Appendix F

Noise and vibration study

Appendix F — Noise and vibration study

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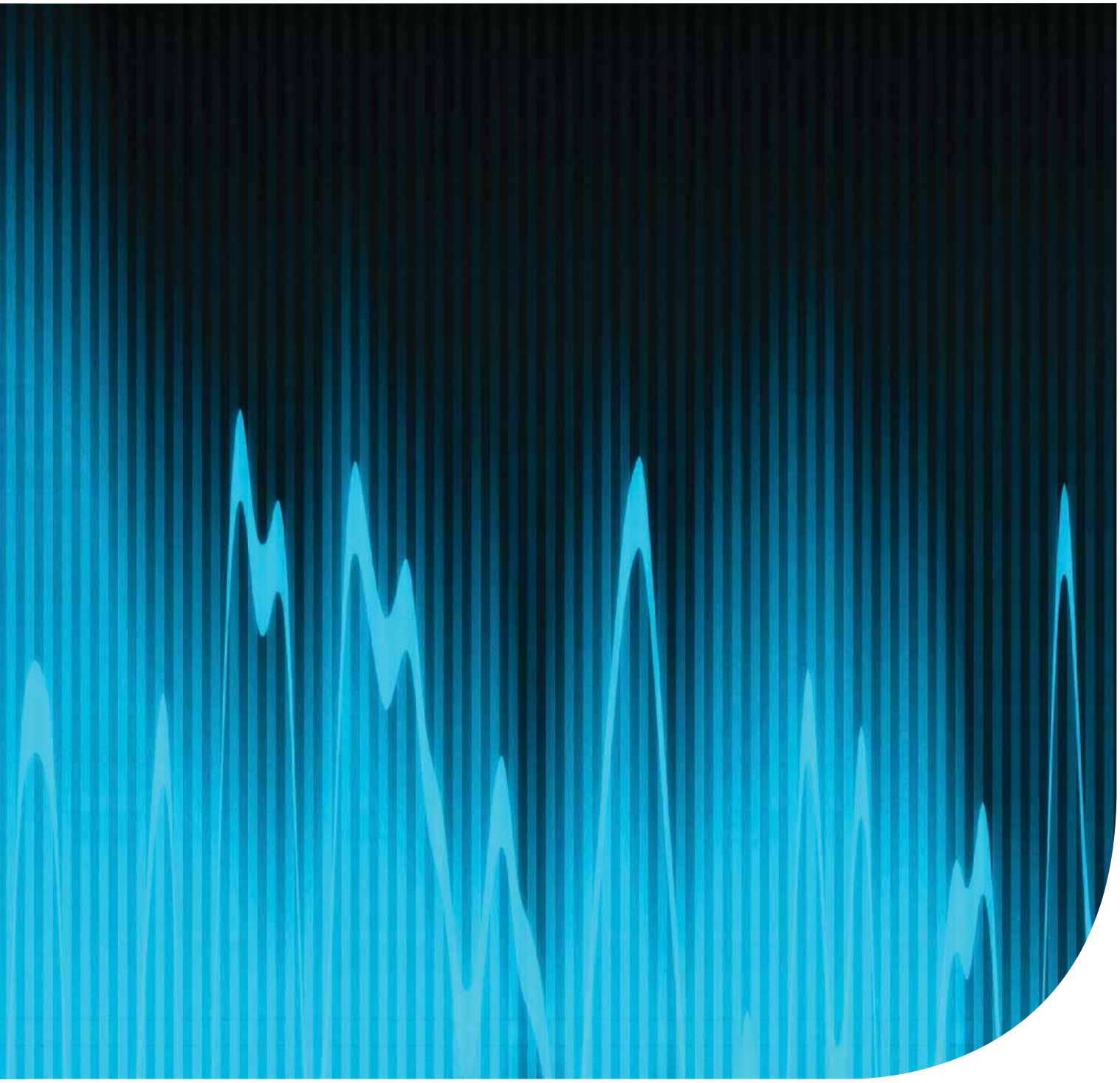
Mount Thorley Operations 2014

Noise and vibration study

Prepared for Mt Thorley Operations Pty Limited | 2 June 2014



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Mountt Thorley Operations 2014

Noise and vibration study

Prepared for Mt Thorley Operations Pty Limited | 2 June 2014

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Mountt Thorley Operations 2014

Final

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1 Introduction

1.1 Background

Mount Thorley Operations (MTO) is an open cut coal mine approximately 10.5 kilometres (km) south-west of Singleton in the Hunter Valley, NSW. The mine is operated by Coal & Allied on behalf of Mount Thorley Co-venture. MTO currently operates under Development Consent No. DA 34/95 (the development consent) issued by the then Minister for Planning on 22 June 1996 under Part 4 of the NSW *Environmental Planning and Assessment Act 1979* (EP&A Act).

Immediately to the north is Warkworth Mine. Since 2004, the two mines have integrated at an operational level and are known as Mount Thorley Warkworth (MTW), with a single management team responsible for all the operations. Equipment, personnel, water, rejects and coal preparation are all shared between the mines. The MTW operations involve an existing operation of approximately 1,300 persons, which includes full-time personnel and a small number of short-term contractors. Ownership of the two mines remains separate.

Mining activities approved under DA 34/95 have mostly been completed with the exception of Loders Pit and Abbey Green North Pit (AGN) with rehabilitation well-progressed on the east of the Site. Run-of-mine (ROM) coal from MTO is transported to either the MTO or Warkworth Mine coal preparation plant (CPP) for processing. Extraction of coal from other pits has been completed; overburden emplacement is ongoing. Product coal from the CPPs is transported via conveyor to the Mount Thorley Coal Loader (MTCL). Coal loaded onto trains at the MTCL is transported to the Port of Newcastle for export.

The Mount Thorley Operations 2014 (the proposal) seeks an approval under Part 4, Division 4.1 of the EP&A Act to complete mining and rehabilitation activities within the current limits of approval.

This assessment forms part of the Environmental Impact Statement (EIS) prepared by EMGA Mitchell McLennan Pty Ltd (EMM) for the proposal.

This noise and vibration assessment has been prepared with reference to the NSW Department of Planning and Environment's (DP&E) State Significant Development - Secretary's requirements Mt Thorley Continuation Project (SSD 6465) and in accordance with the NSW EPA's *Industrial Noise Policy* (*INP*), published in January 2000.

As part of the development of the mine plan for the proposal an order of magnitude style noise impact work package was undertaken by MTO with a comprehensive series of noise modelling scenarios developed and assessed by EMM. The purpose of this work was to inform the mine planning process with regards to potential noise impacts including noise management techniques to minimise impacts, a key risk as noted in the proposal risk assessment.

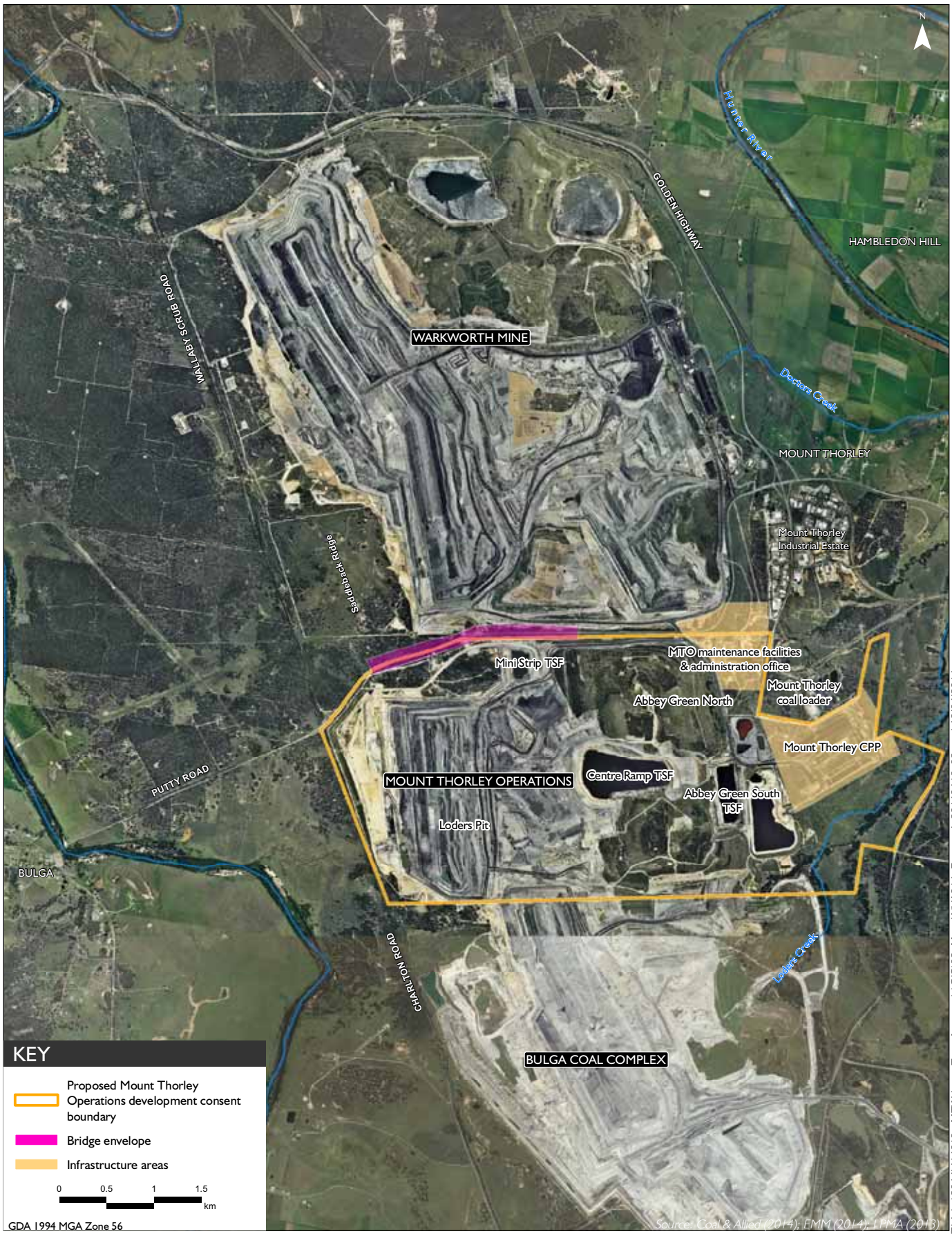
1.2 Project description

The proposal comprises:

- the completion of mining in Loders pit and AGN pit;
- the ability to accept overburden from Warkworth Mine to complete the final landform;

- the maintenance of operational level integrated components of MTW, including upgrades to the water management system;
    - an upgrade to the approved discharge point and increase the discharge rate of 200 megalitres (ML) per day;
    - the ability to transfer and accept mine water from neighbouring mines (eg Bulga Coal Complex, Wambo Mine, Hunter Valley Operations);
    - an increase in dam 9S (Southern out-of-pit - SOOP) storage capacity to 2.2 gigalitres (GL) within the same disturbance footprint; and
- the acknowledgement of all approved interactions with Bulga Coal Complex;
- an upgrade to the CPP to facilitate an increase in maximum annual throughput of 18 Mt; and
- the maintenance of approval of all aspects of the existing operations for Warkworth Mine approved under DA 34/95, including, coal processing rates and integrations with WML amongst other aspects.

The proposal seeks development consent for a period of 21 years to undertake the activities described above and in the EIS. The proposal is shown in Figure 1.1.



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Overview of the proposal

Mount Thorley Operations

Noise and vibration assessment

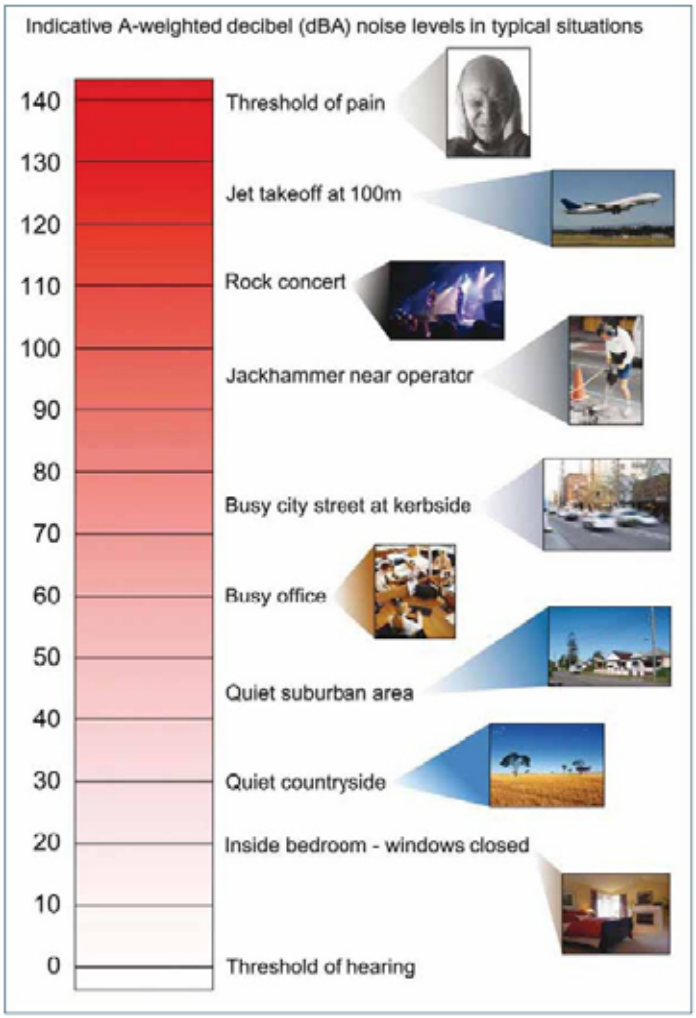
Figure 1.1

1.3 Common noise levels

Table 1.1 gives an indication as to what an average person perceives about changes in noise levels Examples of common noise levels encountered on a daily basis are provided in Figure 1.2.

Table 1.1 Perceived change in noise

Change in sound level (dB)	Perceived change in noise
1 to 2	typically indiscernible
3	just perceptible
5	noticeable difference
10	twice (or half) as loud
15	large change
20	four times as loud (or quarter) as loud



Source: Road Noise Policy (DECCW 2011)

Figure 1.2 Common sources of noise with levels

2 Glossary

A number of technical terms are required for the discussion of noise and vibration. These are explained in Table 2.1.

Table 2.1 Glossary of acoustic terms

Abbreviation or term	Description
ABL	The assessment background level (ABL) is defined in the INP as a single figure background level for each assessment period (day, evening and night). It is the tenth percentile of the measured L90 statistical noise levels.
Amenity criteria	The amenity criteria relate to all industrial noise. Where industrial noise approaches base amenity criteria, then noise levels from new industries need to demonstrate that they will not be an additional contributor to existing industrial noise.
ANZECC	Australian and New Zealand Environment Conservation Council
CNMP	Construction noise management plan
Coal & Allied	Coal & Allied Operations Limited
Day period[1]	Monday to Saturday: 7.00 am to 6.00 pm, on Sundays and public holidays: 8.00 am to 6.00 pm.
dB(A)	Noise is measured in units called decibels (dB). There are several scales for describing noise, the most common being the 'A-weighted' scale. This attempts to closely approximate the frequency response of the human ear.
DGRs	Director-General's environmental assessment requirements
DP&E	Department of Planning and Environment (NSW government)
EA	Environmental assessment
EMM	EMGA Mitchell McLennan Pty Limited
EPA	NSW Environment Protection Authority
EP&A Act	Environmental and Planning Assessment Act 1979 (NSW)
Evening period[1]	Monday to Saturday: 6.00 pm to 10.00 pm, on Sundays and public holidays: 6.00 pm to 10.00 pm.
ICNG	Interim Construction Noise Guideline
INP	Industrial Noise Policy (NSW EPA 2000)
Intrusive criteria	The intrusive criteria refers to noise that intrudes above the background level by more than 5 dB. The intrusiveness criterion is described in detail in this report.
L_1	The noise level exceeded for 1% of the time.
L_{10}	The noise level which is exceeded 10% of the time. It is roughly equivalent to the average of maximum noise level.
L_{90}	The noise level that is exceeded 90% of the time. Commonly referred to as the background noise level.
L_{eq}	The energy average noise from a source. This is the equivalent continuous sound pressure level over a given period. The $L_{eq(15min)}$ descriptor refers to an L_{eq} noise level measured over a 15-minute period.
Linear peak	The peak level of an event is normally measured using a microphone in the same manner as linear noise (ie unweighted), at frequencies both in and below the audible range.
L_{max}	The maximum sound pressure level received during a measuring interval.
Night period[1]	Monday to Saturday: 10.00 pm to 7.00 am, on Sundays and public holidays: 10.00 pm to 8.00 am.
NMP	Noise management plan
PSNL	The project-specific noise levels (PSNL) are criteria for a particular industrial noise source or industry. The PSNL is the lower of either the intrusive criteria or amenity criteria.

Table 2.1 Glossary of acoustic terms

Abbreviation or term	Description
RBL	The rating background level (RBL) is an overall single value background level representing each assessment period over the whole monitoring period. The RBL is used to determine the intrusiveness criteria for noise assessment purposes and is the median of the average background levels.
RNP	Road Noise Policy
RING	Rail Infrastructure Noise Guideline
Sound power level (Lw)	A measure of the total power radiated by a source. The sound power of a source is a fundamental property of the source and is independent of the surrounding environment.
Temperature inversion	A meteorological condition where the atmospheric temperature increases with altitude.
The proposal	Warkworth Continuation 2014
The Site	Area covered by application
Vibration	A motion that can be measured in terms of its displacement, velocity or acceleration. The common unit for velocity is millimetres per second (mm/s).

