN

Job Number | 4262 6580
Revision | A
Date | 24-09-2010

Figure: 15-2

File No: 42626580-g-2028.wor

15.2.2 Noise Measurement Methodology

Long-term unattended noise monitoring was conducted by Australasian Resource Consultants (AARC) at the two dwellings within the MLA 70426 boundary, namely Receptor I (Hobartville Homestead) and Receptor J (Wendouree Homestead). The monitoring took place between 23 and 30 June 2010 at Receptor J and between 26 June and 3 July 2010 at Receptor I. Measurements were undertaken in accordance with the EPA Ecoaccess Guideline: Noise Measurement Manual (2000) and AS1055:1997 "Acoustics – Description and Measurement of Environmental Noise".

15.2.3 Noise Measurement Results

For the purpose of this assessment, the following times of day are defined in Table 15-2:

Table 15-2: Time of Day Definition

Time of Day	Time
Day	07:00 – 18:00
Evening	18:00 – 22:00
Night	22:00 – 07:00

The results of the long-term unattended noise monitoring are summarised in Table 15-3. Any 15-minute period affected by likely adverse weather conditions or likely extraneous noise were excluded from the calculation (refer to Volume 5, Appendix I).

The Rating Background Noise Levels (RBLs) presented in Table 15-3 are typical background noise levels of a very rural environment with natural noise sources and minimal transportation.

Table 15-3: Summary of Unattended Noise Monitoring

Location	Rating Background Noise Level (RBL) L_{A90} dB(A)			Ambient Noise Level (AL) L_{Aeq} dB(A)		
	Day	Evening	Night	Day	Evening	Night
Wendouree Homestead (J)	27	26	26	43	31	27
Hobartville Homestead (I)	26	26	25*	42	31	27

* In accordance with the Ecoaccess guideline, the threshold background level is L_{A90} 25 dB(A). The RBL of L_{A90} 24 dB(A) was adjusted accordingly.

Given the very rural nature of the proposed mine site and far reaching surrounds, it is considered that the measured noise levels obtained from the monitoring locations within the mining lease boundary would be reasonably representative of the noise levels at the locations of Receptors A – H, the closest identified receptors outside the MLA 70426 boundary.

Operational noise criteria based on the levels set out in Table 15-3 are detailed in Section 15.4.2. For the further receptor locations where monitoring was not conducted, the assessment criteria has been based on the lowest daytime, evening and night-time noise monitoring results, effectively from the Hobartville Homestead location.

It is noted that in very rural areas such as the subject site, background noise levels are typically controlled by insect noise in the presence of neutral meteorological conditions (zero or very low wind speed and no precipitation). Somewhat higher background levels often occur in the summer months when insect activity is generally higher. In this respect it is considered that the Project noise criteria established within this assessment, which are based on monitoring undertaken in the cooler months of

June and July, provide for a conservative assessment.

15.3 Background Vibration Monitoring

Background vibration monitoring was not undertaken as part of the EIS as the current (background) local land use would not be expected to provide measureable levels.

15.4 Project Acoustic Criteria

Noise and vibration impacts associated with the site's proposed construction and operations have been assessed in accordance with the relevant state legislation and guidelines:

- *Environmental Protection Act 1994 (Queensland)*;
- *Environmental Protection (Noise) Policy* 2008;
- *EPA Ecoaccess Guideline: Planning for Noise Control*;
- *EPA Ecoaccess Guideline: Noise and Vibration from Blasting*; and
- *EPA Ecoaccess Guideline: Assessment of Low Frequency Noise*.

Additionally, the following guidelines and standards have been considered:

- *AS1055.1 and AS1055.2, 1997 - Description and Measurement of Environment Noise*;
- *Interest in Planning Schemes No. 3 (Queensland Transport)* and *Queensland Rail Code of Practice for Railway Noise Management (November, 2007)*;
- *AS 2187.2, 2006 – Explosives, Storage and Use, part 2, Use of Explosives*;
- *BS7385 Part 2, 1993 - Evaluation and Measurement for Vibration in Buildings, Guide to Damage Levels from Ground-borne Vibration*;
- *BS6472, 1992 - Evaluation of Human Exposure to Vibration in Buildings (1Hz to 80 Hz)*;
- The Health Effects of Environmental Noise – other than hearing loss (enHealth Council, 2004);
- *Australian/New Zealand Standard AS/NZS 2107-2000, Acoustics – Recommended Design Sound Levels and Reverberation Times for Building Interiors*; and
- *World Health Organisation (WHO) Guidelines for Community Noise*, 1999.

Due to the nature of the mining activities, it is noted that there may be some crossover between operational and construction activities. Assessment criteria for general construction and operations are provided in Sections 15.4.1 and 15.4.2 respectively.

Both construction and operations have the potential to cause sleep disturbance and to generate low frequency noise. Also blasting, the only activity considered likely to have the potential to result in ground vibration effects over significant distances and overpressure effects, is also proposed as both a construction and operational activity. Accordingly, criteria for the assessment of sleep disturbance, low frequency noise, and noise and vibration from blasting are provided in Sections 15.4.3, 15.4.4, and 15.4.5, respectively.

15.4.1 Construction Noise Criteria

In the absence of specific guidelines for the assessment of construction noise in Queensland, the Queensland *Environmental Protection (Noise) Policy 2008* (EPP[Noise]) to considered to be the most appropriate legislative guideline for the purpose of this assessment.

