15 Noise and Vibration

Section 15 Noise and Vibration

15.1 Introduction

A detailed noise and vibration impact assessment for the proposed Kevin's Corner Coal Mine Project (the Project) has been undertaken in accordance with the Terms of Reference (TOR) requirements of the Environmental Impact Statement (EIS). The following sections provide a summary of the assessment findings, including a description of the existing environmental values, assessment of potential noise and vibration impacts and recommended mitigation/management measures. The detailed noise and vibration impact assessment report can be found in Volume 2, Appendix P.

This assessment includes potential construction and operational noise and vibration impacts of the mine site and associated infrastructure, including the proposed fly-in fly-out airport, and rail spur, but does not include the operations of the railway corridor or port facilities.

15.2 Existing Acoustic Environment

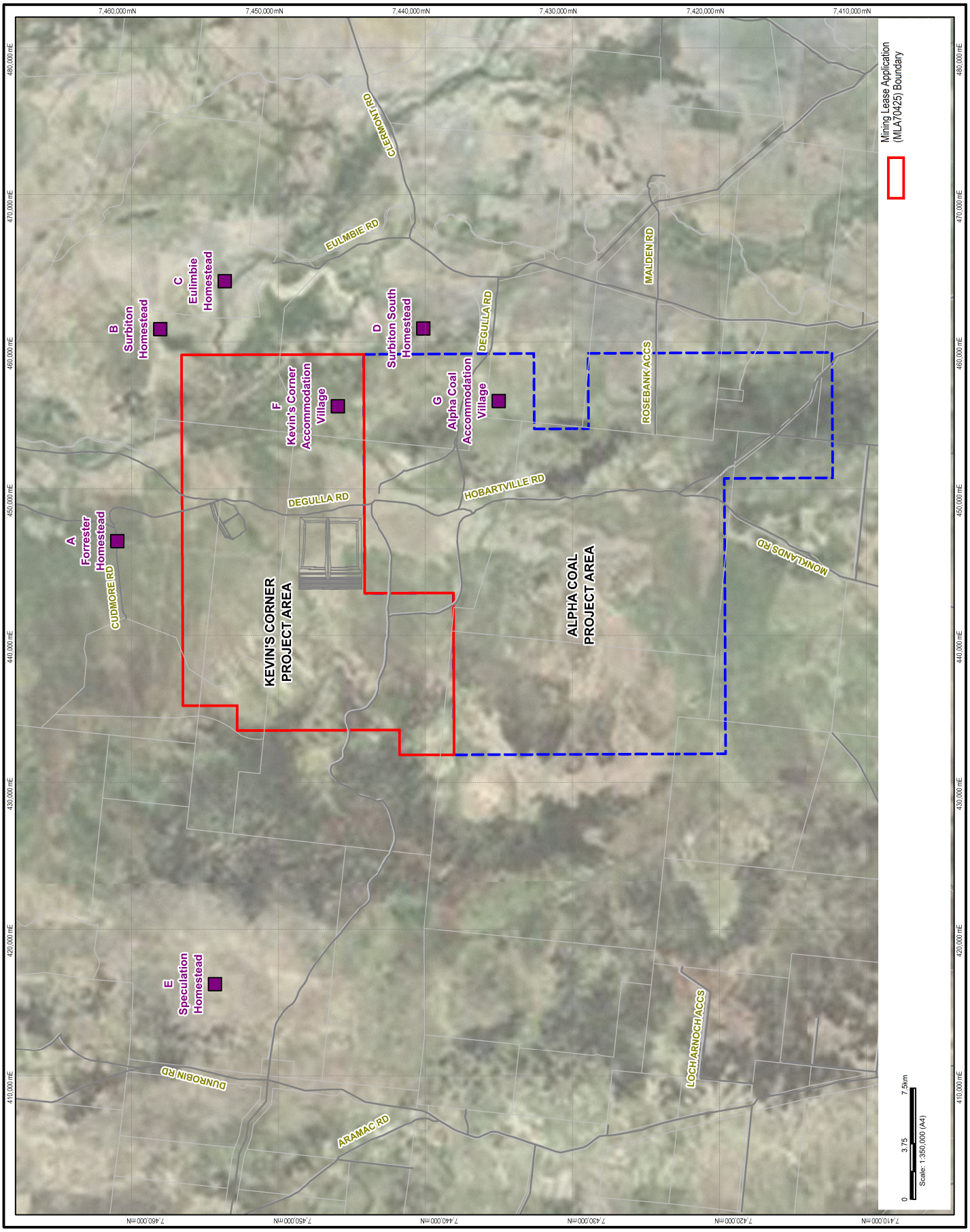
15.2.1 Noise Sensitive Receptors

Current land uses, within and adjacent to the Mine Lease Application (MLA) 70425, are predominantly low intensity cattle grazing. The site and surrounding areas are relatively flat and vegetated. Five existing dwellings located within 15 km of the mining lease boundary to the north, east and west have been identified by the Proponent. Additionally, the proposed on-site Project accommodation village and the neighbouring Alpha Coal site proposed accommodation village are considered as sensitive receptors.