Note: 1. excludes road traffic noise where Day: 07.00 am to 10.00 pm; Night: 10.00 pm to 07.00 am.

3 Existing acoustic management

3.1 Overview of noise management system

The MTW Noise Management Plan (NMP) details a range of existing acoustic management and monitoring procedures which are managing the existing operations to comply with the conditions of the development consent. The management measures include those which are implemented on a continuous (standard) basis, as well as both proactive and reactive measures, categorised in accordance with the hierarchy of control. The hierarchy of control is as follows:

- administrative controls;
- substitution controls;
- engineering; and
- elimination controls.

Together, this suite of management measures and processes comprise the MTW Noise Management System.

The effectiveness of the MTW Noise Management System has been tested on a number of occasions in recent years, including formal compliance audits, requests for Independent Review, ad-hoc supplementary monitoring programs, and departmental requests for information. MTW continues to demonstrate a position of predominant compliance with noise criteria, and a high level of adherence to the measures outlined in the NMP.

MTW continues to work with the Department to improve the NMP, demonstrating commitment to continuous improvement and driving mining industry best practice noise management. It is expected that the continued implementation and refinement of measures outlined in the NMP (as updated from time to time) will enable MTW to effectively manage any noise impacts associated with this proposal, and to ensure a high level of compliance is maintained throughout the life of the Project.

3.2 Administrative controls

The following administrative controls are implemented at MTW, including:

- TRIGGER Action Response Process (TARP);
- Heavy Mining Equipment (HME) Sound Power Level (Lw) screening;
- handover report; and
- validation surveys of the real-time monitoring network.

Each of these measures is described below.

3.2.1 Trigger Action Response Process (TARP)

The TARP is the key reactive noise control implemented at MTW, and involves the effective and timely response to elevated noise (trigger), irrespective of meteorological conditions.

Triggers are enacted in a number of ways, prompting commencement of reactive processes to validate, quantify and appropriately respond to noise conditions, including:

- receipt of a noise alarm from the real-time, directional noise monitoring network;
- identification of elevated noise through routine supplementary surveillance noise monitoring, undertaken by MTW personnel each night;
- notification of elevated noise through the routine (monthly) attended compliance monitoring regime undertaken by experienced and independent experts; and
- receipt of community complaint in relation to noise.

When a trigger is confirmed (noise levels which are approaching or exceeding the noise criteria in the vicinity of nearby private residences), an appropriate response is implemented to ensure the noise event is resolved within 75 minutes of identification. The response may include substitution or elimination measures, commensurate with the nature and severity of the noise event.

3.2.2 HME Sound Power Level (Lw) screening

Understanding of the sound profile of the mining fleet is critical to effective introduction of both proactive and reactive noise controls. To ensure this information is kept up-to-date and relevant, sound power level testing (sound screening) is undertaken on 33% of the attenuated HME fleet annually. In this way, 100% of attenuated equipment will be screened on a rolling three-year cycle. The results of sound screening will be used for the following:

- to inform MTW of equipment which is experiencing degradation in suppression equipment and requiring repair;
- to inform MTW of fleet types and units which can be preferentially deployed into or removed from noise risk areas; and
- to periodically update the predictive modelling interface (PMI) to increase model accuracy and usefulness (refer to Section 5.1).

When one piece of equipment measures >3 dB(L) against operational specifications, MTW maintenance staff will inspect and assign the piece of equipment to the appropriate maintenance schedule.

3.2.3 Nightshift environmental management report

The MTW operational personnel prepare and circulate a report following each night shift which describes the noise management activities undertaken including routine controls, minor changes and equipment shutdowns, if any, during the shift. Where noise enhancing weather conditions are predicted for the shift ahead these are described in the report. Along with the description of the conditions, potential management strategies are also detailed.

3.2.4 Validation surveys of the real-time monitoring network

To ensure that the real-time monitoring network adequately assesses and represents all receivers, validation surveys are undertaken on an as-needs basis, involving supplementary noise monitoring in the vicinity of the private residence concerned, and comparison with measured levels from the nearest real time monitor. Where a survey indicates a change may be required this is reviewed and actioned as appropriate to ensure monitoring systems and reactive triggers remain representative.

3.2.5 Substitution controls

Substitution controls are implemented in response to one or more triggers (described in 'administrative controls' above), and are utilised both proactively and reactively. Substitution measures involve the repositioning or replacement of equipment or reassignment of tasks when conditions require. For example, assignment of sound attenuated trucks to higher (noise) risk hauls during noise enhancing conditions ahead of shift, or reactively following a trigger.

3.3 Engineering measures

In conjunction with its suppliers, MTW has progressed with the attenuation of its fleet of haul trucks and other mining equipment. All new trucks purchased for use on the Site will be commissioned as noise suppressed (or attenuated) units. MTW currently operates a mixture of sound attenuated and non-sound attenuated machines and the existing fleet of trucks are being progressively fitted with suitable noise attenuation packages. Baseline testing has been completed and acoustic engineering is being applied to understand what sound power levels are achievable across the fleet. The attenuation program is being undertaken in a targeted manner, addressing the noisier pieces of equipment as a priority for the operations given the remaining development consent life.

Identification and rectification of defects to sound attenuation equipment is undertaken as required through the normal maintenance process where reasonable and feasible. MTW has also completed works to replace all in-pit reverse alarms with 'quacker' style reverse alarms on its mining fleet.

During 2012, engineering works were undertaken to address noise associated with shovel operations. Engineering controls were introduced including hydraulic snubber brakes, and fitting of self-greasing permalubes to the dipper door pins. Where additional reasonable and feasible opportunities for engineering controls are identified in the future, these will continue to be investigated and trialled as appropriate.

3.4 Elimination controls

Elimination controls are implemented in response to one or more triggers (described in 'administrative controls' above). Elimination controls, equipment or task shutdown, are implemented as a last resort where other controls have been inadequate.

4 MTW noise management system in action

4.1 Night shift Environmental Management Report

MTW operational personnel prepare and circulate a shift report for planning activities and to handover to the next shift.

The report describes the noise management activities undertaken including routine controls, minor changes and equipment shutdowns, if any, during the shift. Where noise enhancing conditions are predicted for the next shift these are described in the report. Along with the description of the conditions, potential management strategies are also detailed. An example of information contained within the handover report is shown in Figure 4.1.

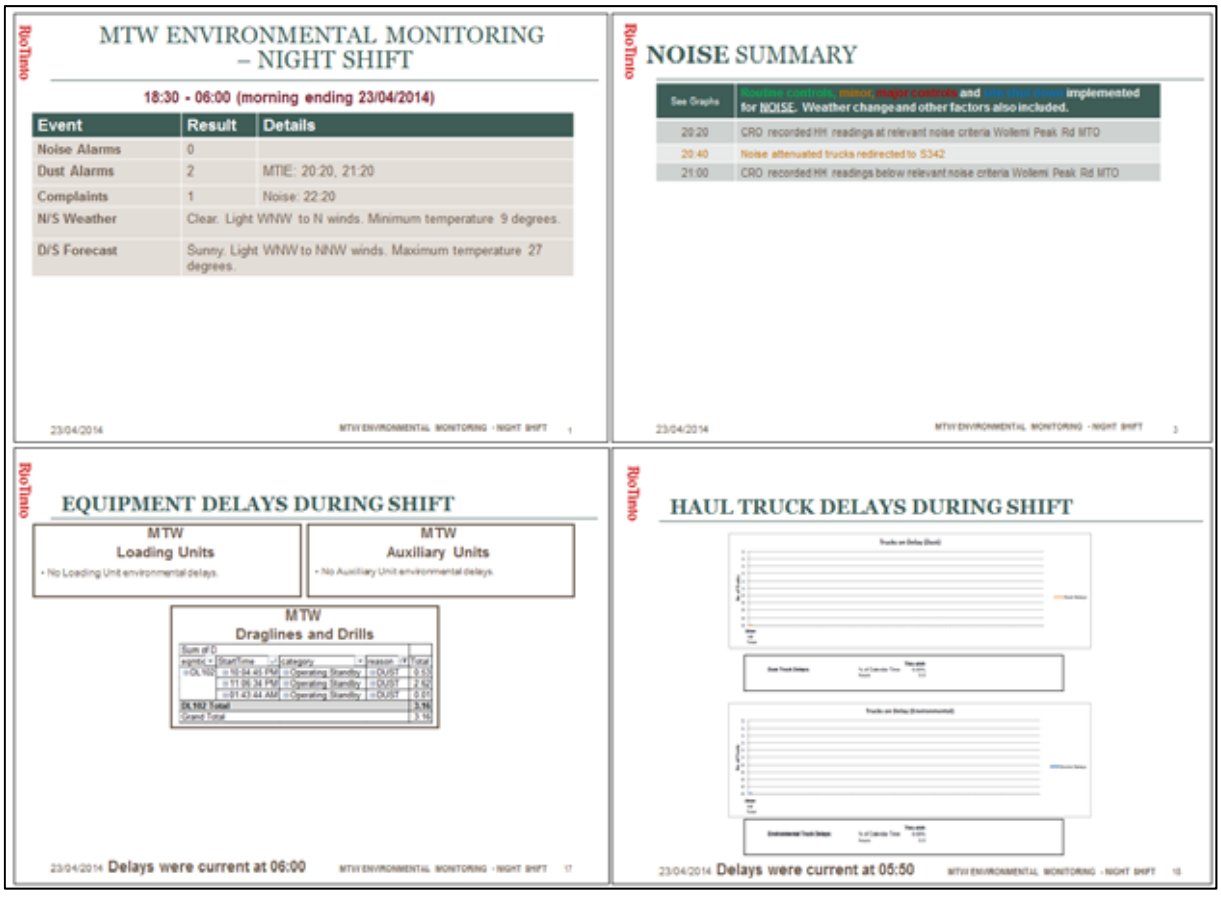


Figure 4.1 Example information from the night shift environmental management report (night shift 22 April 2014)

4.2 Real-time noise monitoring

Directional real-time noise monitoring is utilised to actively manage noise emissions from MTW on a continuous basis during night time operations. The real-time monitoring network comprises a number of monitors which have been strategically placed to adequately represent a wide range of private residences. Operational personnel have access to real-time data via the environmental intranet (also available on hand-held devices such as smart phones) and use a suite of tools to allow for swift resolution of any emerging issues during any shift including live audio streaming, dedicated pages for each monitoring location (an example is provided as Figure 4.2), and 'Noise roses' (a spatial representation of the directional assessment of measured noise, see Figure 4.3).

A real-time noise alarm system was introduced to MTW during 2011 which uses a set of rules to alert operational personnel to emerging noise issues in real-time. Numerous noise alarms have been acknowledged and responded to during night shift operations in 2014. Since the introduction of real-time noise alarms at MTW in 2011, the monitoring network has expanded in the Bulga village area, now comprising four directional real-time monitors to ensure adequate representation of private residences in the area (see Figure 4.4).

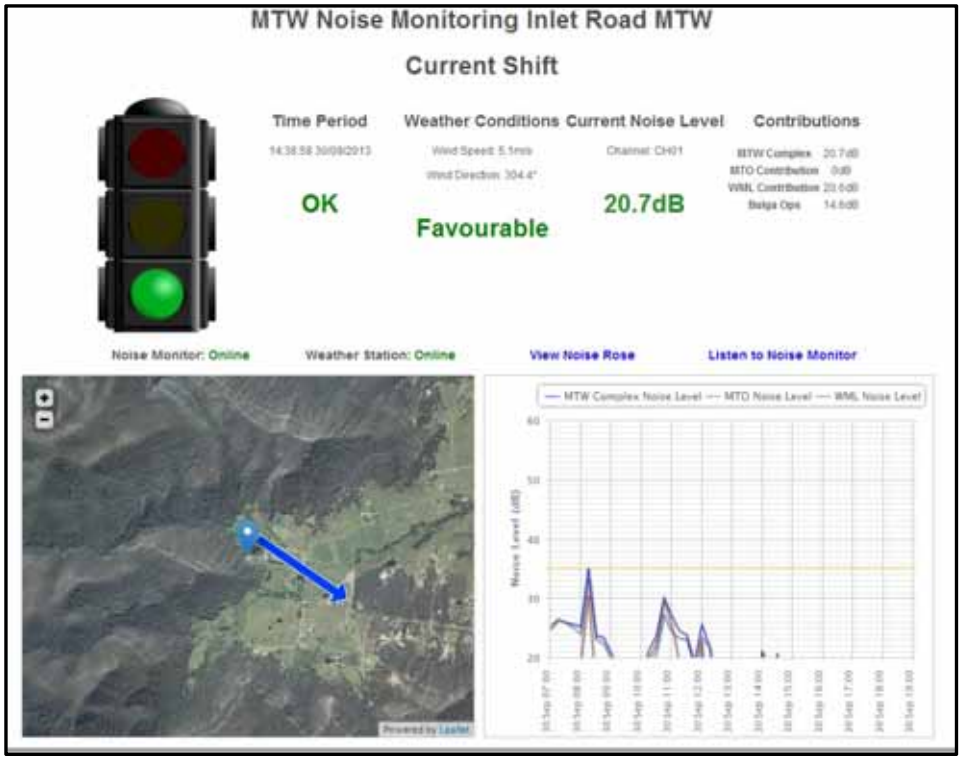


Figure 4.2 **Noise management resource – trending noise levels at 'Inlet Road West' monitoring location**

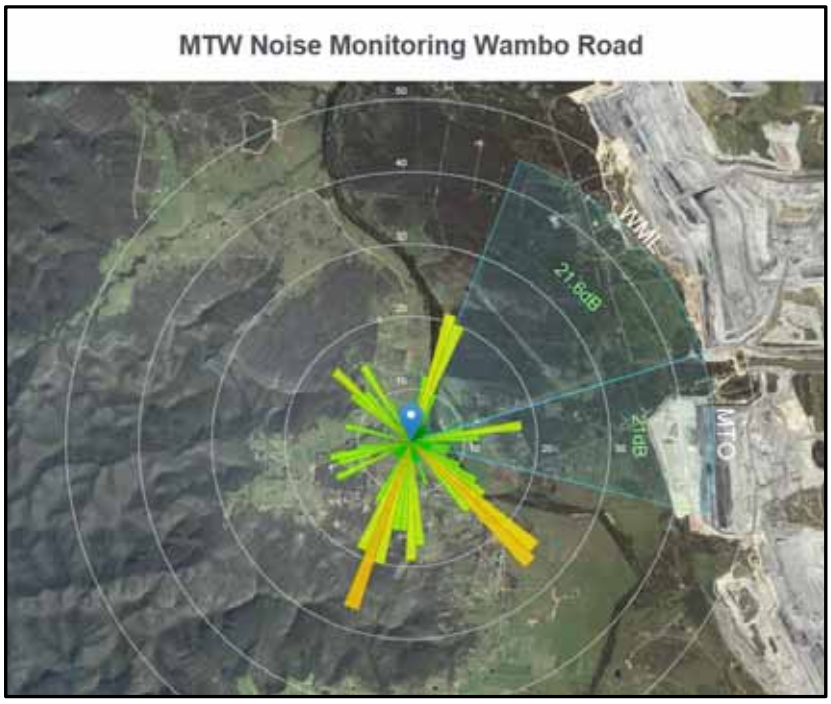


Figure 4.3 **Noise rose – a spatial representation of directional noise assessment in real-time**