15.4.1.1 Environmental Protection (Noise) Policy 2008

The EPP(Noise) does not include specific construction noise limits. It does, however, provide acoustic quality objectives for the protection of amenity, human health and wellbeing, including sleep protection. Construction noise effects have been assessed against these criteria, and are set out in Table 15-4.

Table 15-4: *Environmental Protection (Noise) Policy 2008* - Acoustic Quality Objectives

Sensitive Receptor	Time of Day	Acoustic Quality Objectives (measured at the receptor) dB(A)			Environmental Value
		$L_{Aeq,1hour}$	$L_{A10,1hour}$	$L_{A1,1hour}$	
Dwelling (external)	Daytime and Evening	50	55	65	Health & wellbeing
Dwelling (internal)	Daytime and Evening	35	40	45	Health & wellbeing
Dwelling (internal)	Night-time	30	35	40	Health & wellbeing in relation to the ability to sleep

It is noted that these criteria were developed for the protection of amenity and health and not for the control of construction noise, which is generally regarded as a temporary activity and therefore often afforded greater tolerance. World Health Organisation (WHO) Guidelines for Community Noise,1999 recommends for quality sleep, maximum indoor noise levels should not exceed 45 dB(A).

15.4.2 Operational Noise Criteria

15.4.2.1 Background Creep

To prevent background noise levels progressively increasing over time with the establishment of developments, the Planning for Noise Control guideline provides recommended outdoor background planning noise levels (RBL, min$L_{A90,1hour}$) not to be exceeded for the daytime, evening and night-time periods for various land uses. The land uses surrounding the Project site fit the 'Purely Residential, Very Rural' land use classification described by the guideline.

The Ecoaccess guideline (Section 15.4) notes that it may not be possible to maintain background noise levels in very rural areas below 25 dB(A) as developments occur and in such cases a threshold background level of 25 dB(A) is to be used. The resultant background creep criteria applied for each receptor based on the noise monitoring results are set out in Table 15-5. The Hobartville location criteria, which are based on the lowest daytime, evening and night-time noise monitoring results, have been applied for receptor locations where no background noise monitoring was undertaken.

Table 15-5: Background Creep Criteria

Receptor	min$L_{A90,1hour}$ (dBA)		
	Day	Evening	Night
J (Wendouree Homestead)	32	28	25
I (Hobartville Homestead); Receptors A-H; and K (HPPL Accommodation Village)	31	28	25

15.4.2.2 Planning Noise Levels (PNL)

The Ecoaccess guideline recommends Planning Noise Levels (PNL) for various noise area categories. Where the existing noise level from specific noise sources is close to the maximum planning level, the noise from any new source(s) must be controlled to protect the amenity of the area. To achieve this, the guideline provides a modification method to provide the maximum PNL.

15.4.2.3 Specific Noise Levels (SNL)

The SNL is determined based on the existing measured RBL. In very rural areas, where minimum L_{A90} is lower than 25 dB(A), it may be possible for the SNL to be calculated to a level lower than the recommended background creep criteria (L_{A90}). It is therefore considered appropriate to set the SNL 3 dB(A) higher than the RBL but with consideration of applying penalty adjustments for noise source containing tonality and/or impulsiveness. No penalties for impulsiveness or tonality have been applied as the noise sources under assessment as the envisaged activities are not considered to possess these characteristics.

In accordance with the Ecoaccess guideline, the SNL criteria are applied for the purposes of this assessment, as in this case, they are more stringent than the PNLs. Compliance with the SNL criteria would ensure the PNLs are readily achieved. A summary of operational noise criteria applicable to the Project is provided in Table 15-6.

Table 15-6: Summary of Operational Noise Design Criteria

Receptor	Daytime Criteria		Evening Criteria		Night Criteria	
	$L_{A90,1hour}$ dB(A)	$L_{Aeq,1hour}$ dB(A)	$L_{A90,1hour}$ dB(A)	$L_{Aeq,1hour}$ dB(A)	$L_{A90,1hour}$ dB(A)	$L_{Aeq,1hour}$ dB(A)
J (Wendouree Homestead)	32	30	28	29	25	29
I (Hobartville Homestead); Receptors A-H; and K (HPPL Accommodation Village)	31	29	28	29	25	28

15.4.3 Sleep Disturbance Criteria

Where there exists the possibility that instantaneous, short-duration, high-level noise events may occur during night-time hours (22:00 – 07:00), consideration will be given to the potential for the disturbance of sleep within residences and the accommodation village.

The Ecoaccess guideline makes reference to the WHO Guidelines for Community Noise (Berglund B, Lindvall T and Schwela D H,1999) for sleep disturbance caused by noise impacts.

The WHO guidelines suggest that noise levels inside bedrooms should be limited to 45 dB(A) L_{Amax} and 30 dB(A) L_{Aeq}. In addition, the Australian/New Zealand Standard *AS/NZS 2107:2000 Acoustics – Recommended Design Sound Levels and Reverberation Times for Building Interiors* recommends a satisfactory continuous noise level inside bedrooms of 30 dB(A) L_{Aeq}.

To achieve the internal noise levels described above and for the avoidance of sleep disturbance, the noise levels outside bedroom windows, should be limited to 40 dB(A) L_{Aeq} and 55 dB(A) L_{Amax} assuming 10 dB(A) noise reduction through partially opened windows.

As set out in Section 15.4.1, for the protection of sleep, the EPP (Noise) recommends that internal noise levels do not exceed 40 dB(A) $L_{A1,1hour}$. Assuming a 10 dB(A) reduction through a partially opened window, this is approximately equivalent to an external level of 50 dB(A) L_{A1} and therefore represents a more stringent requirement than proposed by the WHO.