Table 15-1: below details the nearest potentially affected noise sensitive receptor locations and their respective distances from the nearest mining lease boundary and open cast pit area boundary. A site location plan indicating the identified receptor locations is provided in Table 15-1, whilst Figure 15-1 and Figure 5-2 show the proposed site layout, location of the pit areas and primary facilities within the Project site.

Table 15-1: Noise sensitive receptors

Receptor	Address	Approximate distance from MLA 70425 Mining Lease Boundary (km)	Approximate distance from Open Cast Pit Area Boundary (km)
A	Forrester Homestead	4	7
B	Surbiton Homestead	1	10
C	Eulimbie Homestead	5	15
D	Surbiton South Station	4	12
E	Speculation Homestead	19	31
F	KC Accommodation Village	n/a	8
G	ACP Accommodation Village	9	12



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Datum: GDA94, MGA Zone55

HANCOCK GALILEE PTY LTD

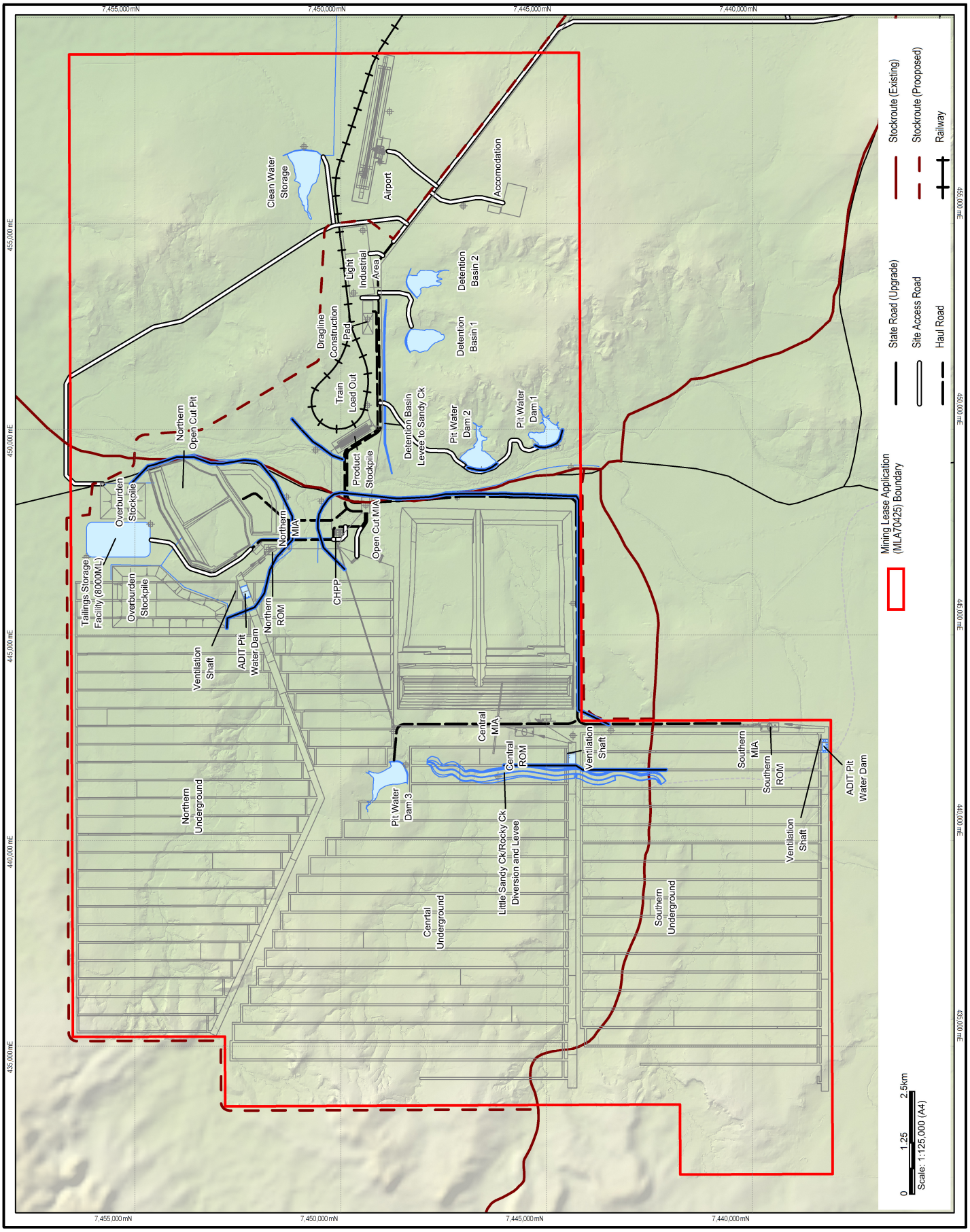
Kevin's Corner Project
Environmental Impact Statement