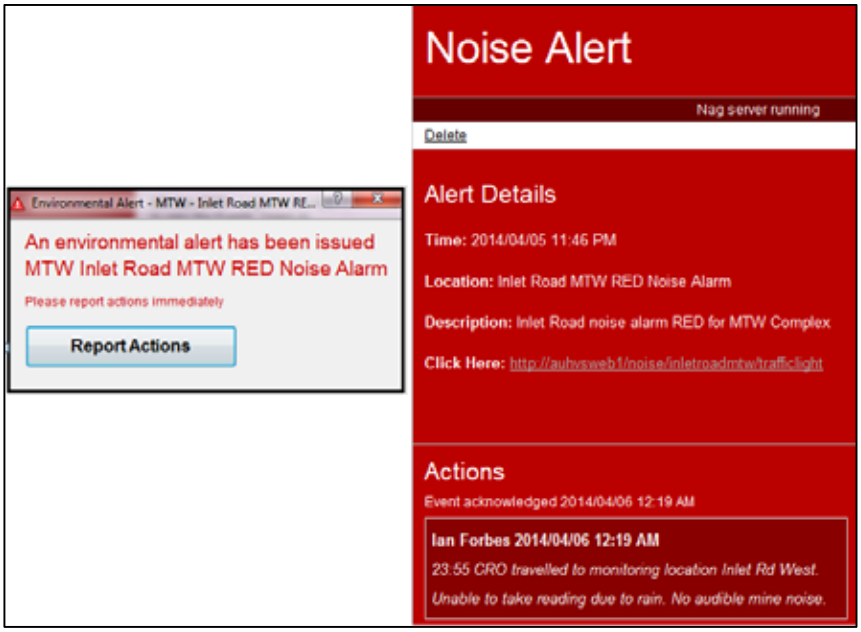
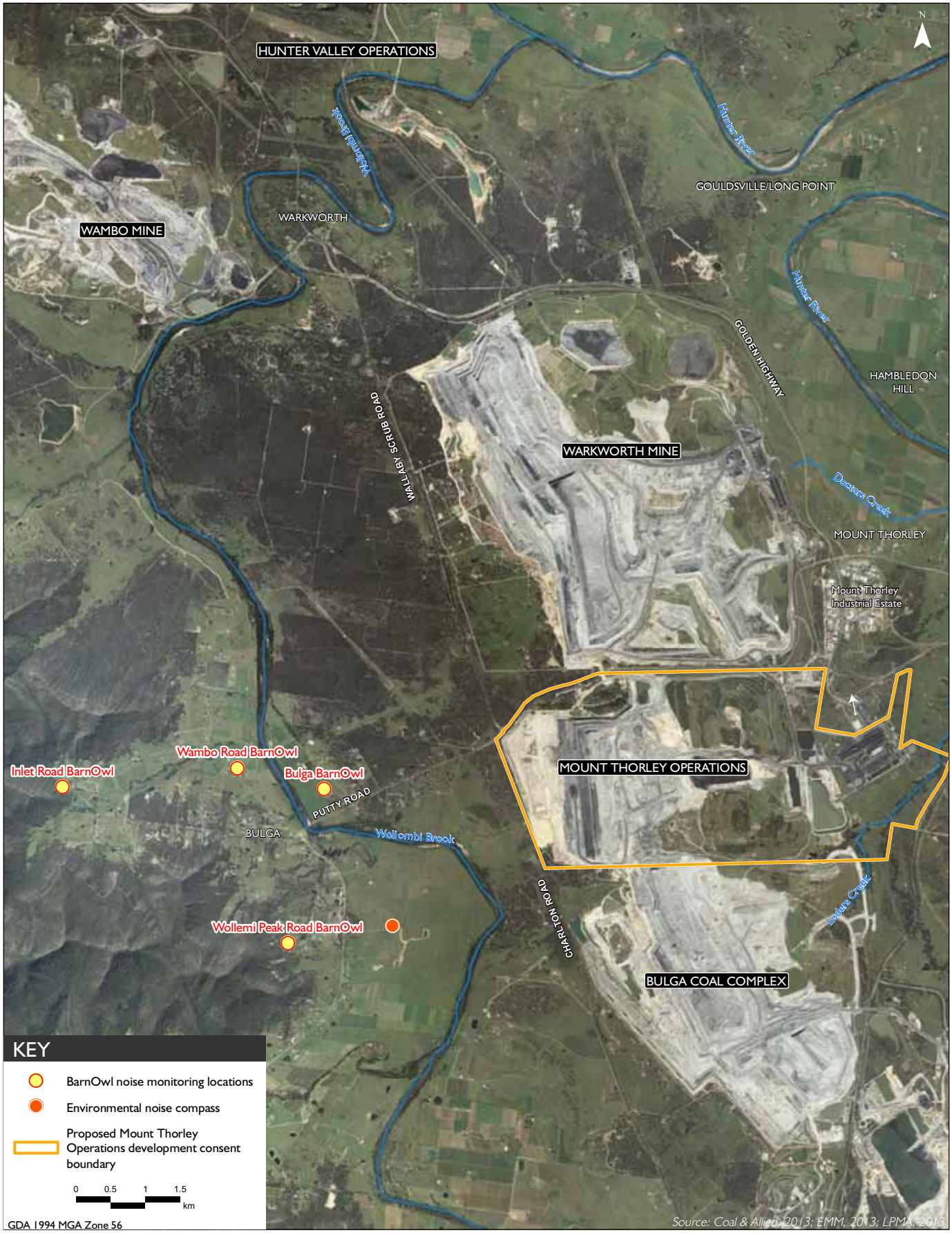


Figure 4.4 **'Real-time' noise alarms in action at MTW**



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Directional real-time noise monitoring locations in the Bulga village community

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Figure 4.5

4.3 Supplementary attended noise monitoring

A programme of targeted supplementary attended noise monitoring is operated at MTW to support the real-time directional monitoring network and ensure the highest level of noise management is maintained. The examples provided in this section generally apply to WML however are directly applicable to MTO given noise management across MTW is integrated. The supplementary programme is undertaken by MTW personnel and involves:

- undertaking routine inspections from both inside and outside the mine boundary;
- routine and as-required handheld noise assessments (undertaken in response to noise alarm and/or community complaint), comparing noise levels against consent noise limits; and
- validation monitoring following operational modifications to assess the adequacy of the modifications.

When a trigger is confirmed (noise levels which are approaching or exceeding the noise criteria in the vicinity of nearby private residences), an appropriate response is implemented to ensure the noise event is resolved within 75 minutes of identification. The response may include substitution of elimination measures, commensurate with the nature and severity of the noise event.

Supplementary noise monitoring undertaken in 2014 has, to-date, resulted in operational modifications (including equipment stoppage and, in some cases complete site shutdown) on numerous nights, resulting in over 8,000 hours of equipment stoppage.

A complete site shutdown (with the exception of dragline operations and some ancillary equipment activity) has been called on several occasions in 2014, in response to elevated noise measurements in the Bulga area. This significant level of operational disruption demonstrates MTW's clear commitment to minimising impacts and maintaining compliant operations.

Table 4.1 details MTW equipment stoppages due to noise year to date, by equipment type.

Table 4.1 MTW equipment stoppages

Equipment type	Equipment delay due to noise management (hours) January – April 2014
Drills	225
Dozers	764
Bladed equipment	41
Loaders	124
Shovels	748
Trucks	6,184

The following case studies are provided to demonstrate the effective implementation of the MTW Noise Management System in recent months.

4.3.1 Night shift 24 February 2014

Fifty-six pieces of equipment were stood down for a total of 181.7 equipment operating hours on the night of 24 February 2014 after elevated noise was detected through supplementary handheld monitoring at the 'Wambo Road' monitoring location. Real-time monitoring data supported the observations of the operator conducting the supplementary assessments. Operational modifications were immediately introduced, with follow-up monitoring undertaken to validate and verify the effectiveness of the modifications. Noise levels were verified as below the trigger limit 65 minutes following detection, compliant with the commitments made in the MTW NMP.

Meteorological conditions on the night assisted noise propagation toward Wambo Road (easterly and south easterly winds), however were such that the consent noise criteria did not apply (average wind speed of 3.8m/sec). Despite this, significant operational modifications were made to ensure noise remained below criteria so as to minimise impacts on surrounding residents. It should be noted that MTW did not receive any community complaints from Wambo Road residents on the night of 24 February 2014. A summary of noise management activities undertaken on the night is shown in Table 4.2.

Table 4.2 Summary of actions implemented on 24 February 2014

Time	Trigger / response / verification	Details
19:40	N/A	Supplementary monitoring undertaken at Wambo Road – noise levels significantly under WML trigger.
21:20	Trigger	Supplementary monitoring undertaken at Wambo Road detects elevated noise from WML.
21:25	Response	Drill 223 and Drill 230 shut down.
21:30	Response	Excavator 393 and supporting equipment shut down.
21:35	Response	Drill 227 shut down.
21:40	Verification	Supplementary monitoring undertaken – noise remains elevated.
21:50	Response	Excavator 313 and supporting equipment shut down.
21:55	Verification	Supplementary monitoring undertaken – noise remains elevated.
22:00	Trigger	Real time noise monitoring data supports supplementary monitoring observations.
22:00	Response	Shovel 344 and supporting equipment shut down.
22:10	Verification	Supplementary monitoring undertaken – noise remains elevated.
22:15	Response	Excavator 310 and supporting equipment, Shovel 345 and supporting equipment shut down.
22:20	Response	Dozer 516 shut down.
22:25	Verification	Supplementary monitoring undertaken confirms controls introduced are effective. Staged restart of some activity commences.
23:10	Verification	Supplementary monitoring undertaken – confirms controls remain effective – additional equipment is returned to service.
23:30	Verification	Supplementary monitoring undertaken – confirms controls remain effective - no further action required.
01:10	Verification	Supplementary monitoring undertaken – confirms controls remain effective - no further action required.
02:00	Verification	Supplementary monitoring undertaken – confirms controls remain effective - no further action required.
03:25	Verification	Supplementary monitoring undertaken – confirms controls remain effective - no further action required.

Figure 4.6 provides a graphic of the noise roses from the Wambo Road monitor for the night of 24 February 2014. Haul truck delays for the same night are displayed in Figure 4.7.

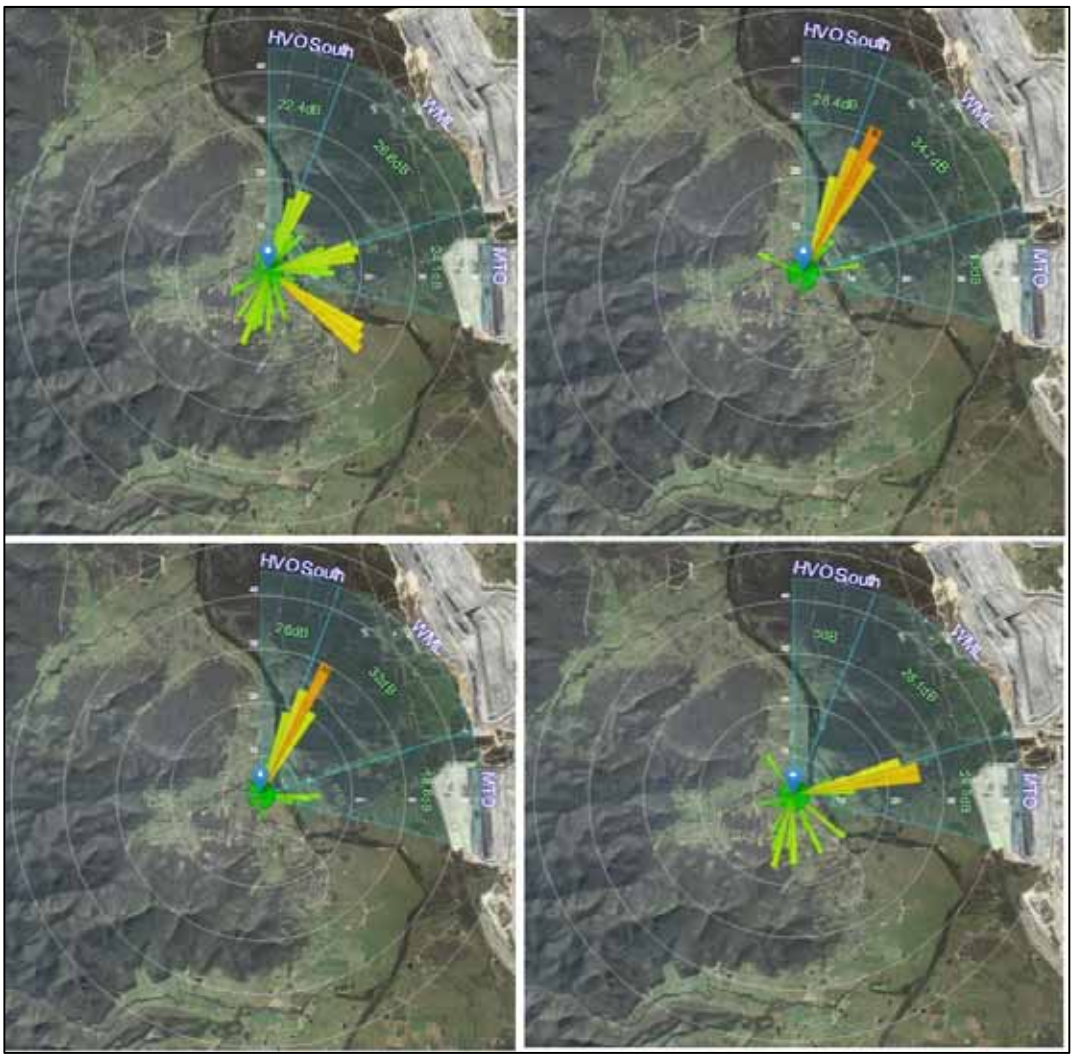


Figure 4.6 **'Noise Rose' graphics from the Wambo Road real-time noise monitor on the night of 24 February 2014. Clockwise from left: 19:40, 21:30, 22:15, 22:50**

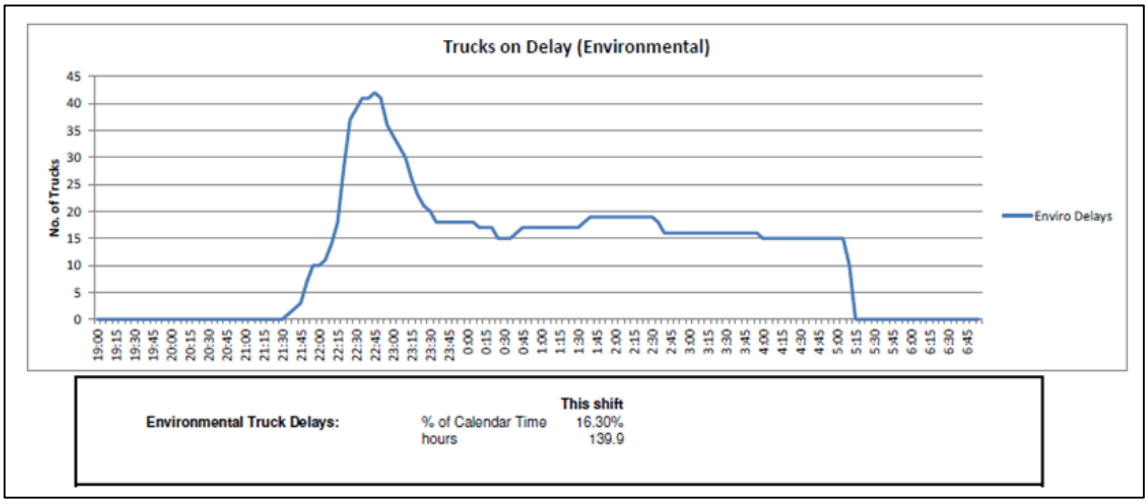


Figure 4.7 Haul truck delays (standby) due to noise on the night of 24 February 2014

4.3.2 Night shift 4 March 2014

Ninety-five pieces of equipment were stood down for a total of 209.6 equipment operating hours on the night of 4 March 2014 after elevated noise was detected through supplementary handheld monitoring at the 'Wollemi Peak Road' monitoring location. Real-time monitoring data supported the observations of the operator conducting the supplementary assessments. Operational modifications were immediately introduced, with follow-up monitoring undertaken to validate and verify the effectiveness of the modifications. Noise levels were verified as below the trigger limit 40 minutes following detection, compliant with the commitments made in the MTW NMP.

Similar to those witnessed on 24 February 2014, meteorological conditions on 4 March were noise enhancing toward Wollemi Peak Road during the period of elevated noise at Wollemi Peak Road (easterly and south-easterly winds). However, again, meteorological conditions were such that the consent noise criteria did not apply (winds >3m/sec for the majority of the period between 8:00pm and 10:00pm). Despite this, significant operational modifications were made to ensure noise remained below criteria so as to minimise impacts on surrounding residents as detailed in Table 4.3.

Table 4.3 Summary of actions implemented on 4 March 2014

Time	Trigger / response / verification	Details
19:40	N/A	Supplementary monitoring undertaken at Wollemi Peak Road – WML noted as inaudible.
20:30	N/A	Supplementary monitoring undertaken at Wollemi Peak Road – WML noted as inaudible.
20:43	Trigger	Complaint received from the Wollemi Peak Road area.
20:55	Trigger	Complaint received from the Wollemi Peak Road area.
21:15	Trigger	Supplementary monitoring undertaken at Wollemi Peak Road detects elevated noise from WML.
21:27	Trigger	Complaint received from the Wollemi Peak Road area.
21:40	Response	Shovel 344 and supporting equipment shut down.
		Excavator 313 and supporting equipment shut down.
21:45	Verification	Supplementary monitoring undertaken at Wollemi Peak Road – noise remains elevated.

Table 4.3 Summary of actions implemented on 4 March 2014

Time	Trigger / response / verification	Details
22:05	Response	Site shutdown (with the exception of Draglines, Drills, and equipment handling reject material on the eastern side of the operation).
22:10	Verification	Supplementary monitoring undertaken at Wollemi Peak Road - confirms controls introduced are effective.
22:30 – 01:20	Verification	Six supplementary monitoring events undertaken at Wollemi Peak Road - confirms controls remain effective.

Figure 4.8 and Figure 4.9 provide noise roses and haul truck delays details respectively.