For the purposes of this assessment, the more stringent 50 dB(A) L_{A1} sleep protection criterion is adopted.

15.4.4 Low Frequency Noise Criteria

The potential for low frequency noise in the range of 20 Hz to 200 Hz was assessed in accordance with the EPA's draft Ecoaccess Guideline: *Assessment of Low Frequency Noise.* The adopted criteria are provided in Table 15-7 and are based on the internal low frequency noise levels guideline.

Table 15-7: Acceptable Indoor Criteria for Non-Tonal Noise

Type of Space	$L_{pA,LF}$ (dB(A))
Dwelling, evening and night	20
Dwelling, day	25
Classroom, office etc	30
Rooms with commercial enterprises	35

It is considered appropriate to apply a 3 dB increase to the levels set out in Table 15-7 in determining appropriate outdoor noise limits for the corresponding uses. This assumes a conservative 3 dB low frequency range attenuation through building façades.

15.4.5 Blasting Noise and Vibration Criteria

Section 440ZB of the *Environmental Protection and Other Legislation Amendment Act* (No. 2) 2008 (Part 2 Amendment of *Environmental Protection Act 1994*) and EPA *Ecoaccess Guideline: Noise and Vibration from Blasting* provide criteria for the control of air blast overpressure and ground vibration.

The ground vibration and overpressure limits set out in the Ecoaccess guideline are more stringent than those provided under Section 440ZB and on this basis have been adopted for the purposes of this EIS assessment. However, whilst limiting blasting to the times suggested by the Ecoaccess guideline is not considered practicable nor necessary, limiting blasting to less sensitive times of the day is proposed.

A summary of the overpressure and ground vibration criteria and time of blasting adopted for the purposes of assessment is provided in Table 15-8**.**

Table 15-8: Summary of Blasting Overpressure and Ground Vibration Design Criteria

Airblast Overpressure and Vibration Parameter	Between 09:00-17:00 Monday to Friday Between 09:00 – 13:00 on Saturdays No blasting on Sundays and public holidays
Airblast Overpressure	115 dB(L) for 9 out of any 10 consecutive blasts regardless of interval between blasts. Any single blast must not exceed 120 dB(L).
Peak Particle Velocity	5 mm/s for 9 out of any 10 consecutive blasts regardless of interval between blasts. Any single blast must not exceed 10 mm/s.

Weather Effects

When a temperature inversion or a heavy low cloud cover is present, values of airblast overpressure would be higher than normal in surrounding areas. Accordingly, blasting will be avoided if predicted values of airblast overpressure in noise-sensitive places exceed acceptable levels. If this is not practicable, blasting will be scheduled to minimise noise annoyance. An appropriate period is generally between 11:00 and 13:00. Similarly, blasting will be avoided at times when strong winds are blowing from the blasting site towards noise sensitive receptors.

15.4.6 Off-Site Road Traffic Noise Criteria

The Department of Transport and Main Roads' (DTMR) Road Traffic Noise Management Code of Practice (CoP) criteria have been adopted for the purposes of this assessment. The CoP aims to protect sensitive noise receptors in the vicinity of new road projects, road upgrades and existing roads with no roadworks.

Table 15-9 sets out the applicable CoP criterion for existing residences nearby existing roads with no roadworks.

Table 15-9: Department of Main Roads' Road Traffic Noise Management Code of Practice Criteria

Activity	Road traffic noise level within a 10 year horizon, $L_{A10(18hour)}$ dB(A)
Existing Residences	68

15.5 Assessment of Potential Noise Impacts

15.5.1 Calculation Method

Noise levels due to the proposed construction and the operation of the mine at the potential noise sensitive receptor locations have been predicted using an acoustics computer model using SoundPLAN Version 7.0. This software program is used internationally and recognised by regulators and authorities throughout Australia. The program allows the use of various noise prediction algorithms. To calculate noise emission levels under neutral and adverse meteorological conditions, the CONCAWE algorithm, which is designed for industrial sites, has been used.

The CONCAWE method was especially designed for the requirements of large industrial facilities such as petroleum and petrochemical complexes, and is now widely used for calculating noise emissions from all types of industrial facilities in Australia. CONCAWE provides calculation methods for predicting noise levels under the influence of wind and the stability of the atmosphere.

15.5.2 Meteorological Conditions

Adverse meteorological conditions have the potential to increase noise levels at a receptor. Such phenomena generally occur during temperature inversions or where there is a wind gradient with wind direction from the source to the receptor.

The prevailing meteorological conditions for the site have been assessed using data extracted from the meteorological model CALMET for the year 2009. Results of a detailed analysis of wind roses and wind class frequency distributions are presented in the Noise and Vibration Assessment (Volume 5, Appendix I). Further details of the meteorological analysis including CALMET modelling used for this assessment are provided in the Air Quality Impact Assessment (Volume 5, Appendix H).

Based on analysis of the CALMET data, the prevailing meteorological conditions for the daytime and evening / night-time periods are summarised in Table 15-10.

Table 15-10: Prevailing Meteorological Conditions

Time of Day	Pasquil Stability Class	Wind Speed (m/s)	Wind Direction	Time of Day
Day (07:00 – 18:00)	B/C	3	ENE	Day (07:00 – 18:00)
Evening & Night (18:00 – 07:00)	F	3	E & ENE	Evening & Night (18:00 – 07:00)

SoundPLAN modelling for adverse meteorological conditions has conservatively assumed moderate inversion (F-class stability category) conditions (3°C/100 m temperature inversion strength for all receptors) and 3 m/s wind speed, with all receptors downwind of the site.