LOCATION PLAN SHOWING MINING LEASE BOUNDARY, PIT AREA BOUNDARY AND RECEPTOR LOCATIONS

Job Number	4262 6660
Revision	B
Date	12-09-2011

Figure: 15-1

File No: 42626660-g-1134.wor



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Datum: GDA94, MGA Zone55

HANCOCK GALILEE PTY LTD

Kevin's Corner Project
Environmental Impact Statement

PROPOSED SITE LAYOUT PLAN

Job Number	4262 6660
Revision	C
Date	12-09-2011

Figure: 15-2

File No: 42626660-g-1135.wor

15.2.2 Noise Measurement Methodology

Long-term unattended and short-term attended noise monitoring have been conducted by URS at the locations of three of the potentially most affected dwellings, including Receptors A (Forrester Homestead), C (Eulimbie Homestead) and D (Surbiton South Homestead). The monitoring took place between 13 and 24 September 2010 at Receptors A and C and between 13 and 26 September 2010 at Receptor D. Measurements were undertaken in general accordance with *AS 1055:1997 Acoustics – Description and Measurement of Environmental Noise* and the Queensland Government's *Noise Measurement Manual third edition* (EPA, 2000).

15.2.2 Noise Measurement Results

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

Table 15-2: Time of day

Time of Day	Time
Day	0700 – 1800
Evening	1800 – 2200
Night	2200 – 0700

During the site visits, insect noise was observed to influence the measured noise levels at all monitoring locations during the evening and night-time periods, with no other notable noise sources other than birds observed. On this basis, during periods where insect noise contributions are indicated in the long-term monitoring results, insect noise corrections have been applied. The corrections, determined from analysis of the attended monitoring data, are based on the differences between the total (full audible bandwidth) A-weighted noise levels and the A-weighted levels re-calculated omitting the 1/3 octave sound pressure level components in the frequency bands clearly dominated by insect noise (between 3 kHz and 6 kHz).

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 calculation.

Table 15-3: Summary of measured noise levels

Location	Rating Background Noise Level (RBL) L_{A90} dB(A)			Ambient Noise Level (AL) L_{Aeq} dB(A)		
	Day	Evening	Night	Day	Evening	Night
Forrester (A)	25	25	25	40	34	32
Eulimbie (C)	25	25	25	46	33	30
Surbiton South (D)	25	25	25	49	29	26
RBLs have been set to the 25 dB(A) threshold level in accordance with the Ecoaccess guideline, Planning for Noise Control.						

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

Given the rural nature of the proposed mine site and far reaching surrounds, it is considered that the measured noise levels obtained from the monitoring locations are adequately representative of the noise levels at the locations of Receptors A – G.

It is noted that in very rural areas such as the subject site, in the presence of neutral meteorological conditions (zero or very low wind speed and no precipitation), background noise levels are typically controlled by insect noise. Somewhat higher background levels typically occur in the summer months when insect activity is higher. In this respect, it is considered that the Project noise criteria established based on the corrected noise levels are conservative and appropriate for the cooler months of the year unaffected by insect noise. Operational noise criteria for the Project, based on the levels set out in Table 15-3, are detailed in Section 15.3.2.

15.3 Project Acoustic Criteria

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

- Environmental Protection Act 1994 (Queensland);
- Environmental Protection (Noise) Policy 2008;
- EPA Ecoaccess Guideline: Planning for Noise Control (EPA, 2004);
- EPA Ecoaccess Guideline: Noise and Vibration from Blasting (EPA, 2006); and
- EPA Ecoaccess Guideline: Assessment of Low Frequency Noise (EPA, 2004).

Additionally, the following guidelines and standards have been considered:

- AS 1055.1 and AS 1055.2 (1997) - Description and Measurement of Environment Noise;
- Interest in Planning Schemes No. 3 (Queensland Department of Transport and Main Roads [DTMR], 2010) and Queensland Rail Code of Practice for Railway Noise Management (Queensland Rail, 2007);
- AS 2187.2 (2006) – Explosives, Storage and Use, part 2, Use of Explosives;
- BS 7385 Part 2 (1993) - Evaluation and Measurement for Vibration in Buildings, Guide to Damage Levels from Ground-borne Vibration;
- BS 6472 (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 Guidelines for Community Noise (WHO, 1999).

Due to 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 general operations are provided in Sections 15.3.1 and 15.3.2, respectively.

Both construction and operations have the potential to cause sleep disturbance and to generate low frequency noise effects. Blasting, the only activity considered likely to have the potential to result in ground vibration effects over significant distances and overpressure effects, is 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 15.3.3, 15.3.4 and 15.3.5 respectively.

15.3.1 Construction Noise Criteria

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

15.3.1.1 Environmental Protection (Noise) Policy 2008

The EPP (Noise) does not include construction noise limits. It does, however, provide acoustic quality objectives for the protection of amenity, and human health and wellbeing, including sleep protection. Construction noise effects have been assessed against these criteria, which 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 and wellbeing
Dwelling (internal)	Daytime and Evening	35	40	45	Health and wellbeing
Dwelling (internal)	Night-time	30	35	40	Health and 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) (1999) recommends for quality sleep, maximum indoor noise levels should not exceed 45 dB(A).

15.3.2 Operational Noise Criteria

15.3.2.1 Background Creep

For the prevention of background noise levels from progressively increasing over time with the establishment of new developments, the Planning for Noise Control guideline provides recommended maximum outdoor background planning noise levels (RBL, min$L_{A90,1hour}$) 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 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.