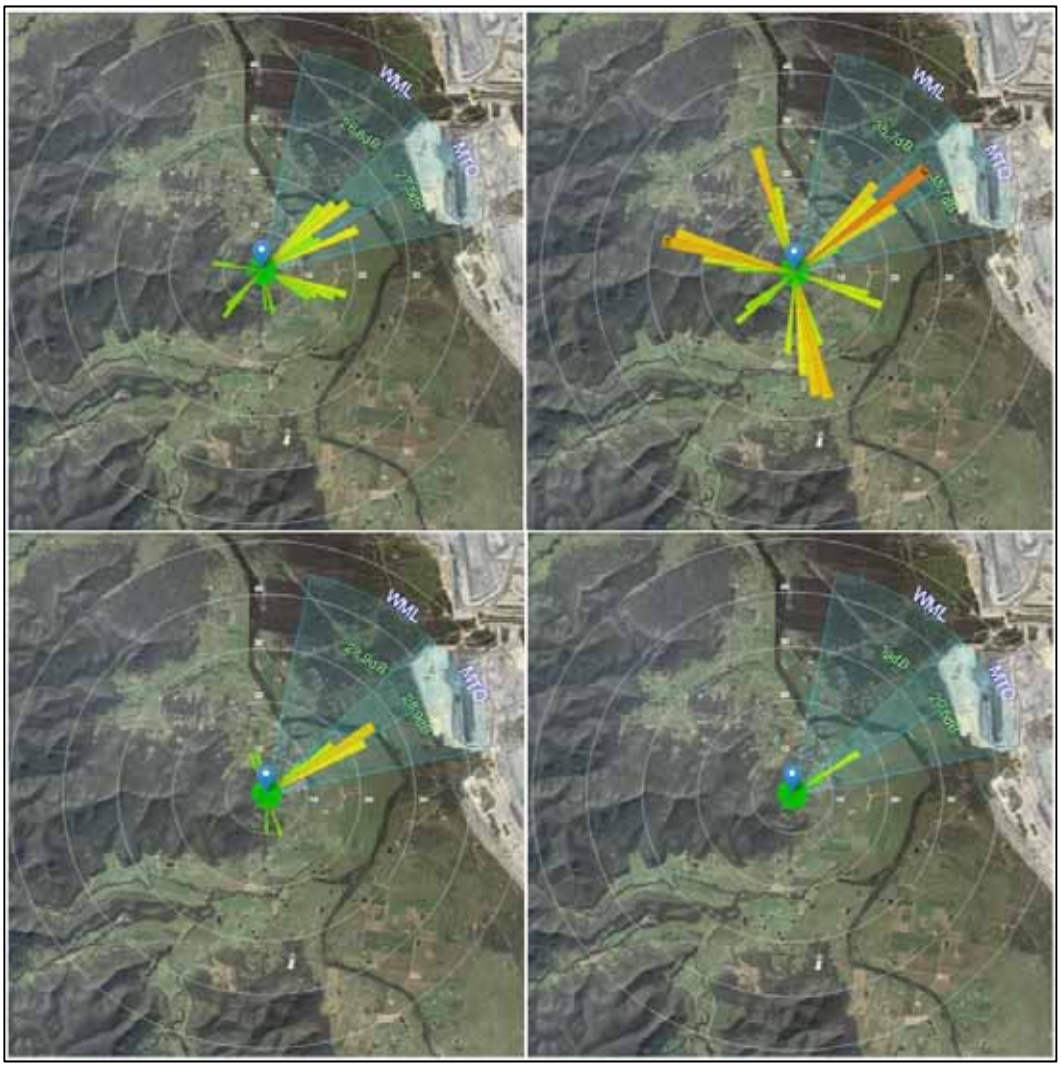


Figure 4.8 'Noise Rose' graphics from the Wollemi Peak Road real-time noise monitor on the night of 4 March 2014. Clockwise from left: 20:00, 21:15, 22:55, 00:50 (5th March)

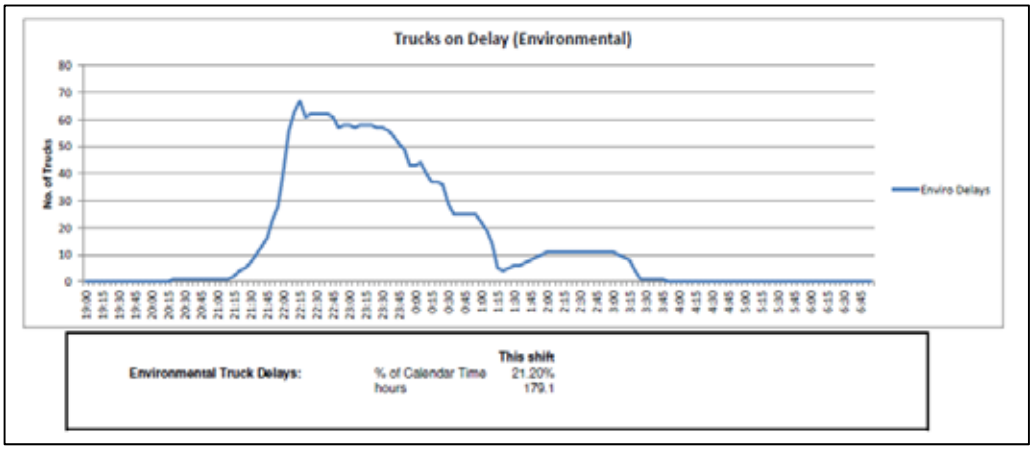


Figure 4.9 Haul truck delays (standby) due to noise on the night of 4 March 2014

4.3.3 Night shift 17 March 2014

Sixty-eight pieces of equipment were stood down for a total of 153.9 equipment operating hours on the night of 17 March 2014 after elevated noise was detected through supplementary handheld monitoring at the 'Wambo Road' monitoring location. Operational modifications were immediately introduced, with follow-up monitoring undertaken to validate and verify the effectiveness of the modifications. Noise levels were verified as below the trigger limit 45 minutes following detection, compliant with the commitments made in the MTW NMP. Real-time noise monitoring data was not available at the time due to a network malfunction.

Meteorological conditions on the night assisted noise propagation toward the Bulga village area (light winds, blowing from the south).

A summary of noise management activities undertaken is presented in Table 4.4.

Table 4.4 Summary of actions implemented on 17 March 2014

Time	Trigger / response / verification	Details
20:30	N/A	Supplementary monitoring undertaken at Wambo Road – WML noted as audible but well below trigger limit.
21:30	N/A	Supplementary monitoring undertaken at Wambo Road – WML noted as audible but well below trigger limit.
22:50	N/A	Supplementary monitoring undertaken at Wambo Road – WML noted as audible but well below trigger limit.
00:10	Trigger	Supplementary monitoring undertaken at Wambo Road detects elevated noise from WML.
00:15	Response	Excavator 312 and supporting equipment shut down.
		Excavator 313 and supporting equipment shut down.
00:25	Verification	Supplementary monitoring undertaken at Wambo Road – noise remains elevated.
00:30	Response	Shovel 344 and supporting equipment shut down.
		Excavator 393 and supporting equipment shut down.
		Front End Loader 649 and supporting equipment shut down.
00:40	Verification	Supplementary monitoring undertaken at Wambo Road – noise remains elevated.

Table 4.4 Summary of actions implemented on 17 March 2014

Time	Trigger / response / verification	Details
00:40	Response	Shovel 345 and supporting equipment shut down.
		Dozer 579 shut down.
00:55	Response	Dozer 518 shut down.
00:55	Verification	Supplementary monitoring undertaken at Wambo Road - confirms controls introduced are effective.
		Dozer 519 shut down.
02:05 – 04:50	Verification	Nine supplementary monitoring events undertaken at Wambo Road – confirms controls remain effective.

Figure 4.10 describes the haul truck delays for the night.

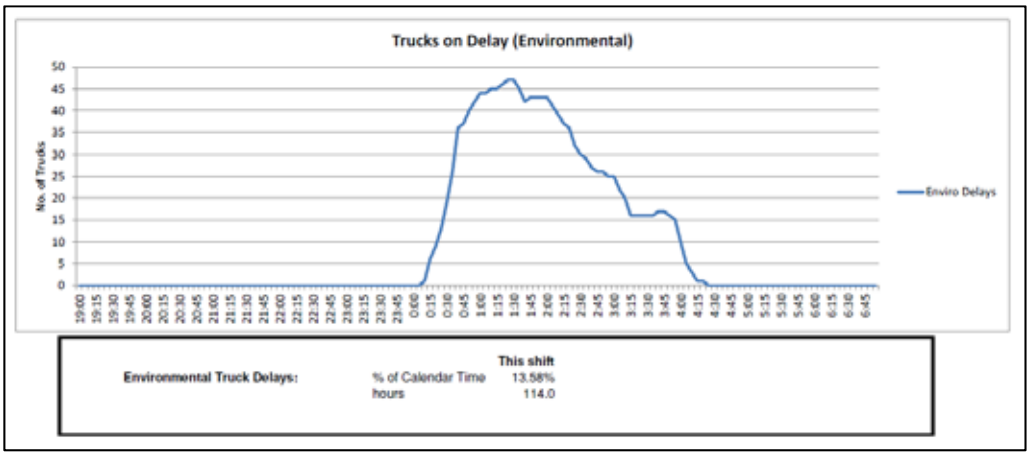


Figure 4.10 Haul truck delays (standby) due to noise on the night of 17 March 2014

5 Continuous improvement - acoustic management

MTW is committed to reasonable and feasible continuous improvement and is currently working towards implementing a predictive modelling interface (PMI) and alternative real-time noise monitoring technology as described below.

5.1 Predictive Modelling Interface

MTW is in the process of developing a PMI which allows for proactive planning of mining operations and weather conditions as a leading measure for managing noise emissions. The PMI utilises predictive meteorological forecast data coupled with detailed mine plans and equipment sound power level information to predict noise levels at residences. The PMI is currently being refined and is expected to be fully integrated into day-to-day operations.

5.2 Development and installation of alternate real-time noise monitoring technologies

MTW is also in the process of investigating alternate noise monitoring technologies to assist with operational control. During 2012 MTW committed capital funding to build and install a first of class directional noise monitor, known as 'environmental noise compass' (ENC) in the Bulga village area. The ENC was installed late December 2013 and is currently collecting data. The ENC aims to accurately pinpoint and identify noise emissions from multiple sources in real-time, to a greater level of accuracy than existing directional noise monitoring technology. This technology is expected to provide additional noise management value to MTW and is considered a first in noise management in NSW. A picture of a typical unit is provided in Figure 5.1.

Figure 5.1 Typical image of the Environmental Noise Compass (ENC)

6 Compliance history

Compliance assessment monitoring for MTO has been undertaken in a number of forms during the period 2004 to 2014 including:

- routine compliance assessment (Global Acoustics) – 2004 to present and in more recent years, monitoring has included low frequency noise assessment;
- Long Point supplementary monitoring program (EMM) – June to October 2011; and
- independent review of noise impacts – Bulga (Sinclair Knight Merz) – December 2011 and January 2012.

An assessment of monitoring data (publically available via the Rio Tinto Coal Australia website www.riotintocoalaustralia.com.au) demonstrates predominant compliance with noise criteria has been achieved throughout the life of the mine.

7 Properties surrounding the mine

A total of 221 privately owned residential locations were identified within proximity of the mine that will be potentially exposed to noise from the proposal. These assessment locations are listed in Appendix A and illustrated in Figures 7.1 and 7.2. The locations are numbered in accordance with the numbering system adopted in the EIS which is consistent with all supporting technical studies of the proposal. It should be noted that mine owned properties are not included in this list. The INP (page 58) defines a receiver as:

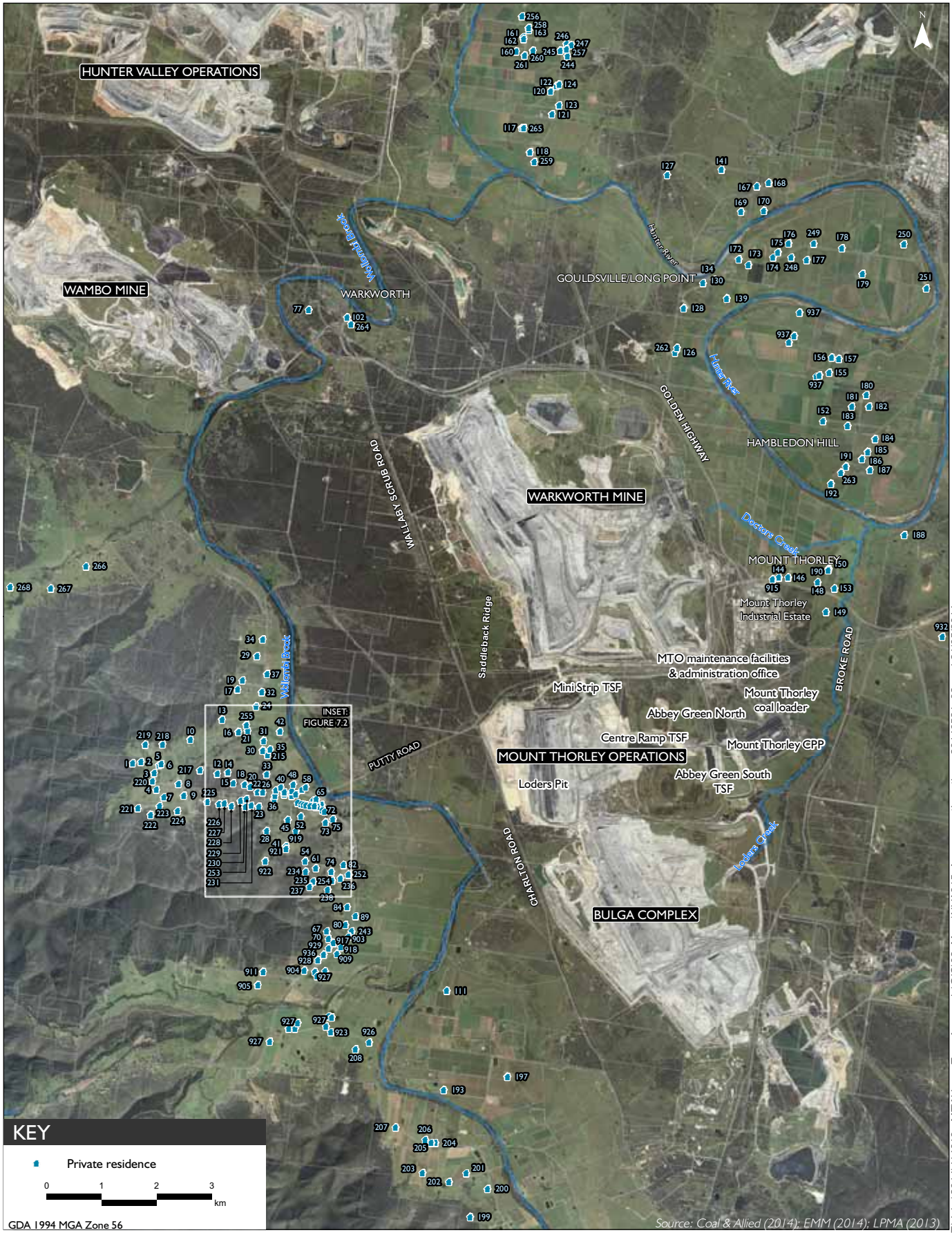
> *"The noise sensitive land use at which noise from a development can be heard."*

Such mine owned properties can be vacant or tenanted with mine staff or persons that have agreements with the mines relating to noise amenity or other emissions. Mine owned residential properties therefore are not considered 'noise sensitive' as defined in the INP. Further, the INP states:

> *"It will be used as a guide by Environment Protection Authority (EPA) officers for setting statutory limits in licences...."*

Such statutory limits have not in the past been set on non-private dwellings/properties by EPA or by NSW DP&E.

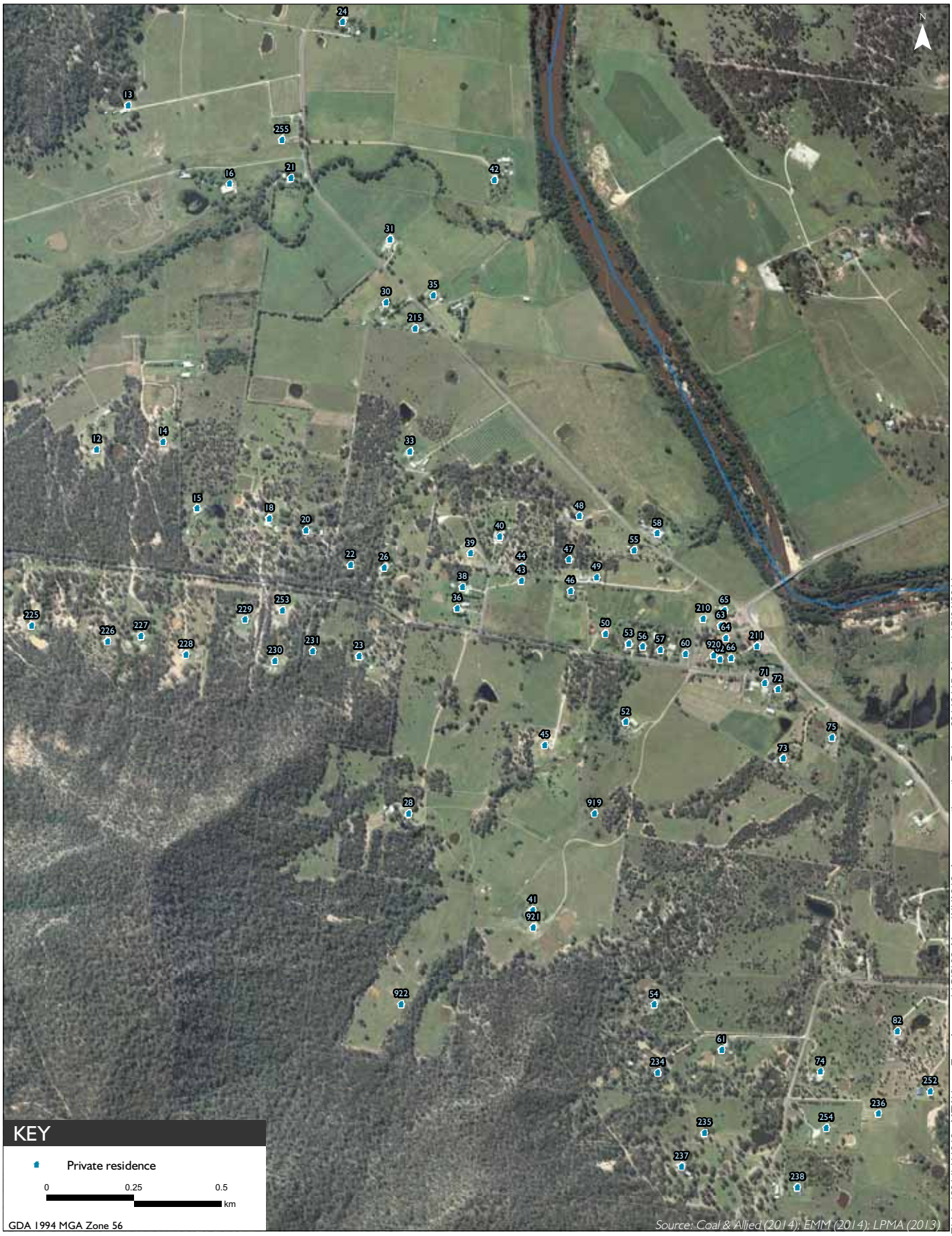
The locations of residences were identified by the applicant using land ownership registrations, aerial photographical images and, where possible, verification in the field limited to publicly accessible locations. It may be possible due to limitations of the mapping process that some properties have been missed or others incorrectly identified as a residence when they are in fact a non-residing building on a privately owned lot (eg shed). Notwithstanding the assessment locations identified are considered representative of all residential locations and catchments surrounding the Site.