15.5.3 Operational Noise

15.5.3.1 Primary Noise Sources

Schedules of equipment have been compiled for the different stages of the Project including fixed plant and mobile equipment associated with mine operation works. The primary on-site operational equipment and operation would be draglines, shovels, excavators, loaders, haul trucks, water trucks, coal haulers, dozers, graders, cranes, crushers, ROM, coal handling and product conveyor belts. Details of noise sources for individual stages are provided in Volume 5, Appendix I.

The major installed equipment and most of the minor equipment would operate generally between 10 to 20 hours per day. For the purposes of this assessment, all plant was assumed to operate 24 hours per day, 7 days a week. Minor equipment and on-site light vehicles were not considered in the assessment as they would have no material influence on the predicted noise levels. Equipment schedules vary for the different stages and operational scenarios assessed.

15.5.3.2 Noise Modelling Scenarios

Potential noise impacts have been predicted separately for neutral and adverse meteorological conditions. Since the most sensitive period is the night time, the noise modelling results for neutral and adverse conditions are compared with the night-time criteria, with source-to-receptor wind.

For the purposes of assessment it has been assumed that the noise generating activities for each stage occur simultaneously and all equipment identified for each scenario operates continuously, which is very conservative.

Table 15-11 summarises the noise modelling scenarios, indicating the numbers of major and minor

operational equipment units applied in the noise modelling. A full detailed schedule of equipment applied in the noise modelling for each operational stage is provided in Volume 5, Appendix I.

Table 15-11: Operation Noise - Modelling Scenarios

Scenario	Period	Description	Equipment			
			Mine Equipment		Fixed Plant	
			Major	Minor	CHPP	Conveyors
1	Day 1 – 2013	• Initial box cut excavations along the full strike length of the mine • Product Coal by 2013: 3.8 Mt per year • No draglines at this stage	47 units	25 units	In Construction	
2	Oct 2013 – Sep 2014	• Box cut excavations • South ROM station in operation. • Product Coal by 2014: 12 Mt per year	100 units	31 units	• CHPP Module 1 • South ROM station	• Southern ROM • Raw coal handling 1 • Product and reject collection • Stock yard 1 • TLO feed 1
3	Oct 2014 – Jul 2015	• Box cut excavations. • Product Coal by 2015: 18.1Mt per year	133 units	49 units	• CHPP Module 2	• Raw coal handling 2
4	Aug 2015 – Oct 2016	• First Dragline servicing northern ramp of Pit C and south of Pit D. • North dump station in operation. • Product Coal by 2016: 25 Mt per year	175 units	49 units	• CHPP Module 3 • North ROM station	• Northern ROM • Raw coal handling 3 • Stock yard 2 • TLO feed 2
5	2017 – 2018	• Dragline servicing Pits C and D, whilst truck-shovel fleets servicing Pits A and B. • Final box cut blocks completed. • Full production of 30Mt per year is reached. • Construction works finished, CHPP, services, TLO and reject systems are operational	200 units	55 units	• CHPP module 4	
6	2018 – 2023	• Three draglines operating across all pits. • Production: 30 Mt per year.	208 units	55 units	• Fully operational	

Scenario	Period	Description	Equipment			
			Mine Equipment		Fixed Plant	
			Major	Minor	CHPP	Conveyors
7	2023 – 2033	• Eight draglines operating across all pits. • Maximum dragline depth in Pit D. • Truck-excavator fleet increases. • Production: 30Mt per year.	224 units	55 units	• Fully operational	
8	2033 – 2043	• Eight draglines operating across all pits. • Mine ceases production at the end of 2042. • Production: 30Mt per year.	277 units	55 units	• Fully operational	

15.5.3.3 Predicted Operational Noise Levels

A summary of the range of results of the noise modelling for each operational stage is presented in Table 15-12, whilst detailed results are provided in Volume 5, Appendix I.

Table 15-12: Summary of Predicted Operational Noise Levels for All Operational Stages

Noise Receptor	Noise Level, L_{Aeq} dB(A)		Criterion, $L_{Aeq,1hour}$ dB(A)			Exceedance
	Neutral Weather	Adverse Weather	Daytime	Evening	Night-time	
A: Forrester Homestead	12 -18	15-22	29	29	28	Nil
B: Eulimbie Homestead	6-9	9-12	29	29	28	Nil
C: Surbiton South Homestead	17 -23	21 -26	29	29	28	Nil
D: Burtle Station	16-21	20-25	29	29	28	Nil
E: Tresillian Homestead	10 -16	13 -19	29	29	28	Nil
F: Mentmore Homestead	2-10	5-14	29	29	28	Nil
G: Monklands Homestead	13 -22	17 -25	29	29	28	Nil
H: Kia Ora Homestead	14 -23	18 -26	29	29	28	Nil
I: Hobartville Homestead	35-42	39-47	29	29	28	Up to 18 dB(A) Daytime; Up to 18 dB(A) Evening; Up to 19 dB(A) Night-time
J: Wendouree Homestead	57-62	59-64	30	29	29	Up to 34 dB(A) Daytime; Up to 35 dB(A) Evening; Up to 35 dB(A) Night-time

Noise Receptor	Noise Level, L_{Aeq} dB(A)		Criterion, $L_{Aeq,1hour}$ dB(A)			Exceedance
	Neutral Weather	Adverse Weather	Daytime	Evening	Night-time	
K: HPPL Accommodation Village	23-30	27-34	29	29	28	Up to 5 dB(A) Daytime; Up to 5 dB(A) Evening; Up to 6 dB(A) Night-time

15.5.3.4 Receptors A – H

The noise levels predicted for each operational stage are within the established noise criteria at all the receptors located outside MLA 70426, under all meteorological conditions. Specific noise mitigation measures to control general on-site operational noise, with respect to the off-site receptors, are not considered necessary, beyond normal good practice.