Table 15-5: Background creep criteria

Receptor	minL$_{A90,1hour}$ (dBA)		
	Day	Evening	Night (*)
A - G	30	28	25
Notes:	* Set at 25 dB(A) threshold in accordance with Ecoaccess Guideline, Planning for Noise Control.		

15.3.2.2 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.

15.3.2.3 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 are not considered to possess these characteristics.

In accordance with the Ecoaccess guideline, the Specific Noise Level criteria are applied for the purposes of this assessment, as in this case they are more stringent than the Planning Noise Levels. Compliance with the Specific Noise Level criteria would ensure the Planning Noise Levels 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

Time of Day	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)
A - G	30	33	28	31	25	28

15.3.3 Sleep Disturbance Criteria

Where the possibility exists that instantaneous, short-duration, high-level noise events may occur during night-time hours (2200–0700), consideration should be given to the potential for the disturbance of sleep within residences and the accommodation village.

The Ecoaccess guideline makes reference to the World Health Organisation's Guidelines for Community Noise (WHO, 1999) for sleep disturbance caused by noise impacts.

The WHO suggests 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 levels 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 L_{Aeq} and 55 dB(A) L_{Amax} assuming 10 dB(A) noise reduction through partially opened windows.

As set out in Section 15.3.1, 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.

15.3.4 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 guideline internal low frequency noise levels.

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 the table above in determining appropriate outdoor noise limits for the corresponding uses. This assumes a conservative value of 3 dB low frequency range attenuation through building façades.

15.3.5 Blasting Noise and Vibration Criteria

Section 440ZB of the *Environmental Protection and Other Legislation Amendment Act (No. 2) 2008* (Part 2 Amendment of the *Environmental Protection Act 1994*) and the EPA Ecoaccess Guideline: Noise and Vibration from Blasting (EPA, 2006) 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 have therefore been adopted for the purposes of this assessment. However, whilst limiting blasting to between the times suggested by the Ecoaccess guideline is not considered practicable nor necessary, limiting the activity to less sensitive times of the day, is recommended where practicable.

A summary of the overpressure and ground vibration criteria and times 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 0900-1700, Monday to Friday Between 0900 – 1300 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 should be avoided if predicted values of airblast overpressure in noise-sensitive places exceed acceptable levels. If this is not practicable, blasting should be scheduled to minimise noise annoyance, generally between 11 am and 1 pm. Similarly, blasting should be avoided at times when strong winds are blowing from the blasting site towards noise sensitive places.

15.3.6 Off-Site Road Traffic Noise Criteria

The Department of Main Roads' Road Traffic Noise Management Code of Practice (CoP) criteria have been adopted for the purposes of this assessment. The CoP aims to protect sensitive 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 (CoP) criteria

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

15.4 Assessment of Potential Noise Impacts

15.4.1 Calculation Method

Noise levels due to the proposed construction and the operation of the site at the identified noise sensitive receptor locations have been predicted using an acoustic computer model created in SoundPLAN Version 7.0. This program is used internationally and is 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 for the Project.

The CONCAWE method was designed for noise assessments 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.

15.4.2 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 2, Appendix P). Further details of the meteorological analysis including CALMET modelling used for this assessment are provided in the Air Quality Impact Assessment (Volume 2, Appendix O).

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 (0700 – 1800)	B/C	3	ENE	Day (0700 – 1800)
Evening & Night (1800 – 0700)	F	3	E & ENE	Evening & Night (1800 – 0700)

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 being downwind of the site.

15.4.3 Operational Noise

15.4.3.1 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 will include draglines, shovels, excavators, loaders, haul trucks, water trucks, coal haulers, dozers, graders, cranes, crashers, ROM, coal handling plant, conveyor belts and underground mine ventilation equipment. Details of noise sources for individual stages are provided in Volume 2, Appendix P.

The major installed equipment and most of the minor equipment is anticipated to operate 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.

15.4.3.2 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.

Table 15-11 summarises the noise modelling scenarios, indicating the numbers of major and minor operational equipment units applied in the noise modelling. A complete schedule of equipment applied in the noise modelling for each operational stage is provided in Appendix P.

Table 15-11: Operation noise - modelling scenarios

Scenario	Period	Description	Equipment			
			Mine Equipment		Fixed Plant	
			Major	Major	CHPP	Conveyors
1	2014	• Roads, rail, airport, workshops, MIAs are fully operational. • Coal mining begins second half of 2014. Truck-excavator fleets servicing the initial excavations. No draglines at this stage. • Underground ventilation equipment in initial locations.	56 units	41 units	• CHPP stage 1 operative	All conveyors operative
2	2015	• Number of coal haulers significantly increased.	64 units	41 units	• CHPP stage 1 operative	All conveyors operative
3	2016	• Maximum rate of production 30 Mtpa assumed from this point	64 units	41 units	• CHPP Stage 2 finished	All conveyors operative
4	2017	• 30 Mtpa	64 units	41 units	• Fully operational	
5	2018	• 30 Mtpa	61 units	41 units	• Fully operational	
6	2023	• Two draglines installed at the open cut pits. • Excavator, coal hauler and dump truck fleets reduced.	39 units	41 units	• Fully operational	
7	2028	• 30 Mtpa • Underground ventilation equipment relocated halfway along the southern faces of the underground mines.	39 units	41 units	• Fully operational	
8	2033	• 30 Mtpa	45 units	41 units	• Fully operational	
9	2042	• Mine ceases production at the end of 2042.	53 units	41 units	• Fully operational	

15.4.3.3 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 2, Appendix P.