Assessment locations

Mount Thorley Operations
Noise and vibration assessment

Figure 7.1



Assessment locations - Bulga

Mount Thorley Operations

Noise and vibration assessment

Figure 7.2

8 Existing acoustic environment

8.1 Bulga background noise review

An extensive data gathering and analysis process was completed using six real time noise monitors in Bulga. The purpose of the monitoring was to quantify the background noise level for which the INP intrusiveness criteria should be set. For an impact assessment, the INP requires the assessment of noise levels that exclude influence on derived representative background noise levels from the Site's existing operations. However, noise from other existing mines in the area are included in the background analysis as per the INP.

This was made possible by the use of noise loggers with directional filtering functionality, and for all locations the BarnOwl logger from SoundScience was used. The BarnOwl's directional L_{eq} data was used to filter influences on the total L_{90} (or background noise metric). That is, L_{eq} noise (of 34 dB(A) or greater) from the direction of MTO that could inflate total L_{90} to levels above 30 dB(A) (the INP's minimum threshold value) were removed from analysis.

The results of the long term background noise monitoring are summarised as rating background levels (RBLs in accordance with the INP) in Table 8.1 for all six locations A to F (refer to Figure 8.1). The data used in the exercise was collected between November 2012 and August 2013. RBLs are shown for day, evening and night assessment period as required by the INP. The assessment background levels (ABLs) determined in accordance with the INP that were used to derive the RBL data is provided in Appendix E. The quantity of data collected for the background noise survey is substantially greater than the INP's required minimum of seven days and, therefore, provides a much more comprehensive representation of the repeatable RBL value at each location.

Table 8.1 Representative background noise levels for Bulga (RBL as per INP)

Location	Period (Duration)	RBL, dB(A)		
		Day	Evening	Night
A. Wollemi Peak Rd	20/06/13 - 14/08/13 (3 months)	33	33	34
B. 367 Wambo Rd	01/12/11 - 29/11/12 (11 months)	30	33	34
C. 128 Wambo Rd	29/11/12 - 31/07/13 (8 months)	33	37	33
D. 193 Inlet Rd	01/12/11 - 28/05/12 (6 months)	30	32	31
E. 339 Inlet Rd	18/03/13 - 30/06/13 (3.5 months)	30	30	30
F. Scout Hall (Putty Rd)	01/12/11 - 04/09/12 (10 months)	33	37	36

Notes: *1. Location E data show RBLs at or below the INP minimum of 30 dB(A)) for some assessment periods, and hence 30 dB(A) was adopted as per the INP across all three assessment periods.*

2. The RBL is as defined in the INP, ie the median value of all ABLs. The ABL is also as per the INP, ie the lower 10^{th} percentile of L_{90} values.

Table 8.1 demonstrates relatively higher background noise at locations A, C and F. These locations are in relatively more exposed locations to the mines, Putty Road or the centre of Bulga than the other three locations (refer to Figure 8.1).

An analysis of the RBLs was completed for unfiltered data (ie whereby MTO source direction was included) and it was found that RBL values are 1 dB to 3 dB higher at most locations for certain periods. For example, at the three locations exhibiting RBLs higher than the INP minimum of 30 dB(A), the unfiltered data shows the following RBLs:

- A. Wollemi Peak Rd - 34 dB(A) day and 35 dB(A) evening and night. That is, 1 dB, 2 dB and 1 dB higher for the day, evening and night respectively;
- C. 128 Wambo Rd - 33 dB(A) day, 37 dB(A) evening and 36 dB(A) night. That is, 3 dB higher at night; and
- F. Scout Hall (Putty Rd) - 33 dB(A) day, 37 dB(A) evening and 35 dB(A) night. That is, 1 dB lower during the night.

The RBL data shows background noise levels are marginally higher during the evening or night at some locations as compared to their corresponding daytime values. This is likely a result of enhancement of neighbouring mine noise from influences of weather conditions. This is shown at five of the six locations monitored and therefore strongly supports a proposition that weather enhanced mine noise is likely during times when temperature inversion conditions exist for example. This should be taken into consideration when reviewing the impact assessment of the proposal.

Notwithstanding higher background noise levels during the evening and night as compared to the daytime, the INP's application notes have been conservatively adopted to determine the final RBL for the six locations as follows:

- A. Wollemi Peak Rd 33 dB(A) day, evening and night;
- B. 367 Wambo Rd 30 dB(A) day, evening and night;
- C. 128 Wambo Rd 33 dB(A) day, evening and night;
- D. 193 Inlet Rd 30 dB(A) day, evening and night;
- E. 339 Inlet Rd 30 dB(A) day, evening and night; and
- F. Scout Hall (Putty Rd) 33 dB(A) day, evening and night.

As shown above, three of the locations (B, D and E) have the INP's minimum threshold background value of 30 dB(A). These locations are relatively more removed from industrial sources (the mines), local road traffic and are further away from the central part of Bulga village, as compared to the other three locations.

The three locations where an RBL of 33 dB(A) is found, is consistent with the data in the Environmental Impact Statement for the Extension of Warkworth Coal Mine (August 2002) (Warkworth EIS 2002) for location N6 in that document, being the central area of Bulga village. Location F herein aligns approximately with location N6 in the 2002 study. Similarly, location N5 in the 2002 study aligns approximately with location B herein and represent the northern parts of Bulga on Wambo Road. These two sites demonstrate a consistent background noise level of 30 dB(A) in both studies.

As shown in Figure 8.1, the six locations are well dispersed across the Bulga area and therefore provide representative data for all residences in the area. Hence, this data was adopted for all Bulga residences based on a specific property's proximity to influencing noise sources in the environment (eg the mines to the east, Putty Road and the central part of Bulga village) as compared with one of the six monitoring locations' proximity to these sources.

The background noise levels assigned to each assessment location are illustrated in Figures 8.2 and 8.3. Where assessment locations are not in proximity to a noise logger and no data exists, the INP minimum of 30 dB(A) is conservatively assumed.

Also, given the differences in calculated RBL at locations D and F at Bulga, a transition of the RBL was developed along this orientation east to west. On the basis that mine noise was one of the main influences on background noise in the area, the transition was developed from demonstrated changes in predicted noise levels for MTO and Bulga mines (as published in their most recent assessments).

This interpolation of the RBL results in a relatively smoother transition in RBL values across this area and more fairly assigns corresponding criteria to adjoining neighbours. This approach minimises the situation often found where one property has a marked step increase in RBL and therefore criteria than their immediate neighbour, or in other words the problematic 'line-in-the-sand' delineation of criteria which often results in different zones of impact (eg one property is assigned treatment while their neighbour is not).

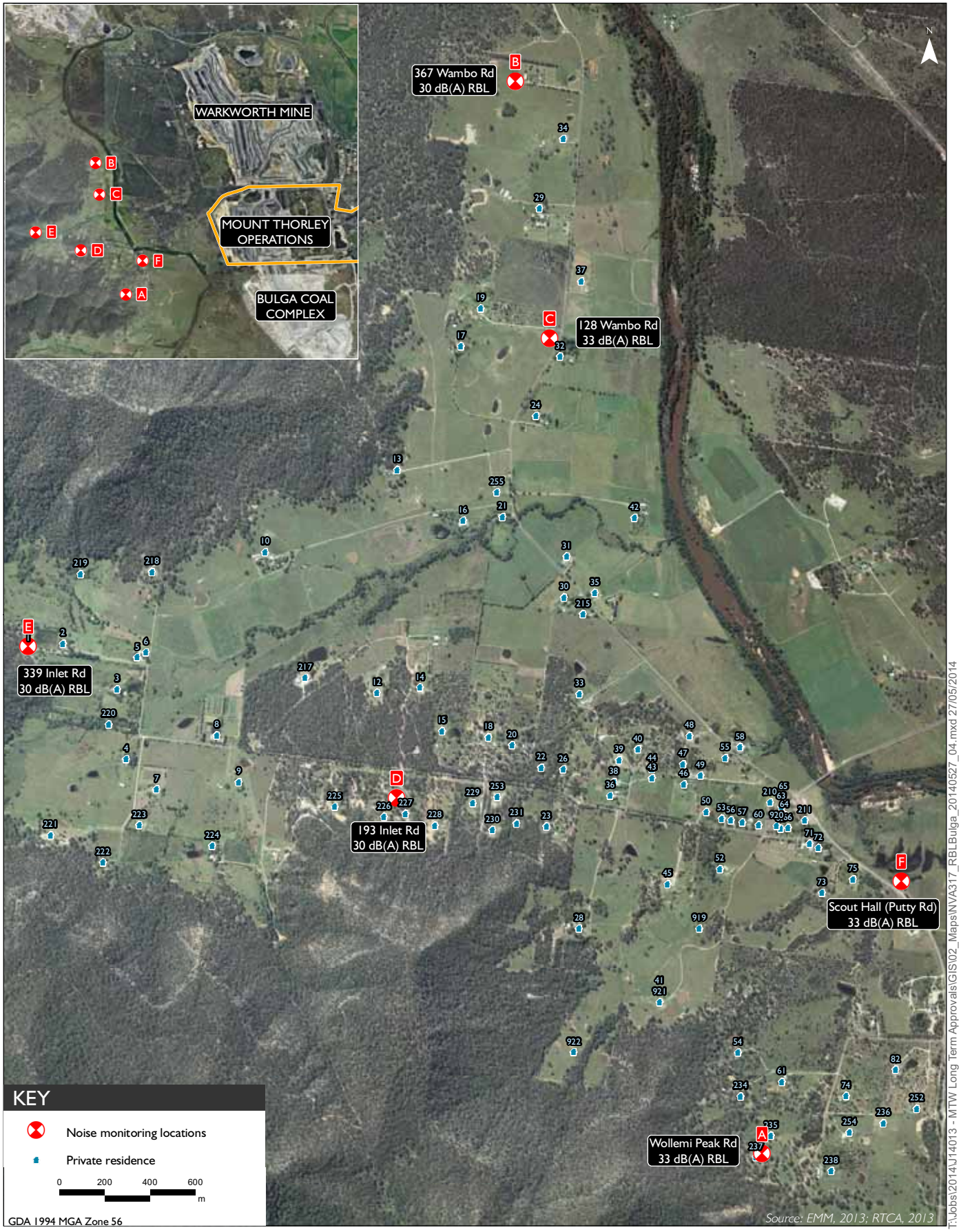
8.2 Background noise levels at other localities

The historic data contained in the Warkworth EIS, 2002 includes RBL data as per the INP for Hambledon Hill, Gouldsville, Long Point Road and Warkworth village. The corresponding RBL values for these locations are as follows:

- Hambledon Hill (east of WML) 30 dB(A) day, evening and night;
- Gouldsville Road (north east of WML) 33 dB(A) day, evening and night;
- Long Point Road (further north east of WML) 30 dB(A) day, evening and night; and
- Warkworth village (north west of WML) 33 dB(A) day, evening and night.

For residences of Maison Dieu to the north of MTO and Warkworth Mine, in the absence of suitable long term monitoring data, background noise levels consistent with the INP's minimum threshold value of 30 dB(A) has been conservatively adopted. It is probable that background noise levels are higher due to Hunter Valley Operations South mine and other industry to the north of these residences.

The other group of residences considered are those located in relative proximity to the Mount Thorley Industrial area to the south east of Warkworth Mine. Background or RBL data at these locations is not documented in any literature in the public domain. It is expected that these properties would be influenced by industrial noise from the nearby industrial estate, including the Mount Thorley coal loader and associated rail operations, as well as MTO. Further, some properties in this vicinity do not have operational noise limits in either Warkworth Mine or MTO's development consent. They do, however, have existing acquisition rights due to impacts from the mines. These are locations 144, 146 and 915 (915 is on the same lot as 144 and hence the same acquisition limit is adopted). Furthermore, existing acquisition consent noise limits for these properties differ for Warkworth Mine and MTO. For example, the Warkworth Mine development consent includes an acquisition limit of 44dB(A) for assessment location 144 while the MTO development consent modified in 2012 places location 144 in an 'acquisition on request' list. Hence, RBL values were not assigned to these locations and an assessment is completed against acquisition limits. Those properties in this area that do not have acquisition rights will be assessed conservatively as having the INP's minimum threshold RBL of 30 dB(A) for day, evening and night.