15.5.3.5 Receptor J, Wendouree Homestead

This location is predicted to be highly noise affected, with noise levels of up to 64 dB(A) L_{Aeq} under adverse meteorological conditions. This represents an exceedance of the night time limit by some 35 dB(A). It is expected that the measures required to mitigate an exceedance of this order would be impracticable.

In order to achieve a satisfactory level of amenity inside the dwelling and to achieve the sleep protection criterion, some 34 dB(A) noise reduction through the dwelling's external facades would be necessary. In this respect, it should be noted that the composite level of attenuation that may be achieved through a dwelling's external facades is usually limited by the acoustic performance of its windows. In order to meet the internal noise standards at this location, it is expected that substantial upgrading of the dwelling's glazing would be necessary. Furthermore, as the dwelling's windows would be required to be kept closed, to achieve the criteria, the provision of air conditioning would be required.

15.5.3.6 Receptor I, Hobartville Homestead

This location is predicted to be affected, with noise levels of up to 47 dB(A) L_{Aeq} under adverse meteorological conditions. This represents an exceedance of the night time limit by some 19 dB(A). Based on the predicted external L_{Aeq} noise level, the internal noise limit for sleep protection would only be expected to be met with windows of the dwelling closed. Therefore, it is considered that whilst mitigating the external noise level exceedance at this location may not be practicable, meeting the sleep protection limit could be achieved with the adoption of air conditioning for the dwelling, to allow for windows to be kept closed.

15.5.3.7 Receptor K, HPPL Accommodation Village

The key amenity issue for the HPPL accommodation village is sleep protection as limited external activity is expected and its primary function is to provide sleeping facilities for mine personnel between shifts. On this basis, only the internal noise criteria are considered appropriate for the assessment of the accommodation village. External noise levels of up to 34 dB(A) L_{Aeq} are predicted at this location under adverse meteorological conditions so the internal noise criteria would be met with windows

open. The accommodation will need to be air conditioned allowing windows to be kept closed. Further measures, such as physical barriers through vegetation planting etc, will be considered by the Proponent during design of the accommodation village.

15.5.4 Construction Noise

15.5.4.1 Primary Noise Sources

Construction equipment has been nominated for the different stages of the construction works. Typical construction equipment expected on site include cranes, compressors, drills, water trucks, dozers, graders, and loaders. Details of construction noise sources for individual stages are provided in Volume 5, Appendix I.

15.5.4.2 Predicted Construction Noise Levels

The noise levels at each receptor location generated by the construction activities have been predicted by modelling. The noise modelling has been carried out considering neutral and adverse meteorological conditions. The results for the predicted noise levels during construction of the mine site are summarised in Table 15-13**.**

Table 15-13: Summary of Predicted Construction Noise Levels for All Construction Stages

Receptor	Noise Level, L_{Aeq} dB(A)		Criterion, $L_{Aeq,1hour}$ dB(A)			Exceedance
	Neutral Weather	Adverse Weather	Daytime	Evening	Night-time	
A: Forrester Homestead	<10	<10	50	45	40	Nil
B: Eulimbie Homestead	<10	<10	50	45	40	Nil
C: Surbiton South Homestead	<10	11	50	45	40	Nil
D: Burtle Station	<10	11	50	45	40	Nil
E: Tresillian Homestead	<10	<10	50	45	40	Nil
F: Mentmore Homestead	<10	<10	50	45	40	Nil
G: Monklands Homestead	<10	<10	50	45	40	Nil
H: Kia Ora Homestead	<10	<10	50	45	40	Nil
I: Hobartville Homestead	17-18	22-23	50	45	40	Nil
J: Wendouree Homestead	30-41	35-45	50	45	40	Up to 5 dB(A) Night-time*
K: HPPL Accommodation Village	10-11	14-15	50	45	40	Nil

Notes: * under adverse weather conditions

The predicted construction noise levels indicate an exceedance of the EPP (Noise) night-time limit by up to 5 dB(A) under adverse weather conditions at Location J. No exceedance of the EPP (Noise) noise limits are predicted at any other location for the construction of the mine infrastructure during the day or night time periods. It should be noted that the predicted noise levels result from a conservative noise modelling approach where it has been assumed that all equipment operates continuously and simultaneously during the assessment period.

Specific physical construction noise mitigation measures are not considered necessary. However, adoption of noise management strategies implementing good industry practice are proposed to

minimise noise emissions from the proposed construction works.

15.5.5 Low Frequency Noise

The Ecoaccess low frequency impact assessment process requires initial screening tests to determine whether predicted levels at receptor locations would exceed 50 dB(L) and whether linear levels would exceed A-weighted levels by 15 dB or more. In the case of an exceedance of these indicator limits further investigation is required.

It is noted that the mining equipment noise sources under assessment emit noise typically over a broad spectrum and have not been known to generate the dominant low frequencies that the Ecoaccess guideline was intended to address. The SoundPLAN predictive noise modelling estimated the noise levels to be no more than 43 dB(L) at the receptor locations outside the mining lease boundary. Additionally, while linear noise levels of up to 58 dB(L), 73 dB(L), and 49 dB(L) are predicted at Locations I, J, and K, respectively no more than 15 dB difference between linear levels and A-weighted levels is predicted at these locations.