Table 15-12: Summary of predicted operational noise levels for all operational stages

Receptor	Predicted Noise Levels				Operational Noise Level Criteria		Exceedance
	L_{A90} [dB(A)]		L_{Aeq} [dB(A)]		L_{A90} [dB(A)]	L_{Aeq} [dB(A)]	
	Neutral Weather	Adverse Weather	Neutral Weather	Adverse Weather	D / E / N	D / E / N	D / E / N
A: Forrester Homestead	17 – 19	22 – 24	21 – 24	25 – 28	30 / 28 / 25	33 / 31 / 28	Nil / Nil / Nil
B: Surbiton Homestead	12 – 14	16 – 17	19 – 20	22 – 24	30 / 28 / 25	33 / 31 / 28	Nil / Nil / Nil
C: Eulimbie Homestead	up to 2	up to 5	10 – 12	14 – 16	30 / 28 / 25	33 / 31 / 28	Nil / Nil / Nil
D: Surbiton South Homestead	21 – 24	21 – 24	13 – 15	17 – 19	30 / 28 / 25	33 / 31 / 28	Nil / Nil / Nil
E: Speculation Homestead	< 10	< 10	< 10	< 10	30 / 28 / 25	33 / 31 / 28	Nil / Nil / Nil
F: KC Accomm. Village	up to 23	up to 28	up to 33	up to 38	30 / 28 / 25	33 / 31 / 28	5 / 7 / 10
G: ACP Accomm. Village	7 – 12	11 – 16	14 – 18	18 – 22	30 / 28 / 25	33 / 31 / 28	Nil / Nil / Nil
Notes	D: Daytime (0700-1800); E: Evening (1800-2200); N: Night-time (2200-0700)						

Receptors A – E

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

Of the existing residential receptors, Location A (Forrester Homestead) is predicted to be exposed to the highest general operational noise levels from the site. Analysis of the modelling results indicate that the predicted L_{A90} noise levels at the Forrester site are controlled principally by the northern underground mine's ventilation equipment and the predicted L_{Aeq} levels are controlled by the northern underground mine ventilation system, excavators operating within the northern open-cut pit and mobile plant operating in the northern aspect of the site, principally to the north of the northern open-cut pit.

Whilst not a requirement for compliance, the noise contribution from the northern underground mine ventilation system can be effectively reduced at the Forrester site by re-orientating the discharge

stacks so that the discharge is directed horizontally to the south, away from Forrester. Modelling indicates that this would be expected to reduce the ventilation equipment's relative noise contribution by up to approximately 5 dB and the cumulative L_{A90} noise level by approximately 3 dB at Location A.

It is understood that this measure could be implemented with relative ease and therefore it is recommended.

Receptor F, HGPL Accommodation Village

The key amenity issue for the Project accommodation village is sleep protection as limited external activity is expected and its primary function is to provide sleeping facilities for mine workers 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 38 dB(A) L_{Aeq} are predicted at this location under adverse meteorological conditions and as such it would be expected that the internal noise criteria would be met with windows open. It is anticipated that the accommodation will be air conditioned and provided with mechanical ventilation, allowing windows to be kept closed.

15.4.4 Construction Noise

15.4.4.1 Primary Noise Sources

Construction equipment has been nominated for the different stages of the construction works. Typical construction equipment expected to be used on the Project site includes cranes, compressors, drills, water trucks, dozers, graders, and loaders. Details of construction noise sources for individual stages are provided in Volume 2, Appendix P.

15.4.4.2 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 presented in Volume 2, Appendix P and 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	up to 15	up to 19	50	45	40	Nil
B: Surbiton Homestead	up to 15	up to 20	50	45	40	Nil
C: Eulimbie Homestead	up to 13	up to 18	50	45	40	Nil
D: Surbiton South Homestead	up to 13	up to 18	50	45	40	Nil
E: Speculation Homestead	< 10	< 10	50	45	40	Nil
F: KC Accommodation Village	up to 55	up to 59	50	45	40	Up to 9 dB(A) Daytime; Up to 14 dB(A) Evening; and Up to 19 dB(A) Night- time.
G: ACP Accommodation Village	up to 10	up to 14	50	45	40	**Nil**

Relatively consistent construction equipment schedules are anticipated over the various construction stages, hence substantially consistent noise levels are predicted for the three stages. Throughout the mine construction stages no exceedances of the EPP (Noise) daytime, evening and night-time noise limits are predicted at the receptors located outside the mining lease boundary. With respect to these residential receptors, no specific physical construction noise mitigation measures are considered necessary. However, adoption of noise management strategies implementing good industry practice is recommended to minimise noise emissions from the proposed construction works.