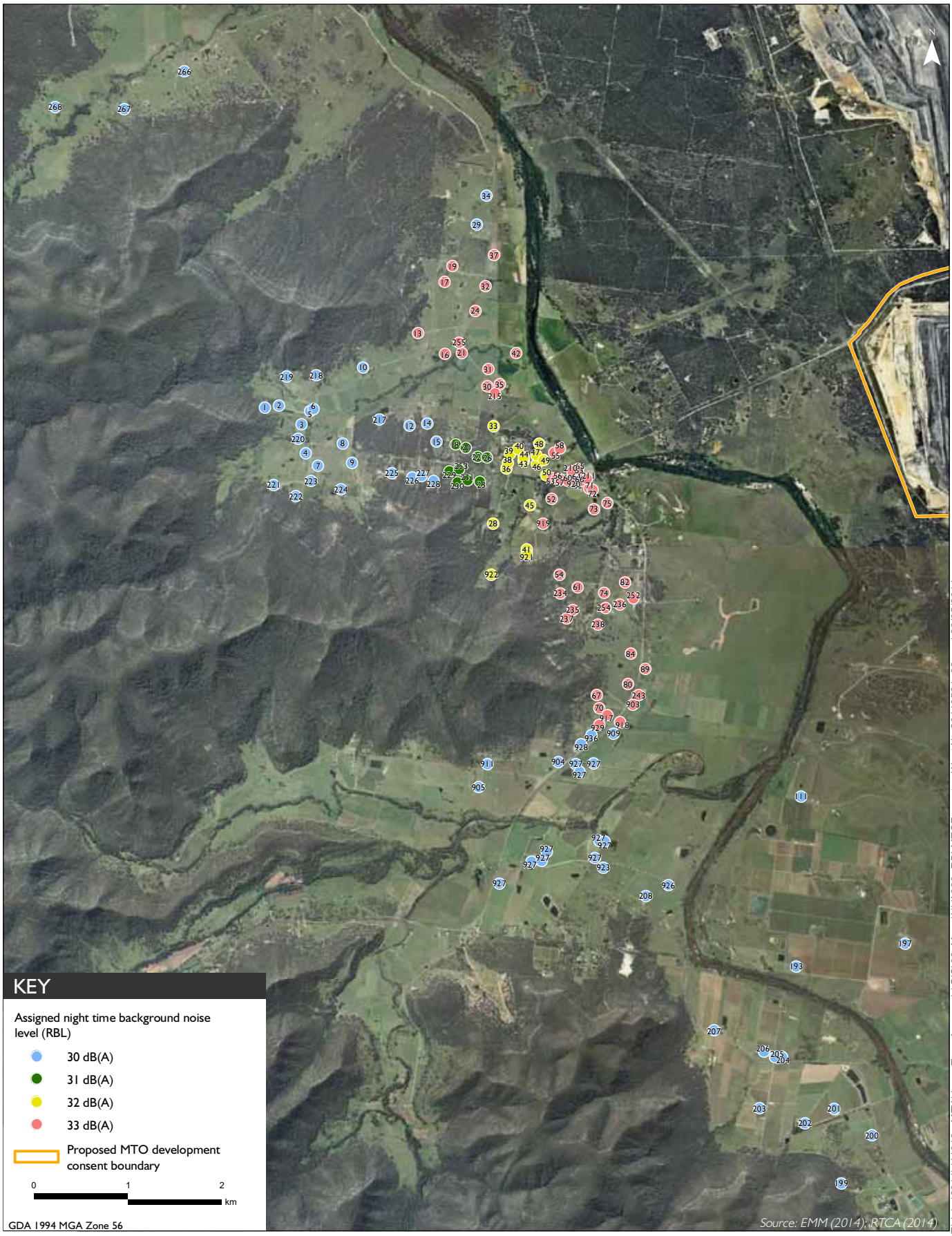


Long-term background noise monitoring locations in Bulga

Mount Thorley Operations

Noise and vibration assessment

Figure 8.1



EMM

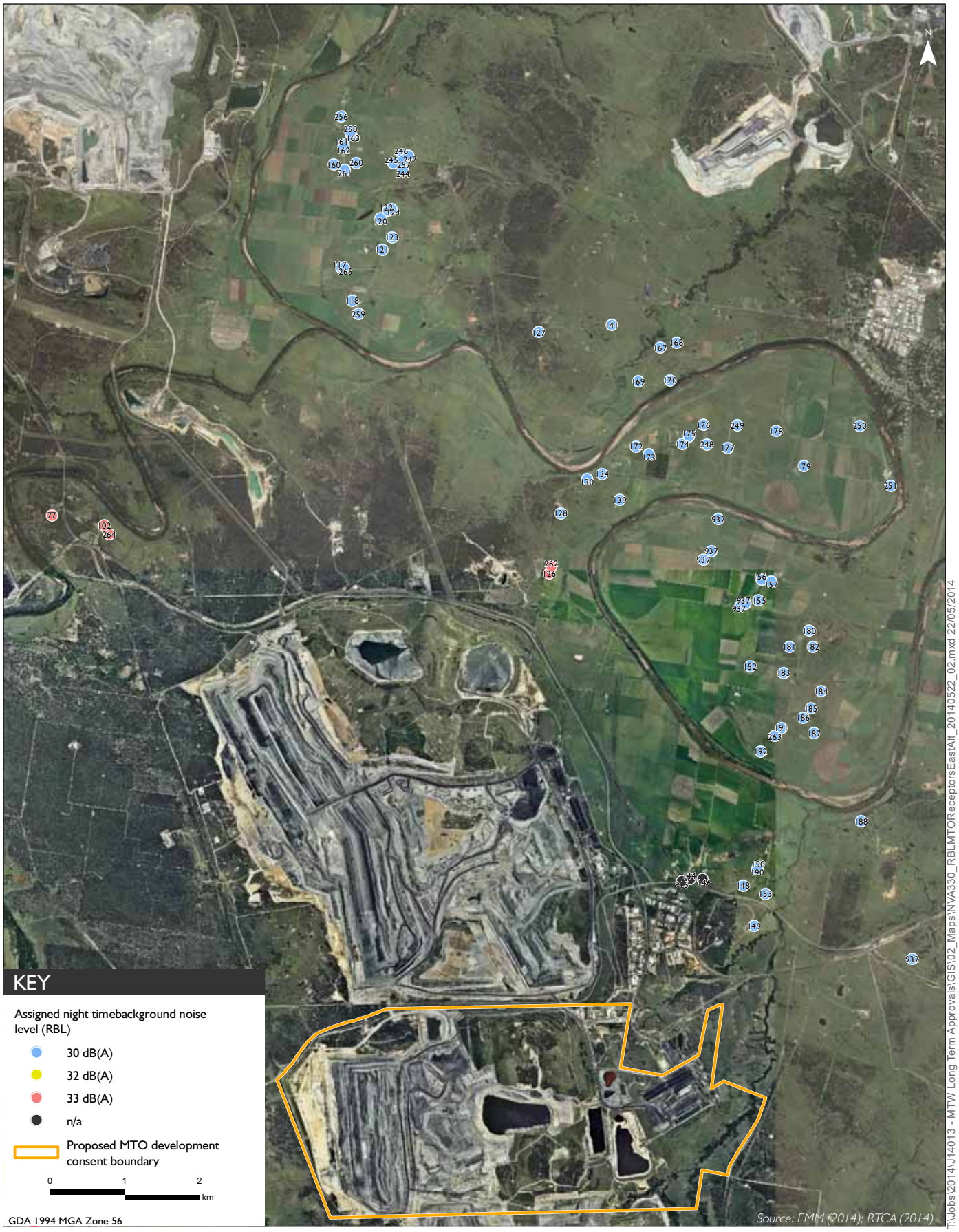
COAL & ALLIED

Assigned night time background noise levels - Western and southern assessment locations

Mount Thorley Operations

Noise and vibration assessment

Figure 8.2



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COAL & ALLIED

Assigned night time background noise levels - Eastern and northern assessment locations

Mount Thorley Operations

Noise and vibration assessment

Figure 8.3

8.3 Local weather patterns

A review was completed of meteorological data from the applicant's Automatic Weather Station (AWS) located at Charlton Ridge. The data was used in determining the above RBL values in accordance with the INP. The data was also statistically analysed to determine seasonal prevailing winds and any correlations with seasonal RBL values. These are noted in Table 8.2 and when reviewed alongside RBL data for example (as provided in Appendix E), the following trends are observed:

- Location A - The monitoring data available at the time was collected during the three winter months in 2013. During winter the winds are predominantly westerly, and therefore the data is considered to be less affected by mine noise than other times in the year. The winter period is also less likely to be affected by wildlife noise (eg insects).

- Location B - There are 11 months of data for this location and hence the long term analysis provides an assessment across all seasons. It is apparent that summer months are influenced by insect noise as evident from the relative flatness and converging L_{90} and L_{eq} levels. The convergence of these noise metrics continues into autumn (eg March 2012), particularly during the night period. The data exhibited a noticeable increase in RBLs for the evening and night periods compared to daytime periods for the warmer months in the year.

- Location C - There is eight months of data analysed for this location, including summer, autumn and most of winter. The RBL values for January, February and March are relatively elevated as compared to other months. The data exhibited a noticeable increase in RBLs for the evening periods for the warmer months in the year. This was likely to be caused by insects and the like based on the relative flatness in the data during the summer months.

- Location D - As for other locations, it is probable that summer months present relatively elevated RBLs as compared to other seasons.

- Location E - Data was recorded during autumn and winter months where prevailing winds were predominantly westerly and hence likely to have kept mine noise at lower levels, resulting in the presented RBLs of 30 dB(A).

- Location F - The data exhibited a noticeable increase in RBLs for the evening and night periods for the warmer months in the year. The influences of seasonal weather and insects provide for a strong justification to assign representative RBLs for each site and period. However this was not the adopted approach and a conservative RBL adopted across all periods.

Table 8.2 Seasonal wind analysis

Season	Month	Comment on predominant winds
Summer	December	Predominantly easterly winds for D, E, N
	January	Predominantly easterly winds for D, E, N
	February	Predominantly easterly winds for D, E, N
Autumn	March	Predominantly easterly winds for D, E, N
	April	Drop in % of easterly winds; 55 % instead of >70%
	May	Westerly winds almost 50% of the time
Winter	June	Westerly winds >50% of the time
	July	Westerly winds >50% of the time
	August	Westerly winds nearly 80% of the time

Table 8.2 Seasonal wind analysis

Season	Month	Comment on predominant winds
Spring	September	Westerly winds almost 50% the time
	October	Increase in % of easterly winds ; nearly 50% on average; 70% in evening
	November	Increase in % of easterly winds ; nearly 50% on average; 88% in evening and 75% at night

Notes: D = Day, E = Evening, N = Night

9 Noise and vibration criteria

9.1 NSW Industrial Noise Policy

The overall aim of the NSW INP is to allow the need for industrial activity to be balanced with the desire for quiet in the community. One of its specific objectives is to establish noise criteria to protect the community from excessive intrusive noise and preserve amenity for specific land uses.

The INP discusses that within the community, there is a very large range of human reaction to noise, including those who are very sensitive to noise. This noise-sensitive sector of the population will react to intruding noises that are barely audible within the overall noise environment, or will have an expectation of very low environmental noise levels. On the other hand, there are those within the community who find living in noisy environments, such as near major industry, on main roads or under aircraft flight paths, an acceptable situation. The bulk of the population lies within these two spectrums, being unaffected by low levels of noise and being prepared to accept levels of noise commensurate with their surroundings.

The criteria in the INP have been selected to protect at least 90% of the population living in the vicinity of industrial noise sources from the adverse effects of noise for at least 90% of the time (refer Section 1.4.1 of the INP "Principles underpinning the noise criteria"). Provided the criteria in the INP are achieved, then it is unlikely that most people would consider the resultant noise levels excessive.

The INP sets two separate noise criteria to meet environmental noise objectives: one to account for intrusive noise and the other to protect the amenity of particular land uses. The intrusiveness of an industrial noise source may generally be considered acceptable if the equivalent continuous (energy-average) A-weighted level of noise from the source (represented by the L_{Aeq} descriptor), measured over a 15-minute period, does not exceed the background noise level measured in the absence of the source by more than 5 dB. The INP requires intrusive noise criterion to be measured over a 15 minute period.

The 15-minute period used for the intrusive noise criterion has been selected as a reasonable estimate of the period over which annoyance may occur. This time period has been used by the EPA for at least the past 14 years when the INP has been in force, and experience has shown that it is a reasonable approach to assessing intrusive noise impacts. Whereas the amenity criterion is measured over a longer time period (ie an entire 11-hour daytime, 4-hour evening or 9-hour night period) and aims to limit cumulative continuing increases in the ambient noise level within an area from industrial noise sources. In assessing the noise impact of industrial sources, both components must be taken into account for residential assessment locations, but, in most cases, only one will become the limiting criterion and form the project-specific noise levels (PSNL) for the industrial source.

9.1.1 Intrusiveness criterion

The intrusiveness criteria are derived in accordance with the INP (ie background plus 5 dB) and are listed in Table 9.3. As will be described later, these become the limiting or PSNL for the proposal.

9.1.2 Amenity criteria

The INP uses the amenity criteria to limit continuing increases in noise levels. It states "Meeting the acceptable noise levels in Table 2.1 will protect against noise impacts such as speech interference, community annoyance and, to some extent, sleep disturbance. These levels represent current best practice for assessing industrial noise sources, based on research and a review of assessment practices used overseas and within Australia."

Most residences in surrounding areas potentially affected by this proposal would be categorised as rural or suburban according to the INP. However, two areas are considered as Urban/Industrial interface. The residential categories as defined in the INP are as follows:

Rural area

> "an acoustical environment that is dominated by natural sounds, having little or no road traffic..*";*

Suburban area

> "an area that has local traffic with characteristically intermittent traffic flows or with some limited commerce or industry";

Urban area

- dominated by 'urban hum' or industrial source noise;
- has through traffic with characteristically heavy and continuous traffic flows during peak periods;
- is near commercial districts or industrial districts;
- has any combination of the above, where 'urban hum' means the aggregate sound of many unidentifiable, mostly traffic-related sound sources; and

Urban/Industrial

> "an area defined as for 'urban' above that is in close proximity to industrial premises and that extends out to a point where the existing industrial noise from the source has fallen by 5 dB. Beyond this region the amenity criteria for the 'urban' category applies. This category may be used only for existing situations".

In the above context, the centre of Bulga is a 'suburban' area while most other assessment locations considered in this assessment reside in 'rural' areas. For this study, categorising residences as rural or suburban is inconsequential since the limiting night time amenity criterion is identical for both categories. Outside of the INP, it is acknowledged that feedback from Bulga residences describe their area as rural rather than suburban.

A relatively small number of residences adjoin the Mount Thorley industrial area and hence their amenity category is better described as urban/industrial interface according to the INP's definition. Similarly, the remaining two residences in Warkworth village are exposed to relatively high industrial noise from Wambo Mine as will be demonstrated in the cumulative assessment later in this report. These two residential areas are therefore assessed as Urban/Industrial interface.

The amenity criterion for each of these categories is given in Table 9.1 (as per Table 2.1 of the INP).

One fundamental difference between the intrusiveness and amenity criteria is that the former is applicable over 15 minutes in any period, while the latter is assessed over the entire duration of the day (7 am – 6 pm), evening (6 pm – 10 pm) or night (10 pm – 7 am) periods.

Table 9.1 EPA residential amenity criteria

Indicative noise amenity area(Residence)	Time of day	Recommended L_{Aeq} noise level, dB(A)	
		Acceptable	Maximum
Rural	Day	50	55
	Evening	45	50
	Night	40	45
Suburban	Day	55	60
	Evening	45	50
	Night	40	45
Urban	Day	60	65
	Evening	50	55
Urban/Industrial interface	Night	45	50
	Day	65	70
	Evening	55	60
	Night	50	55

The INP approach to derivation of amenity noise levels is directly applicable for proposed developments, new to an area with an existing level of industrial noise. Section 2.2.4 of the INP (Assessment in developing areas) clarifies that the acceptable amenity noise levels represent the ideal total level of noise from industry that should be met by a proposed development and any future developments. This section advocates where several developments are proposed, these are to be assessed as a group. It states:

> *"This holistic approach allows project-specific noise levels to be set for a proposed industrial development, so that the total impact from all proposed and potential industrial developments does not cause amenity to deteriorate. In addition, this approach provides an equitable distribution in the burden of meeting the noise criteria."*

As the proposal relates to an existing site that has been present as long or longer than other mines in the area, it is not equitable to assume MTO does not exist (ie and therefore a proposed project) while at the same time assuming other mines do exist. The appropriate method is to adopt a holistic approach as advocated by the INP, particularly given it is highly unlikely that any further developments will contribute to cumulative noise given geographic physical limitations.

The objective of the INP's holistic approach to amenity noise is to satisfy the recommended acceptable noise levels. The strictest of these is the night time acceptable amenity criterion of 40 dB(A), which has been adopted in this assessment for most residences and from all industrial noise sources as per the INP. This is a practical approach in the current situation given the reasons above but also because the neighbouring industrial sites (Warkworth Mine and Bulga Coal Complex) are changing their noise contribution in the area as described in respective environmental assessments. The other instrument that supports this holistic approach is the non-discretionary Mining SEPP described in Section 9.2.

In deriving the amenity target for MTO, the INP does not support and it is not appropriate to ignore MTO's current contribution to the total existing industrial noise levels of the area.

Nonetheless to illustrate the holistic method's appropriateness, we considered several example assessment locations in Bulga to demonstrate whether the intrusive or amenity criteria is the more limiting when ignoring the presence of the existing MTO operations. Table 9.2 demonstrates that all example assessment locations adopt the intrusiveness criteria as the limiting criteria. In one case (location 58) the two criteria have the same target level, but the intrusive value is the more limiting metric.

Table 9.2 EPA residential amenity versus intrusiveness criteria test cases

Assessment location (Area)	Existing Industrial noise[1]	Amenity Criteria			Intrusiveness criteria
	$L_{eq,9hr}$, dB(A)	ANL $L_{eq,9hr}$, dB(A)	Difference, dB(A)	Adjusted criteria $L_{eq,9hr}$, dB(A)	$L_{eq,9hr}$, dB(A)
15 (Bulga)	35	40	5	38	35
26 (Bulga)	36	40	4	38	36
44 (Bulga)	36	40	4	38	37
58 (Bulga)	36	40	4	38	38
77 (Warkworth village)	57	50	-7	40	35
128 (Gouldsville)	37	40	3	40	35
146 (Mount Thorley)	38	50	12	50	N/A
150 (Mount Thorley)	34	40	6	39	35

Notes: 1. In deriving 'existing' noise levels from WML and Bulga mine, the latest noise assessment were adopted. This provides a more realistic quantification of the cumulative impacts when the proposal coincides with neighbouring contributions, which are changing on those of current levels. Existing Wambo mine noise adopted from 2003 EIS. Where locations do not match those listed, the closest neighbouring location was used. HVOS results obtained from the 2003 EIS. An industry accepted approximation between $L_{eq,15min}$ and $L_{eq,9hr}$ of 3dB was adopted.

Assessment location 58

- existing industrial noise level is 36 dB(A) (ignoring the whole of WML and made up of adverse weather results for Bulga mine and MTO as modelled in early years in recent publications as described in the cumulative noise assessment section later in this report);
- the night amenity criteria is derived from Table 2.2 of the INP as 38dB(A)$L_{eq,9hour}$ (or acceptable level 40 dB(A) minus 2 dB);
- the night time intrusiveness criterion for this location is 38 dB(A)$L_{eq,15minute}$; and
- As an $L_{eq,9hour}$ metric, the 38 dB(A) amenity criterion is less stringent than a 38 dB(A) $L_{eq,15minute}$ intrusiveness metric and this would apply across assessment locations of Bulga generally. Since intrusiveness criteria for Bulga residences are 38 dB(A) $L_{eq,15minute}$ or lower, the intrusiveness criteria will be more limiting than amenity criteria.

9.1.3 Summary of criteria approach

Irrespective of the RBL values assigned to specific assessment locations, the amenity criteria sets a noise 'ceiling' for all industrial sites to stop 'noise creep'. This is illustrated in Figure 9.1 using the night time amenity criterion of 40 dB(A)$L_{eq,9hour}$. This is an example only, but shows as each mine comes into existence (Mine 1 to Mine 3 in that order) it is possible that RBL values step up each time as does the corresponding intrusive criteria for each mine. However, this creep effect is at some point stopped by the amenity criteria ceiling as shown because the INP requires that both the intrusiveness and amenity criteria are met.