It is concluded that low frequency noise would not be at a level to cause annoyance to these residential receptors and compliance with the 20 dB $L_{pA,LF}$ criterion inside these dwellings is predicted. Accordingly, no adjustment to the A-weighted operational noise criteria is deemed necessary.

15.6 Blasting Noise and Vibration

Blasting would be carried out using ammonium nitrate/fuel oil (ANFO) explosive. The transportation, storage and use of explosives will be in accordance with the relevant Australian Standards (i.e. AS 2187 Explosives – storage, transport and use) and all state legislation (i.e. *Explosive Act 1999*). Over the 30 years Life of Mine (LOM) the average amount of ANFO used per annum is estimated to be approximately 82,000 tonnes.

One 4-man blast crew has been allowed per 15,000 tonnes of explosives per year. The maximum number of blast crews by 2033 is seventeen, including shot-firers. The explosives supplier will operate the explosives depot and supply the explosives trucks and operators.

The first 15 to 20 m of the Tertiary sediments will be excavated, using truck-shovel, while the rest of the Tertiary and weathered Permian overburden will require some blasting to maintain excavation productivity. All fresh over- and inter-burden will require blasting. All blast holes will be confined and standard central Queensland strip mining blasting techniques will be used. Electronic initiation will be used to optimise blast performance and to limit the maximum instantaneous charge (MIC) values.

The maximum range of MIC is 350 kg – 1,300 kg, while the likely range of MIC is 550 kg – 1,000 kg. No waste excavation blasting is anticipated beyond the pit areas.

Approximately 400 to 500 blasts are anticipated annually during the operational phase, with considerably less during construction.

15.6.1 Ground Vibration

Calculations indicate that blasts requiring up to the maximum 1,300 kg MIC will not exceed the most stringent 5 mm/s ground vibration criterion (Ecoaccess criterion for 90% of blasts) at the closest sensitive receptor location (Location J, Wendouree Homestead) based on minimum setback distance to the pit area.

At Location J, ground vibrations would be expected in the order of 4 mm/s, which would be expected to be easily noticeable, but considerably below accepted thresholds for structural damage to buildings.

For lower capacity MIC blasts at greater setback distance, the predicted magnitude of vibration reduces substantially. Due to the setback distances afforded to Location I (Hobartville Homestead) and Location K (HPPL Accommodation Village), maximum capacity blasts peak particle velocity (PPV) is predicted to not exceed 1 mm/s, while at the closest sensitive receptor locations beyond the mining lease boundary PPV is predicted to not exceed 0.2 mm/s.

Therefore, with respect to ground vibration, the proposed blasting schedule may be undertaken in full compliance with the established criteria, without risk of damage to the receptor properties or undue community annoyance.

The TOR states that information should be supplied on blasting, which might cause ground vibration or fly rock on or adjacent to, the site with particular attention given to places of work, residence, recreation, worship and general amenity. Given the substantial setback distances to the identified receptors, fly rock impacts from blasting at these locations would not be expected.

15.6.2 Vibration Effects on Underground Pipelines

Standard DIN 4150.3-1999 recommends offset distances for buried pipelines constructed from various materials for the prevention of damage from vibration effects. Masonry or plastic pipes are most susceptible; for these pipeline types an offset distance of 510 m is recommended. There are no known buried pipelines within 510 m of the proposed blasting areas and therefore no adverse effects on pipelines due to blasting are expected.

15.6.3 Vibration Effects on Underground Communications Cabling

Optic fibre cables will supply communications to the site, and will likely enter the mine site along the Powerlink transmission line easement. It is understood that the cable network would not be sited within 500 m of the proposed blasting areas and therefore no adverse effects on communications networks due to blasting are expected.

15.6.4 Overpressure

The resultant overpressure due to confined blasting experienced at the identified sensitive receptor locations would be dependent on the maximum charge per blast event, the distance from the blast site, and ground geology. Additionally, it should be noted that air blast overpressure propagation can be increased under certain meteorological conditions (with the occurrence of temperature inversions and/or source to receptor wind direction) and decreased with topographic shielding.

15.6.4.1 Receptors A-H

Calculations indicate that blasts requiring up to the maximum 1,300 kg MIC would not exceed the most stringent 115 dB(L) overpressure criterion (Ecoaccess criterion for 90% of blasts) at any sensitive receptor location beyond the mining lease boundary based on minimum setback distance to the pit area. Of the identified receptors beyond the MLA 70426 boundary, Location H (Kia Ora Homestead) is the closest to the pit area boundary at a setback distance of approximately 7 km. At this location overpressure levels of no more than 113 dB(L) are predicted.

15.6.4.2 Receptor J, Wendouree Homestead

Considering the range of MICs proposed, there is potential for exceedances of the overpressure criteria at the sensitive receptor locations within MLA 70426. At Location J (Wendouree Homestead) overpressure levels in the 129 – 135 dB(L) range are predicted. The upper extent of this range exceeds the ANECC structural damage threshold criterion and therefore the efficacy of control measures to mitigate this exceedance, beyond acquisition of the property, would be expected to present a significant challenge.

15.6.4.3 Receptor I, Hobartville Homestead

At Location I (Hobartville Homestead) the use of lower capacity blasts, not exceeding MIC 350 kg, would not be expected to result in an exceedance of the 115 dB(L) limit, whereas maximum capacity 1,300 kg MIC blasts are predicted to marginally exceed the 120 dB(L) limit. On this basis, it is expected that overpressure effects may be mitigated through blasting controls at the Hobartville location (keeping in mind its very old building).