At the Project Accommodation Village, external noise levels of up to L_{Aeq} 59 dB(A) are predicted under adverse meteorological conditions. This would indicate the potential for exceedance of the EPP (Noise) limits by up to 9 dB(A) during the daytime, 14 dB(A) during the evening period and 19 dB(A) at night.

As previously noted, the key amenity issue for the accommodation village is sleep protection. On this basis, achieving the internal noise criteria is considered the principal performance requirement with respect to the acoustic design of the accommodation village.

In order to ensure that satisfactory internal noise levels are achieved, based on the predicted external noise levels, the accommodation building envelope design will be required to achieve an attenuation of 30 dB(A). Walls and roofs can be readily designed to provide at least this level of attenuation with the use of appropriate materials. The overall noise reduction through the buildings' facades will, therefore, be dependent upon the type of glazing used in windows and doors.

Acoustic design requirements for the accommodation village buildings to ensure that satisfactory internal noise levels are achieved are discussed in the EM Plan (Volume 2, Appendix W).

15.4.5 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 typically emit noise of a broadband nature and have not been known to generate the dominant low frequencies that the Ecoaccess guideline was intended to address. Notwithstanding this, SoundPLAN predictive noise modelling estimated the noise levels to be no more than 45 dB(L) at the receptor locations outside the mining lease boundary. Additionally, whilst linear noise levels of up to 51 dB(L) is predicted at Location F, no more than 15 dB difference between linear levels and A-weighted levels is predicted at this location.

On this basis 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.

15.4.6 Blasting Noise and Vibration

Blasting at the Project site is anticipated to be conducted 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. *Explosives Act 1999*).

One 4-man blast crew has been allowed for per 15,000 tonnes of explosives per year. The maximum number of blast crews by 2033 is 17, including shot-firers. It has been assumed that the explosives supplier would operate the explosives depot and supply the explosives trucks and operators.

The first 15-20m of the tertiary truck-shovel overburden would be excavated whilst the rest of the tertiary and weathered Permian overburden would require some blasting to maintain excavation productivity. All fresh overburden and the inter-burden between the C and D seams require blasting. It is intended that all blast holes will be confined and standard central Queensland strip mining blasting techniques would be used and that electronic initiation will be used to optimise blast performance and to limit the Maximum Instantaneous Change (MIC) values.

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

15.4.6.1 Ground Vibration

Calculations indicate that blasts requiring up to the maximum 1300 kg MIC would not exceed the most stringent 5 mm/s ground vibration criterion (Ecoaccess criterion for 90% of blasts) at the closest sensitive receptor locations, based on minimum setback distance to the open cast pit areas.

Ground vibrations of substantially less than 1 mm/s are expected at the identified receptor locations. Vibrations of this magnitude would be considerably below accepted thresholds for structural damage to buildings.

For lower capacity MIC blasts and at greater setback distance the predicted magnitude of vibration reduces substantially.

Therefore, it is considered that 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.

15.4.6.2 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.

15.4.6.3 Vibration Effects on Underground Communications Cabling

Optic fibre cables are proposed to supply communications to the site, and would likely enter the mine site along the Powerlink powerlines and/or rail corridor. 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.

15.4.6.4 Overpressure

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

Receptors A-G

Calculations indicate that blasts requiring up to the maximum 1300 kg MIC would not exceed the most stringent 115 dB(L) overpressure criterion (Ecoaccess criterion for 90% of blasts) at any of the identified sensitive receptor locations based on minimum setback distance to the open cast pit areas. Of the identified receptors beyond the mining lease boundary, Location A (Forrester 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.

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. It is recommended that calculations are revised and predictions refined on the availability of site specific constants and once the exact locations for blasting are known. Blast monitoring should be undertaken to assess compliance, determine the site constants and confirm the predictions.

Blasting carried out within the recommended hours (0900 – 1700) would not be expected to ordinarily be affected by the presence of temperature inversions as these generally occur during the night-time and early morning period. Source to receptor wind direction may be expected to give rise to increased noise levels at the receptors, however, and should be considered when planning blasting.

It is therefore considered that, provided blasting is properly managed, the proposed blasting program can be carried out to meet the overpressure criteria at all identified receptor locations. Reducing the MIC capacity and increasing distance is the most effective way of reducing blasting impacts. Recommendations on the management of overpressure from blasting are provided in the EM Plan (Volume 2, Appendix W). It would be expected that these would be provided to the blasting contractor for consideration and would be incorporated into a blasting plan.

15.4.7 Sleep Disturbance

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

The on-site accommodation village buildings will be appropriately acoustically designed and provided with mechanical ventilation and air-conditioning to satisfy the internal noise criteria. The sleep protection criterion is expected to be readily achieved within the Project Accommodation Village.

15.4.8 Off-Site Traffic Noise

The potential off-site traffic noise impact associated with the proposed operation and construction 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: Site Access Road, via Degulla 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 will alter the noise emission from roadways, increasing the $L_{A10(18hour)}$, which is an average of the L_{A10} traffic noise levels produced between 0600 and 0000 hours (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 operation were obtained from the draft Traffic Assessment prepared for the Project (Volume 2, Appendix 17).