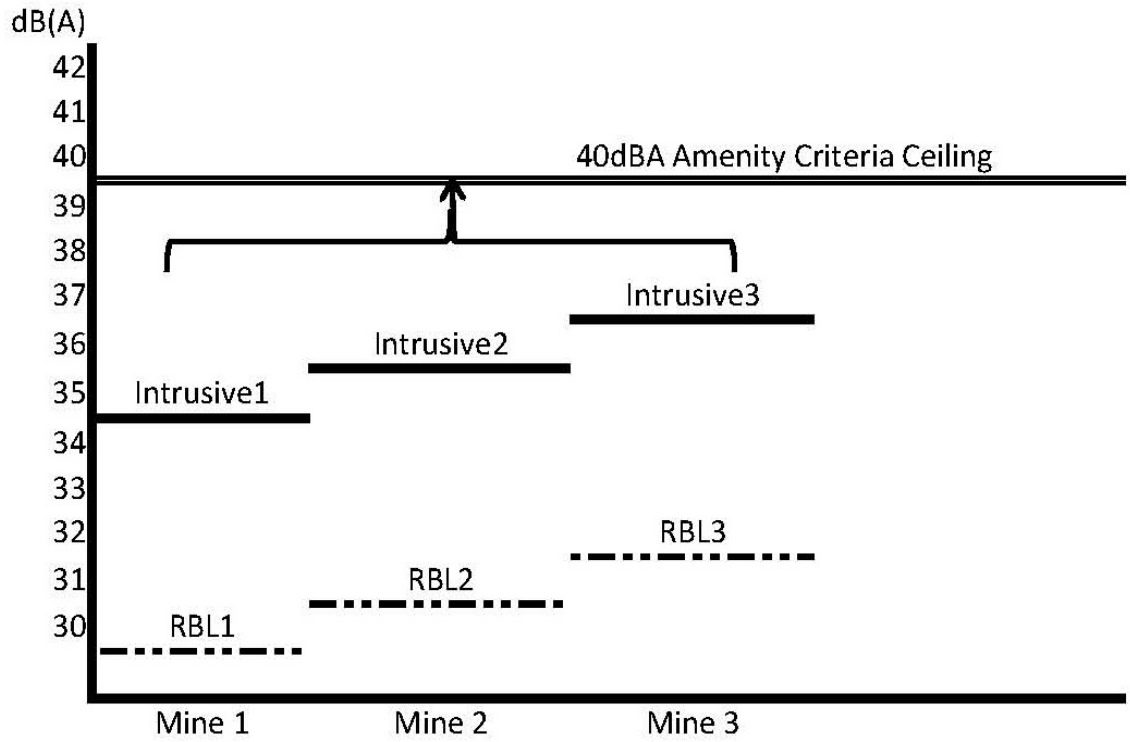


Figure 9.1 Amenity criteria to stop 'noise creep'

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

The State Environmental Planning Policy (Mining, Petroleum Production and Extractive Industries) 2007 (Mining SEPP) includes clause 12AB Non-discretionary development standards for mining. The clauses relevant to this project are listed below.

Clause 12AB(1):

> The object of this clause is to identify development standards on particular matters relating to mining that, if complied with, prevents the consent authority from requiring more onerous standards for those matters (but that does not prevent the consent authority granting consent even though any such standard is not complied with).

Clause 12AB(3) Cumulative noise level:

> The development does not result in a cumulative amenity noise level greater than the acceptable noise levels, as determined in accordance with Table 2.1 of the Industrial Noise Policy, for residences that are private dwellings.

Other clauses of interest for this project are listed below.

Clause 12AB(5) Airblast overpressure:

> Airblast overpressure caused by the development does not exceed:
>
> (a) 120 dB (Lin Peak) at any time, and

(b) 115 dB (Lin Peak) for more than 5% of the total number of blasts over any period of 12 months, measured at any private dwelling or sensitive receiver.

Clause 12AB(6) Ground vibration:

Ground vibration caused by the development does not exceed:

(a) 10 mm/sec (peak particle velocity) at any time, and

(b) 5 mm/sec (peak particle velocity) for more than 5% of the total number of blasts over any period of 12 months, measured at any private dwelling or sensitive receiver.

The cumulative noise clause described in the Mining SEPP is fundamental to this study and is clear in its objective that the holistic approach to amenity is advocated as described earlier.

9.3 Operational noise assessment criteria

Operational noise assessment criteria for the proposal have been set considering the methods described in the NSW INP and the Bulga background noise monitoring review (prepared in accordance with the NSW INP as described in Section 8.1).

Table 9.3 provides the proposed assessment criteria or PSNL for the proposal.

Table 9.3 Noise assessment criteria, dB(A)

Locality	Assessment location	Rating Background Level (RBL)[1]	Intrusiveness criteria, PSNL (RBL+5dB), $L_{eq,15min}$[2]	Derivation of RBL
Bulga	13, 16, 17, 19, 21, 24, 30-32, 35, 37, 42, 52-58, 60-67, 70-75, 80, 82, 84, 89, 210, 211, 215, 234-238, 243, 252, 254, 255, 903, 917-920, 929	33	38	Proximity similar to logger at A,C and F
	28, 33, 36, 38-41, 43-50, 921, 922	32	37	Background set using degradation of noise levels from MTO and Bulga Mine in this region (discussed in Section 8.1)
	18, 20, 22, 26, 23, 229, 230, 231, 253	31	36	Background set using degradation of noise levels from MTO and Bulga Mine in this region (discussed in Section 8.1)
	1-10, 12, 14, 15, 29, 34, 217, 218-223, 224-228	30	35	Proximity similar to logger at B, D or E
	266-268, 904, 905, 909, 911, 927, 928, 936	30	35	RBL not available - assumed minimum
Gouldsville/ Long Point	126, 262	33	38	RBL From 2002 EIS location N2
	128, 130, 134, 139, 172-179, 248, 249	30	35	RBL assumed from 2002 EIS location N3
	127, 141, 167-170, 250, 251	30	35	RBL not available - assumed minimum
Hambledon	152, 155-157, 180-187, 191,	30	35	RBL from 2002 EIS location N6

Table 9.3 Noise assessment criteria, dB(A)

Locality	Assessment location	Rating Background Level (RBL)[1]	Intrusiveness criteria, PSNL (RBL+5dB), $L_{eq,15min}$[2]	Derivation of RBL
Hill/Wylies Flat	192, 263, 937			
Maison Dieu	117, 118, 120-124, 160-163, 244-247, 256-261, 265	30	35	From HVOS Coal Project EA 2008
Milbrodale	111, 193, 197, 199-208, 923, 926	30	35	RBL not available - assumed minimum
Mount Thorley	144, 146, 915	n/a[3]	n/a[3]	RBL not available.
	148-150, 153, 188, 190, 932	30	35	RBL not available - assumed minimum
Warkworth	77, 102, 264	33	38	RBL assumed from 2002 EIS location N4

Notes: *1. Rating background level, or RBL, derived in accordance with the INP as described in Section 8.*

2. Intrusiveness criteria is equal to the measured RBL + 5 dB.

3. RBLs without influence from the Site are not available and existing consent do not specify operational limits (only acquisition limits are provided in the existing consent). These locations have been previously identified as impacted by the Site.

9.4 Zones of impact

Section 1.4.8 of the INP describes zones of impact from industrial noise. It states "The various assessed levels of impact around an industrial noise source could be described as a zone of affectation, characterised by annoyance. Within this zone could lie a much smaller zone closer in to the source where impacts were greater and justified acquisition of residences. The border between the annoyance and acquisition zones would be represented by a noise level well above both background level and the EPA's criteria."

The commonly applied approach to zones of impact accepted by the NSW DP&E is provided below.

9.4.1 Noise management zone

The noise management zone is where modelled noise levels are above the PSNL but below the acquisition criteria (described later in Section 9.4.2). Within the management zone, receptors may experience noise levels up to 5 dB(A) above the PSNL. Depending on the degree of potential impact above the PSNL (1 to 5 dB), noise impacts in the noise management zone could range from minor (1 to 2 dB) to moderate (3 to 5 dB). For contemporary planning approvals for mining projects in the NSW, DP&E has prescribed the following actions in the conditions of approval:

- prompt response where issues of concern are raised by community;
- noise monitoring onsite and within the community at representative locations;
- consideration of on-site noise mitigation measures and plant maintenance procedures by the mine and where appropriate sound suppression components and preventative maintenance;
- investigation of, and where practical and cost-effective, acoustical treatment/mitigation at receptors where levels are 3 to 5 dB above PSNL (typically referred to as the 'mitigation zone').

The INP at Section 8.2 'Negotiation between proponent and regulator' states

> Where proposed mitigation measures will not reduce noise levels to the project-specific noise levels, the proponent should seek to negotiate with the regulatory/consent authority to demonstrate that all feasible and reasonable mitigation measures have been applied. The regulatory/consent authority can choose to accept the level of impact proposed, or negotiate for a better level of control where this is considered achievable.
>
> Where, in the final analysis, the level of impact would still exceed the project-specific noise levels, the economic and social benefits flowing from the proposed development to the community should be evaluated against the undesirable noise impacts.
>
> Where it can be demonstrated by the proponent that the development offers net benefits, a regulatory consent authority may consider these as grounds for applying the achievable noise levels, rather than the project-specific noise levels, as the statutory compliance limit.

9.4.2 Noise affectation zone

The noise affectation zone applied by DP&E is where noise levels are more than 5 dB over the PSNL. Implementation of the following measures may be required:

- discussions with relevant property owners to assess concerns and provide solutions;
- implementation of acoustical mitigation at receptors; and
- negotiated agreements with property owners, or acquisition of the property by the applicant upon request by the property owner.

9.5 Cumulative noise

In addition to considering the individual impact of the proposal on residences, the INP also requires an assessment of the proposal's contribution to the total, or cumulative noise received by any particular residence from all industrial operations.

The cumulative noise impacts resulting from the proposal are most appropriately assessed in the context of the amenity criteria listed in Table 9.1. The assessment of cumulative impacts is presented in Section 11. This approach is consistent with the INP's approach to the assessment of cumulative noise.

9.6 Sleep disturbance

The operational criteria described in Sections 9.1, which consider the average noise emission of a source over 15 minutes, are appropriate for assessing noise from steady-state sources, such as engine noise from mobile plant and other equipment. However, noise from sources such as reversing alarms or track plates is intermittent (rather than continuous) and, as such, needs to be assessed using the L_1 or L_{max} noise metrics. Such criteria is provided in the INP application notes which can be found on the EPA website (http://www.epa.nsw.gov.au/noise/applicnotesindustnoise.htm).

The most important potential impact of intermittent noise to be considered is sleep disturbance of nearby residents. While the INP does not specify a criterion for assessing sleep disturbance, various studies including the EPA's *Road Noise Policy* (RNP) (DECCW 2011) indicate that levels below 50 to 55 dB(A) inside homes are unlikely to wake sleeping occupants. If bedroom windows are open, this corresponds to an external maximum noise level of approximately 60 to 65 dB(A) L_{max}. Similarly, the World Health Organisation (WHO 1999) suggest that levels below 45 dB(A) inside homes are unlikely to wake sleeping occupants. It is noted that the WHO criterion applies under the assumption that windows are closed.

However, the EPA's current position on sleep disturbance, is that maximum (L_{max}) noise from industrial sources should not exceed background (or RBL) plus 15 dB. Based on a night time RBL of between 30 dB(A) and 33 dB(A (refer to Section 8), this assessment has adopted an external sleep disturbance criterion of 45 dB(A) to 48 dB(A) L_{max} for residences as applicable.

Where the sleep disturbance criterion is satisfied, sleep disturbance is unlikely. But where it is not met, a more detailed analysis is required. The detailed analysis should quantify the extent of impacts, including levels of exceedance above the criterion and the duration and the number of events that may occur.

9.7 Low frequency noise

Low frequency noise (LFN) has been raised as an issue by surrounding residences of MTO in previous consultation undertaken as part of normal noise management activities and also as a part of the social impact assessment consultation being undertaken for this EIS. MTO has listened to this feedback and to consider this issue EMM have completed three different methods of assessment for LFN as detailed below. These include the INP, 'Broner' and the Department of Environment Food and Rural Affairs (DEFRA) (UK) methods.

9.7.1 Industrial Noise Policy

Section 4 of the INP provides guidelines for applying 'modifying factor' adjustments to account for low frequency noise emissions. The INP states that where there is a difference of 15 decibels or more between the measured 'C' weighted (dBC) and measured 'A' weighted (dBA) levels, then a correction factor of 5 dB is applicable to the measured noise at the assessment location.

The INP's LFN criteria are being reviewed in light of challenges in practice at large distances from sources. For example, sounds that do not pose low frequency dominated spectra at close range, would by virtue of enough distance loss factors, inappropriately attract the INP penalty for low frequency as higher frequencies in their spectra are considerably more abated than the lower frequencies. The INP LFN criteria were originally intended for testing sources at relatively close range.

A letter prepared by the NSW Ombudsman (dated 22 January 2014) to DP&E relating to the subject site and the INP's approach to LFN, is attached in part as Appendix F. This document notes that: the DP&E (formerly DPI) and EPA (formerly OEH) agrees on the technical merits on the difficulty in applying the LFN modifying factor in rural areas; EPA have commissioned a comprehensive study on LFN as part of the revision of the INP; that EPA would not include conditions about LFN in an Environmental Protection Licence (EPL); and a review of the INP will be conducted with LFN being a priority issue.

The letter shows that the Environment Defenders Office (EDO) forwarded a complaint on behalf of the Bulga Milbrodale Progress Association Inc. (BMPA), about the DP&E's decision to refuse to apply LFN data in accordance with the Industrial Noise Policy (INP) and condition of consent for Mount Thorley and Warkworth coal mines, to the NSW Ombudsman.

The results of this complaint, were contained in the letter to DP&E. A copy of this was obtained under the Government Information (Public Access) Act 2009. An extract from this letter follows:

> *"As you are aware, Bryce Purches of this office had made inquiries with the DP&E and the NSW Office of Environment and Heritage (OEH). Mr Purches has recently left, and the file has been reallocated to me for assessment of the information received by those agencies.*
>
> *The Ombudsman is primarily concerned to ensure government agencies are fair and reasonable in their dealings. It is clear that opinions, even by experts, may differ. We are unwilling in such situations to question expert opinion, except in those rare cases where the opinion appears so unsupportable that it suggests something improper may have occurred. It is seldom appropriate for us to decide between differing technical views, nor do we have the resources to routinely obtain our own independent expert opinion.*
>
> *To this end, we sought information from DPI and OEH about the review of the INP, and the application of LFN data to the operations of Mount Thorley Warkworth open cut mine in accordance with the conditions of consent DA 300-9-2002-1.*
>
> *DPI has provided information and evidence to demonstrate that the (then) DECCW (OEH) had from 2010 made a commitment to revise the INP in relation to low frequency noise, and to review the INP as a whole. While progress on this has been slower than expected, our verbal interactions with OEH has confirmed that they anticipate a review will be completed later this year.*
>
> *Assessment of LFN appears to be quite contentious, especially in rural settings. I do not propose to develop a view as to which position is most likely accurate, as I have explained above, we do not have that expertise, or the resources to seek that expertise.*
>
> *It would appear to me, however, that the following points have been agreed by DP and OEH:*
>
> - *There may be technical merit as to the difficulty in applying the low frequency modifying factor in rural areas, subject to further study. OEH has commissioned a comprehensive study of LFN as a part of the INP review, titled Low Frequency Noise & Infrasound, still underway;*
> - *That OEH would not include conditions about LFN in Environment Protection Licences; and*
> - *A review of the INP would be conducted, and LFN would be a priority issue.*
>
> *When we receive complaints about compliance and enforcement, failure to take action alone is generally not sufficient grounds to justify an investigation by this office. We look closely at the facts of each case, including the agency's reasons for its decisions.*
>
> *In this case, there appears to be appropriate consideration of professional advice from qualified staff and experts about LFN that casts doubt as to the practicality of strict enforcement of the condition of consent. Notwithstanding this, OEH has also acknowledged that any review of LFN in the INP will include consultation with NSW Health given the health issues said to be associated with LFN.*
>
> *Noise monitoring continues to be a high priority issue, and a Noise Management Plan and Noise Monitoring Programme for the whole mining complex are in place. Further, DPI due to a Land and Environment Court decision.*

For the reasons outlined above, it appears to me the information and evidence provided by the agencies is sufficient to satisfy me that the DPI has provided adequate reasons for its decision and has properly considered all relevant issues, and there is no other evidence of wrong conduct that requires intervention by this office.

I appreciate why you forwarded this matter to this office, and I acknowledge the importance of noise monitoring and the impacts of noise on the local community. BMPA should continue to engage with the agencies and the mine operators as is appropriate and participate in community consultation and engagement as opportunities arise."

The above confirms that the applicant currently undertakes regular LFN monitoring as part of the noise management regime for the MTO.