15.6.4.4 Receptor K, HPPL Accommodation Village

At Location K (HPPL Accommodation Village) overpressure levels are predicted to not exceed 114 dB(L) and therefore the criteria would be expected to be readily achieved at this location.

It must be noted that the predictions detailed above are based on site constants which are generally regarded to provide conservative results and hence the predicted levels should only be used as a guide. Calculations will be revised and predictions refined based on additional site specific constants obtained once the exact locations for blasting are known. Blast monitoring will be undertaken to assess compliance, determine the site constants and confirm the predictions.

Blasting carried out within the recommended hours (09:00 – 17:00) would not be expected to ordinarily be affected by the presence of temperature inversions as these generally occur during night-time and early morning periods. Source to receptor wind direction may be expected to give rise to increased noise levels at the receptors and will be considered when planning blasting.

Provided blasting is properly managed, the proposed blasting program will meet the overpressure criteria at all but the Wendouree Homestead receptor locations. Reducing the MIC capacity and increasing distance is the most effective way of reducing blasting impacts. Strategies for the management of overpressure from blasting are provided in the Environmental Management Plan (Volume 5, Appendix P). These would be provided to the blasting contractor for consideration and will be incorporated into a blasting plan.

15.6.5 Sleep Disturbance

The predicted night-time period levels are significantly below 50 dB(A) L_{Amax} at receptor locations A-H. Therefore, the operation is not predicted to give rise to sleep disturbance at these locations.

As discussed, the sleep protection criterion would not be readily achieved at receptor locations J and I with windows open. Substantial upgrading of the Wendouree Homestead's building envelope would be necessary to meet the sleep protection performance criterion. However, any such upgrade is not proposed due to the predicted blasting overpressure exceedance at this location.

Assuming a conservative noise reduction from outside to inside of 20 dB(A) through the external façades of the Hobartville Homestead's dwelling with windows closed, the internal noise criteria would be expected to be achieved. Provision of air conditioning units would, however, be required to satisfy

the internal noise criteria (i.e. no open windows).

The sleep protection criterion is expected to be readily achieved within the HPPL Accommodation Village, which would be provided with air conditioning, allowing windows to be kept closed.

15.6.6 Off-Site Traffic Noise

The potential off-site traffic noise impact associated with the proposed construction and operations of the Project has been assessed based on traffic volume predictions undertaken for the development. The increases in traffic volumes for each road section have been estimated for trips to and from the site. The following route sections were identified:

A: Alpha to Alpha Coal Mine site, via Clermont-Alpha Road;

B: Clermont to Alpha Coal Mine site, via Clermont-Alpha Road;

C: East of Alpha to Alpha, via Capricorn Highway; and

D: West of Alpha to Alpha, via Capricorn Highway.

The changes in traffic volumes would alter the noise emission from roadways, increasing the $L_{A10(18hour)}$, which is an average of the L_{A10} traffic noise levels produced between 06:00 and 24:00 (18 hours). The level of noise emission increase depends on the increase rate of the annual average daily traffic (AADT). These AADT figures and predicted traffic volumes due to mine construction and operations were obtained from the Proponent, based on equipment and construction materials, truck-load quantities, waste transport, personnel movements and consumable deliveries. The accuracy of these figures is dependent on preliminary predictions of traffic volumes and therefore a conservative approach has been taken.

Table 15-14 provides a summary of the calculated $L_{A10(18hour)}$ road traffic noise levels for the subject road sections at the affected sensitive receptor locations.

Table 15-14: Predicted Road Traffic Noise Results

Sensitive Receptor	Route	Setback (from Clermont-Alpha Rd)	Existing Traffic Noise $L_{A10(18hours)}$ yr 2009	Predicted Road Noise dB(A)		Relative Increase in Noise Level (dB)	
				Construction yr 2013	Operation yr 2041	Construction yr 2013	Operation yr 2041
Mentmore Homestead	A	500 m	23	31	33	8	10
Tressillian Homestead	B	600 m	23	27	30	4	7
Burtle Station	B	200 m	27	31	34	4	7

The ongoing mine operations will generate significantly more traffic than the construction phase of the project. The increase in operational traffic will be due principally to personnel transport, from Alpha town or Clermont to the mine site and Alpha airport to the accommodation village.

The predicted traffic volumes generated by the Project represent a significant increase when compared with the existing level of traffic. While full compliance with the 68 dB(A) $L_{A10(18hour)}$ CoP criterion is expected to be readily achieved without the requirement for any specific mitigation, a perceived increase in road traffic noise experienced by the identified receptors is considered likely.

The Mentmore Homestead (Location E) is predicted to be the most affected of the identified receptors,

with a relative increase in $L_{A10(18hour)}$ noise levels by some 8 dB during peak mine construction and by some 10 dB during peak mine operations. Increases of this order represent an effective perceived doubling in subjective loudness. Noise management strategies to minimise the noise from the off-site road traffic associated with the proposed mine construction and operations have been provided in the EM Plan.