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
Surbiton South Homestead	A	500 m	n/a[1]	31	32	n/a[1]	n/a[1]
Burtle Homestead	B	200 m	25	34	35	9	10
Tressillian South	B	600 m	21	30	31	9	10
Notes	1: New Road – No baseline AADT available						

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. Whilst 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 relative noise level increases identified are in the order of 10 dB(A), which represents 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 operation have been provided in the EM Plan (Volume 2, Appendix W).

15.4.9 Rail Noise and Vibration

The Proponent proposes to construct a standard gauge, 17 km long rail spur and loop to connect the Project mine site to the proposed 495 km long Alpha Coal railway line for the purposes of transporting processed coal from the mine site to the proposed Port of Abbot Point. The rail line would be designed to enable the export of 60 to 80 Mtpa of quality thermal coal to overseas markets.

Gutteridge Haskins and Davey P/L (GHD) has undertaken an assessment of the potential noise and vibration impacts resulting from the construction and operation of the proposed Alpha Rail Corridor Project (*Report for Alpha Rail Project – Noise Assessment, August 2010 [Revision 0*]).

15.4.9.1 Operational Phase

The GHD assessment did not, however, consider the Kevin's Corner rail spur or the sensitive receptor locations relevant to this assessment. Accordingly, URS has undertaken further assessment using the details and assumptions considered in the GHD assessment to predict potential rail noise and vibration impacts at the receptors identified in Table 15-1: .

The resultant predicted rail noise levels at the receptors due to the Project rail movements are presented in Table 15-15, whilst the predicted rail noise levels with consideration to both the Project and Alpha Coal rail movements are provided in Table 15-16. In predicting these levels, it has been

assumed the Project rail spur will carry 50% of the total rail traffic (the remaining 50% assumed to be associated with the Alpha Coal Project).

Table 15-15: Rail noise modelling results – Project rail movements considered

Receptor	Noise Level, L_{Aeq} dB(A)		Rail CoP $L_{Aeq,24hour}$ dB(A) Criterion	Exceedance
	Neutral Weather	Adverse Weather		
A: Forrester Homestead	26	31	65	Nil
B: Surbiton Homestead	36	41	65	Nil
C: Eulimbie Homestead	51	56	65	Nil
D: Surbiton South Homestead	31	35	65	Nil
E: Speculation Homestead	< 10	< 10	65	Nil
F: KC Accommodation Village	40	46	65	Nil
G: ACP Accommodation Village	26	31	65	Nil

Table 15-16: Rail noise modelling results – Project and Alpha Coal rail movements Considered

Receptor	Noise Level, L_{Aeq} dB(A)		Rail CoP $L_{Aeq,24hour}$ dB(A) Criterion	Exceedance
	Neutral Weather	Adverse Weather		
A: Forrester Homestead	28	32	65	Nil
B: Surbiton Homestead	39	43	65	Nil
C: Eulimbie Homestead	54	59	65	Nil
D: Surbiton South Homestead	38	43	65	Nil
E: Speculation Homestead	< 10	< 10	65	Nil
F: KC Accommodation Village	41	46	65	Nil
G: ACP Accommodation Village	38	43	65	Nil

The results indicate that the $L_{Aeq,24\ hour}$ 65 dB(A) rail noise criterion would be satisfied at all the identified receptor locations. The highest rail noise levels are predicted at Location C (Eulimbie Homestead), this receptor being the closest to the rail line, set back from the line by some 1,600 m and from the mine site by some 16 km.

The GHD rail noise predictions indicate the train noise L_{Amax} levels being approximately 15 dB(A) higher than the L_{Aeq} level. Based on this margin it would be expected that L_{Amax} noise criterion of 87 dB(A) would be readily achieved at all the identified receptors.

Whilst compliant L_{Amax} noise levels are predicted at the sensitive receptors locations, it is noted that for some receptors, these levels exceed the sleep disturbance levels recommended by the WHO, 1999 and the EPP (Noise), 2008.

Given the setback distance to nearest sensitive receptors (A-G), no adverse community reaction due to operational vibration impacts would be expected.

15.4.9.2 Construction Phase

The EPP (Noise) daytime guideline noise level of 50 dB(A) $L_{Aeq,1hr}$ is predicted to be achieved at the identified receptor locations (A-G) during construction of the rail spur for all construction activities.

Given the setback distance to the nearest sensitive receptors from the rail spur, ground vibration levels associated with various items of construction plant are not anticipated to be perceptible and therefore no adverse community reaction due to construction vibration impacts would be expected.

Construction Blasting

The GHD assessment notes that blasting may potentially be required for excavations of sections of the rail corridor where hydraulic excavators with hammer attachments are ineffective. It recommends that blasting should only occur between 0900 to 1700 Monday to Friday and 0900 to 1300 Saturday.

The report notes that a MIC of greater than 100 kg should not be required and a charge of 50 kg or less is likely to be appropriate. Estimates of air blast overpressure and ground vibration due to potential blasting are provided based on blasts in the MIC range of 10-100 kg. These are consistent with URS predictions.

With consideration to the maximum anticipated MICs (up to 100 kg), compliance with the Ecoaccess blasting noise and vibration criteria is predicted at all receptors A-G.

15.4.10 Aircraft Noise Impact

The determination of aircraft noise levels for the purpose of this assessment has been based on the methodology set out in AS 2021 (2000) (Part A). The method takes account of the distances (DL and DT) between the landing and take-off ends of the runway and the receptors, and also considers set back distances (DS) from the flight path to the receptors. The standard allows for aircraft noise levels received at receptor locations to be determined based on reference DL, DT and DS distances for various aircraft types. For the purpose of this assessment, a straight flight-path following the direction of the proposed runway has been assumed. Table 15-17 identifies the DL, DT and DS distances applied in this assessment.

Table 15-17: Receptor setback distances based on AS 2021-2000 method

Receptor	DL (m)	DT (m)	DS (m)
B: Surbiton	296	2602	8634
C: Eulimbie	3515	5821	6979
D: Surbiton South	6189	8495	6719
F: KC Accommodation Village	750	1556	2313

Table 15-18 summarises the noise levels obtained. It is noted that the tables available in AS 2021 (2000) do not generally consider DS values over 2,300 meters and therefore only approximate noise levels are available for the receptors with DS greater than 2,300 m.

Table 15-18: Predicted aircraft noise levels based on AS 2021-2000

Aircraft Types	Operation	Maximum Noise Levels at Receptors within 10 km of Airstrip dB(A)				Criteria dB(A)	
		Surbiton *	Eulimbie *	Surbiton South *	Kevin's Corner Accommodation Village	20 or Less Flights per Day	Greater than 20 Flights per Day
Boeing 727	Take off	62	65	64	61	< 80	< 75
	Landing	53	57	58	57	< 80	< 75
Boeing 737-300 Boeing 737-400 Airbus A320	Take off	58	64	66	62	< 80	< 75
	Landing	61	66	66	52	< 80	< 75
Saab 340 Boeing Dash 8 Fokker F50	Take off	51	45	47	51	< 80	< 75
	Landing	44	49	50	43	< 80	< 75
Corporate Jet	Take off	51	51	51	50	< 80	< 75
	Landing	45	45	47	49	< 80	< 75
Typical Light General Aviation Aircraft	Take off	50	48	49	50	< 80	< 75
	Landing	43	48	49	41	< 80	< 75
Notes	* Distances from the extended line of the proposed runway to these receptors are greater than data available in AS2021-2000, therefore noise levels are approximate.						

The predicted aircraft noise levels presented in the table above all lie within the acceptable limits set out in AS 2021-2000.

Noise levels from smaller light aircraft types will be 50 dB(A) or below. Of the aircraft types considered, the Airbus A320, would provide the highest noise levels, generating external noise levels of up to 66 dB(A) at Eulimbie and Surbiton South and 62 dB(A) at the accommodation village during take-offs.

15.4.11 Impacts on Fauna

Volume 1, 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 Project. In relation to the potential noise and vibration impacts upon these ecological values, the findings of the ecology assessment are as follows:

- An increase in noise, vibration and dust associated with the construction and operational phases of the Project may lead to the displacement of native species from their current home ranges;
- The increase in noise and vibration emissions that are anticipated to result from construction and operational 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.

15.4.12 Noise Mitigation Measures

Specific physical construction and operational 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 2, Appendix W) will further reduce the potential for noise issues during the proposed construction and operation periods.

15.5 Summary of Potential Noise and Vibration Impacts

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

Operational Noise

Noise levels generated by the proposed operation are predicted to be within the established noise limits at all receptor locations outside the mining lease boundary under all meteorological conditions. Whilst exceedances of the criteria by up to 5 dB(A) during the daytime, 7 dB(A) during the evening and 10 dB(A) during the night-time are anticipated at the on-site Project accommodation village, the key amenity issue for this receptor is sleep protection as limited external activity is expected and its primary function is to provide sleeping facilities for mine workers between shifts. The accommodation would be designed to ensure satisfactory sleep protection is achieved.

Construction Noise

Whilst 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 9 dB(A) during the daytime, 14 dB(A) during the evening period and 19 dB(A) at night at the on-site Project accommodation village location during the construction stages. As noted above, the accommodation would be designed to ensure satisfactory sleep protection is achieved.

No other exceedances of the EPP (Noise) values are predicted during the daytime, evening or night periods throughout the construction stages at any other identified sensitive receptor location.

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 on-site Project accommodation village (Receptor F). The accommodation village will be acoustically designed to ensure that satisfactory internal noise levels are achieved.

Low Frequency Noise

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

Blasting

No overpressure or ground vibration exceedances are anticipated at any of the identified receptor locations.

Off-Site Traffic Noise

Full compliance with the Department of Main Roads' 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.

Rail Noise

URS concurs with the general findings of the rail noise and vibration assessment carried out by GHD. Full compliance with the Queensland Rail's CoP is predicted at all identified receptors. No construction noise or vibration impacts on the identified receptors are predicted.

Aircraft Noise

Predicted aircraft noise levels are within the acceptable limits set out in AS2021-2000.