15.6.7 Impacts on Fauna

Volume 2, Section 9 of the EIS describes the environmental values identified onsite, in terms of terrestrial flora and fauna, amphibians, reptiles, birds and mammals for the Alpha Coal Project (Mine). In relation to the potential noise and vibration impacts upon these ecological values, the findings of the ecology assessment include:

- An increase in noise, vibration, and dust associated with the construction and operations phases of the Project may lead to the displacement of native species from their current home ranges;
- The increase in noise and vibration emissions which would result from construction and operations activities may discourage the Southern Squatter Pigeon (*Geophaps scripta scripta*) and Little Pied Bat (*Chalinolobus picatus*) from utilising the immediate area. These impacts may also affect insect abundance, water quality, and reproductive behaviour;
- Indirect impacts upon breeding and feeding activities due to noise and vibration disturbance are also possible;
- While no literature on the effects of blasting on tree roosting bat species was found, it is probable that some concussive impacts would occur in nearby roost trees which may lead to short-term displacement of bats from the affected areas. Therefore, the blasting process could potentially impact the Little Pied Bat via increased predation, if blasting occurred when avian predators, both raptors and owls, were active; and
- While the effects of blasting and vibration on cave-dwelling bat species are poorly understood, the observations of one study found the noise and vibration from blasting had no apparent impact upon the observed colony.

With reference to noise and vibration, the ecological assessment proposes the following management strategies for species of conservational significance:

- Undertaking blasting in intensive bursts (over days or weeks rather than every day) so that prolonged impacts upon the Little Pied Bat and other potentially vibration and / or noise sensitive species are minimised.
- If blasting does need to occur on a daily basis, restrict blasting to one or two periods of short duration during the day and avoid periods when avian predators are most active.
  - Where possible, consider using earth banks and / or noise barriers to baffle blasting.
  - Where possible, consider using plant machinery (scraper, D10 bulldozer etc) instead of blasting.

15.6.8 Noise Mitigation Measures

Specific physical construction and operations noise mitigation measures are not considered necessary. While the proposed activities have limited potential for impact on the local ambient noise environment, noise management and blasting control strategies are set out in the EM Plan (Volume 5, Appendix P) which would further reduce the potential for noise issues during the proposed construction and operations periods.

15.7 Summary of Potential Noise and Vibration Impacts

The following provides a summary of the outcomes of the assessment of potential noise impacts:

15.7.1 Operations Noise

Noise levels generated by the proposed operations are predicted to be within the established noise limits at all receptor locations outside the mining lease boundary under all meteorological conditions. The existing receptors within the mining lease boundary are expected to be affected. Exceedances of the night-time criteria by up to 35 dB(A) and 19 dB(A) are anticipated at Wendouree Homestead (Receptor J) and Hobartville Homestead (Receptor I), respectively.

15.7.2 Construction Noise

While no specific limits exist for the control of construction noise, the EPP (Noise) night-time acoustic quality objective is predicted to be exceeded by up to 5 dB(A) at the Wendouree Homestead (Receptor J) location during the construction stages. No other exceedances of the EPP (Noise) values are predicted during the daytime, evening or night periods throughout the construction stages.

15.7.3 Blasting

The Wendouree Homestead receptor (Receptor J) is predicted to be adversely affected by high overpressure levels from blasting. Overpressure levels of up to 135 dB(L) are predicted, which exceeds the ANECC structural damage threshold criterion. Mitigation measures to reduce overpressure effects at this location are considered impracticable. It is expected that overpressure effects may be mitigated through blasting practice controls at the Hobartville Homestead (Receptor I) and Accommodation Village (Receptor K) locations. No overpressure exceedances are anticipated beyond the mining lease boundary and the ground vibration criteria is expected to be met at all sensitive receptor locations.

15.7.4 Sleep Disturbance

Predicted noise levels are within the sleep disturbance noise limit for all receptors beyond the mining lease boundary. Noise levels that could give rise to sleep disturbance are predicted at the Wendouree Homestead (Receptor J) and Hobartville Homestead (Receptor I) locations. Additionally rail traffic during the night-time period has the potential to cause sleep disturbance at the Eulimbie Homestead location (Receptor B) and potentially at the Surbiton South Homestead (Receptor C) location.

15.7.5 Low Frequency Noise

The proposed operation assessed using the Ecoaccess guideline indicates that low frequency noise would not be at a level to cause annoyance to the closest residential receptors.

15.7.6 Off-Site Traffic Noise

Full compliance with the DTMR Road Traffic Noise Management CoP criteria is predicted for all construction and operational stages. Due to the relative increase in vehicle volumes, however, noticeably increased noise levels are likely to be perceived by the most affected receptors.

15.8 Conclusion

Current land use within and adjacent to the MLA 70426 is predominantly cattle grazing, and the site and surrounding areas are relatively flat and vegetated. There are two existing dwellings located within MLA 70426 and a further eight dwellings located within 20 km of the site boundary. Background noise monitoring was undertaken as part of the assessment and the results are reflective of the rural environment.

Noise and vibration assessments were undertaken for both construction and operations scenarios. The primary on-site operational noise sources are expected to be draglines, shovels, excavators, loaders, haul trucks, water trucks, coal haulers, dozers, graders, cranes, crushers, ROM, coal handling and product conveyor belts. Similarly the primary on-site construction noise sources are expected to be cranes, compressors, drills, water trucks, dozers, graders, and loaders.

Noise levels generated by the proposed operations are predicted to be within the established noise limits at all receptor locations outside the mining lease boundary under all meteorological conditions. The existing receptors within the mining lease boundary are expected to be affected.

While no specific limits exist for the control of construction noise, the EPP (Noise) night-time acoustic quality objective is predicted to be exceeded by up to 5 dB(A) at the Wendouree Homestead during the construction stages. No other exceedances of the EPP (Noise) values are predicted during the daytime, evening or night periods throughout the construction stages.

Main impact of noise and vibration is on Wendouree Homestead, no real mitigation other than acquisition.