9.7.2 'Broner' method

A paper by Dr Norm Broner, "*A Simple Outdoor Criterion for Assessment of Low Frequency Noise Emission*" published in Acoustics Australia Vol.39 April 2011, provides absolute level criteria for frequency noise. The paper presents the following targets external to a residence:

- For the daytime or when source operates intermittently (1-2 hours):
  - desirable 65 dBC L_{eq}
  - maximum 70 dBC L_{eq}
- For the night time or when the source operates continuously:
  - desirable 60 dBC L_{eq}
  - maximum 65 dBC L_{eq}

This assessment will also review LFN against the Broner (2011) approach.

9.7.3 Department of Environment, Food and Rural Affairs (United Kingdom)

The Department of Environment Food and Rural Affairs (DEFRA) (UK) commissioned the University of Salford to prepare a detailed study on LFN in the community with the intent of formulating a practical LFN criterion to be used in the field by environmental health officers. The study, *Proposed criteria for the assessment of LFN disturbance* (Dr Moorhouse et al 2005), draws on several European LFN assessment methods to develop a frequency based reference criterion.

The process involves measuring the L_{eq}, L_{10} and L_{90} in third octave bands between 10 Hz and 160 Hz within an unoccupied room where the alleged LFN source has been observed. If the measured L_{eq} exceeds the levels in Table 9.4 in any third octave band, then this indicates the presence of a LFN source. This character of the noise should also be checked using an audio recording, where possible.

Table 9.4 DEFRA – proposed low frequency reference curve

Hz	10	12.5	16	20	25	31.5	40	50	63	80	100	125	160
dB, Leq	92	87	83	74	64	56	49	43	42	40	38	36	64

Notes: 1.The levels can be relaxed by 5 dB if: the source is present during the day only; or if the source is steady as demonstrated by: L10-L90 < 5 dB or the rate of change of sound pressure level (Fast time weighting) is less than 10 dB per second, where these parameters are evaluated in the third octave band which exceeds the reference curve values by the greatest margin.

The criterion applies to internal measured noise levels and therefore has fundamental limitations at the proposal stage, where external noise levels in single octave bands down to 31.5 Hz can be typically modelled and assessed. The application at the proposal stage would also rely on broad assumptions relating to the facade reduction provide by a given dwelling, which would vary greatly depending on the building materials dwelling to dwelling (eg light-weight versus brick veneer construction). Furthermore, room acoustic affects such as reverberation and room modal characteristics would present challenges at the assessment stage.

A test of internal LFN was completed at an unused dwelling to demonstrate the DEFRA approach and the results are described later in this report.

10 Operational noise impact assessment

This section presents the results of modelled noise levels from the proposal inclusive of the effect of prevailing meteorological conditions recorded at the Site.

The INP requires the assessment of predicted noise levels against the PSNL's and where these are exceeded, identify all reasonable and feasible noise mitigation. The INP Section 7 "Mitigating noise from industrial sources" states there are three main strategies for noise control. These are controlling noise at the source, the transmission path and at the receiver.

Initial modelling for unmitigated operations showed that mitigation measures were warranted. The applicant has currently attenuated approximately 50% of the haul truck fleet, with the aim of attenuating all trucks by the end of 2016. Attenuation packages to all dozers, excavators and drills is progressing and will also be completed by the end of 2016 calendar year. The cost of the attenuation program is in excess of $50M across MTW. This mitigation strategy has been included in the noise modelling.

Noise mitigation along the transmission path was also considered and was found to be ineffective for the residences of Bulga given the relatively flat open terrain between the Site and residences.

Finally, controlling noise at the receiver has been considered and properties have been identified where treatment to existing dwellings would be made available.

10.1 Noise modelling approach

To assess the potential for noise impacts on residences, a total of three indicative mine scenarios have been assessed. These three indicative mine plans reflect the worst-case operating scenarios in respect of the potential for impacts to surrounding residences. These indicative mine plans are referred to as Year 3, Year 9 and Year 14, each indicating the approximate time after the anticipated commencement date.

Mining of the existing approved open cut resources at MTO is anticipated to be complete by approximately 2022. Following this, rehabilitation would be undertaken. The proposal would continue existing operational practices including use of draglines, shovels, excavators, loaders, dozers and truck fleets. This combination has proved appropriate for the geological conditions encountered at the mine and the required production rates. These activities would continue within the existing MTO tenement (CL 219).

Indicative mine plan snapshots showing the proposal's operations in 2017 (nominally Year 3), 2023 (Year 9) and 2028 (Year 14) can be seen in EIS Figures 1.5, 1.6 and 1.7, respectively.

The indicative Year 3, 9 and 14 mine plans were chosen as representative mining snapshots which allow for technical assessments for activities occurring at MTO.

- In indicative Year 3 mine plan (nominally 2017), mining has ceased in all pits with the exception of Loders Pit. Rehabilitation activities have been completed in sections of the Site near the CRTSF and also areas in the south-east. Indicative Year 3 is also generally representative of current operations.

- Indicative Year 9 (nominally 2023) is approximately the half way point of the proposal timeframe and represents when coal and overburden are being transported from Warkworth Mine to MTO for processing and emplacement, respectively. It is expected that AGN will commence mining in 2018 or 2019 and be completed within approximately two years before becoming a Tailings Storage Facility (TSF) as approved. For modelling purposes, and to ensure a worst case scenario is captured, the noise study has conservatively assumed that mining in AGN is still taking place in 2023; however, in practice it is likely to be completed and being used as a TSF before 2023. Rehabilitation activities have been completed across more than half of the Site with the exception of Loders Pit which is receiving overburden from Warkworth Mine to develop final landform and the base of the TSF to RL 50m which will start receiving tailings once AGN is full in approximately 2026.

- Indicative Year 14 (nominally 2028) represents a similar scenario to Year 9 (2023) with coal and overburden transfer occurring. No mining is anticipated to occur. Rehabilitation activities have been completed across the majority of the Site with the exception of the Loders Pit which is receiving tailings from Warkworth Mine.

During operations, alternative mine plans may be used to the indicative plans above, provided that the environmental impacts remain within the envelope as assessed in the EIS. The mining operations can therefore retain some flexibility within the constraints of the identified and assessed environmental envelope.

Noise modelling was based on three-dimensional digitised ground contours for the surrounding land, mine pits and overburden emplacement areas for three stages. The indicative mine plans represent worst case snapshots and equipment was placed at various locations and heights, representing realistic operating conditions in each of these indicative stages of the mine.

The noise model was configured to predict the total L_{eq} noise levels from mining operations based on the sound power levels presented in Table 10.2. These sound power levels are short term L_{eq} values of generally pass-by events and are therefore conservative representations of the INP's assessment metric, the $L_{eq,15minute}$. It should be noted that the model includes the entire spectral emissions for each individual plant item and therefore uses these spectra to predict received levels. This accounts for the linear characteristics of each source and not just the overall dB(A) level. The results presented assume all plant and equipment to be operating simultaneously and at full power. In practice, such an operating scenario would occur very infrequently. The noise predictions presented are therefore conservative.

The noise modelling reflected in this chapter is based on mine planning that has been optimised over many iterations of noise modelling. In arriving at this mine plan, alternative noise minimisation techniques such as reducing the height of night-time overburden emplacement activities were considered but found to be impractical or to provide minimal acoustic benefit.

Importantly, the modelling includes best practice noise attenuation to all dominant noise plant including haul trucks, drills, dozers and excavators. The applicant is committed to attenuation of its entire fleet by the end of 2016. The attenuation status as of April 2014 is 50% of all haul trucks.

10.2 Noise modelling parameters

The prediction of noise from The proposal's operations was undertaken using the Predictor software by Bruel & Kjaer. The software predicts total noise levels at residences from the concurrent operation of multiple noise sources. The model included consideration of factors such as the lateral and vertical location of plant, source-to-receiver distances, ground effects, atmospheric absorption, topography of the mine and surrounding area and meteorological conditions. This section outlines the base parameters used in the noise modelling.

In EMM's experience on many similar projects, the EPA, has encouraged site specific validation of noise predictions wherever possible to better represent potential impacts from industrial operations. The results of an extensive field validation exercise part of and as documented in the 2002 and 2010 Warkworth noise assessments were adopted in the current prediction of noise levels for prevailing winds. Similar studies have been conducted and results of which published in technical journals (eg *Experimental Outdoor Sound Propagation' 13th International Congress on Sound & Vibration*, 2006 and *Experimental Outdoor Sound Propagation vs ENM* Australian and New Zealand Acoustic Society Conference, 2007). These studies concluded that the prediction of L_{eq} noise is consistently overestimated during weather enhanced conditions, a finding also consistent with a NSW Australian Acoustic Society presentation by Dr Robert Bullen in 2009 about such modelling software algorithms, particularly the Environmental Noise Model (ENM) algorithm.

10.2.1 Equipment noise levels

Table 10.1 describes the main noise sources associated with the proposal.

Table 10.1 Main noise sources of the proposal

Mining activity	Typical plant
Mine	Drills, shovels, front-end loaders, trucks, excavators, dozers, graders, draglines, cable reelers and generators for lighting sets.
Overburden emplacements, rejects emplacement and haul roads	Trucks, dozers, graders and generators for lighting sets.
Coal transportation	Trucks and graders on haul roads, CPP and conveyor.

Sound power levels for equipment used for in-pit earth-moving and overburden emplacement are listed in Table 10.2. These sound power levels are based on measurements at Site, and supplier in-service commitments for newly purchased or retro-fitted attenuated equipment. As described earlier, these are short term pass-by values and therefore a conservative representation of $L_{eq,15minute}$.

Table 10.2 Equipment sound power levels used in noise modelling - including attenuated equipment

Typical item	Representative $L_{eq,15minute}$ sound power level, dB(A)
#Haul truck	115
Water cart	116
#Drill	114
Shovel	117
#Dozer	115
Rubber tyre dozer	117

Table 10.2 Equipment sound power levels used in noise modelling - including attenuated equipment

Typical item	Representative $L_{eq,15minute}$ sound power level, dB(A)
Dragline	119
Grader	108
Loader	116
#Excavator (3600)	119
#Excavator (5500)	117
Lighting plant (night only)	104
Infrastructure area:	
CPP	113
Reclaimer	111
Crusher/feed bin	105
#Conveyor (covered)	75 per linear metre
Conveyor (uncovered)	82 per linear metre

Notes: *1. # Indicates attenuated plant.*
2. The Proponent commits to all new trucks, dozers, drills and excavators purchased for use on the site are commissioned as noise suppressed (or attenuated) units and the existing fleet of trucks, dozers, drills and excavators on site are progressively fitted with suitable noise attenuation packages to ensure that 100% of the fleet being used on site is attenuated by the end of 2016.

The applicant adopts a strict specification to suppliers when purchasing new plant or fitting attenuation packages to existing plant. This specification includes a dB(L) or linear target in addition to a dB(A) target as shown in Table 10.3.

It should be noted that in previous assessments for MTW and other mines in the Hunter Valley, an attenuated haul truck sound power level of 113dB(A) is referenced. MTW has been engaging with their suppliers for many years now to confirm a technical pathway to achieve that sound power level. At the time of publishing this study, MTW, in conjunction with its suppliers, have been successful in testing and operating sound suppressed haul trucks to a sound power level of 115dB(A) in-service. MTW has conservatively opted to model the haul trucks with a sound power level of 115dB(A) for this EIS to represent a more accurate reflection of the noise emitted from the Site.

A supplier of the Site's haul trucks (Komatsu) has confirmed a technical path to reliably reach a 113 dB(A) sound power level in the future. This technology is not currently available and at present, this next phase package of attenuation is likely to be tested in the next 12 months. If this materialises, the predicted noise levels herein will reduce if it is determined that the package is reasonable and feasible to adopt.

Table 10.3 In-service target sound power levels

Plant	Lw, dB(L) (Primary target)	Lw, dB(A) (Reference only)
Haul Truck	123	115
Water Truck	125	116
Dragline	126	119
Shovel (electric)	124	117
Excavator	126	119
Loader	123	116

Table 10.3 In-service target sound power levels

Plant	Lw, dB(L) (Primary target)	Lw, dB(A) (Reference only)
Grader	117	108
Track dozer (1st gear)	123	115
Rubber Tyred Dozer	121	117
Drill	121	114

10.2.2 Mining equipment schedule for MTO

The typical equipment schedules for the three modelled indicative mining scenarios are presented in Table 10.4. The modelled location of mining equipment is detailed in Appendix C.

Table 10.4 Modelled typical mining equipment schedule (MTO only)

Equipment	Year 3	Year 9	Year 14
Haul truck	25	20	6
Water cart	1	2	1
Drill	1	1	0
Shovel	1	0	0
Dozer	5	6	0
Rubber tyre dozer	1	0	0
Dragline	1	0	0
Grader	2	2	1
Loader	0	1	0
Excavator (3600)	2	2	0
Lighting plantplant[1]	5	5	0
Infrastructure area:			
plant CPP	1	1	1
Reclaimer	4	4	4
Crusher/Feed bin	1	1	1

Notes: 1. Lighting plant operates only during evening and night periods.

2. The listed plant are those proposed to operate within the MTO site boundary and exclude plant within WMLs site boundary.

10.3 Predicted noise during calm weather

Operational noise levels to residences were determined for periods with no wind or temperature gradients, which are termed SI (Still Isothermal) or 'calm' conditions. Values for air temperature and relative humidity used in the noise modelling were 20°C and 70 per cent for day, and 10°C and 90 per cent for evening and night periods.

The $L_{eq,15min}$ noise levels at assessment locations resulting from mining operations during calm conditions for day, evening and night periods are presented in Appendix D (columns 4, 5, 7, 8, 10, 11). Comparison of predicted noise levels for day, evening and night periods for any particular year of mining indicates little difference This is not unexpected as the equipment fleet is identical for both day and night scenarios with the exception that the latter includes lighting plant.

Notably, operational noise levels were predicted to comply with the INP's PSNL's for all assessment locations during calm meteorological conditions for day, evening and night periods.

10.4 Predicted noise during 'prevailing' meteorological conditions

The INP provides guidance on how noise due to varying meteorological conditions is to be assessed. The procedure is based on identifying and combining worst case meteorological conditions at the site (referred to as the 'prevailing meteorology') and assessing the noise levels against the relevant limits.

During wind and temperature gradient conditions, noise levels at residences may increase or decrease compared with noise during calm conditions. This is due to refraction caused by the varying speed of sound with increasing height above ground. The level of noise received increases when the wind blows from source to assessment locations or under temperature inversion conditions, and conversely, decreases when the wind blows from receivers to source or under temperature lapse conditions.

Despite the increase in noise at properties caused by adverse winds, ambient noise also increases during such weather conditions (due to wind induced vegetation noise) and mine noise can be masked.

10.4.1 Assessment of potential for temperature inversions

The Pasquil stability class represents the degree of mixing in the atmosphere, and can be used to gauge the presence and magnitude range of temperature inversions. Stability classes are categorised from Class A to Class G. Stability Class A applies under sunny conditions with light winds when dispersion is most rapid. Stability Class D applies under windy and/or overcast conditions when dispersion is moderately rapid and Stability Class F and G occur at night when winds are light and the sky is clear. Stability Classes B, C and E represent the presence of intermediate conditions. Temperature inversions may occur during Classes E, F and G. In particular, Class F generally represents a range of temperature gradients from 1.5ºC/100 m up to less than 4ºC/100 m.

Records of wind speed, wind direction and sigma-theta (α - used to approximate Pasquil stability classes) were acquired from the Coal & Allied Charlton Ridge AWS for the period 2007 to 2013, inclusive. The proposal's air quality specialist confirmed this data as representative for the site and surrounds through a comparison of data from other neighbouring weather stations.

The Stability Class frequency for the area, as determined from the hourly weather data, is indicated in Table 10.5. The last column indicates that atmospheric stability class F/G occurs for only 8 per cent of the winter nights in the area. This is well below the EPA's INP's 30% per cent threshold where stability class F are considered to be a 'feature' of an area and therefore does not need to be included in noise impact assessment. Nonetheless, the prediction of noise impacts in this assessment includes consideration of the effects of a 3.9ºC/100 m temperature inversion consistent with the recommendations of the INP. This approach is appropriate given the well documented presence of temperature inversions in the broader Hunter Valley region.

Table 10.5 Atmospheric stability class frequency for Warkworth Mine

Stability Class	Percentage of occurrence (winter night)
A	8
B	5
C	18
D	49
E	12
F/G	8
Total	**100**

Notes: 1. This information is based on winter night analysis for years 2007 to 2013 inclusive as provided by Coal & Allied from the Charlton Ridge AWS.

10.4.2 Assessment of prevailing winds for the area

A detailed review of the vector components of the aforementioned hourly wind data (direction and speed) was undertaken in accordance with the INP. The results are summarised in Appendix C. The wind directions determined to be a feature of the area in accordance with the INP are summarised in Table 10.6. The cumulative total values indicate wind speed occurrence above the INP 30 per cent threshold, which triggers the requirement for assessment (Section 5.3 of the INP). This is determined by a cumulative arithmetic addition of percentage occurrence values (refer Appendix C). EMM's wind calculator adopted for the proposal provides results consistent with the EPA's wind calculator (as found on the EPA's website) for defining feature wind directions.

It is demonstrated that the assessable winds occur during the evening and night time, and these specific winds are considered a 'feature' of the area according to the INP.

For indicative Years 3 and 9 of proposed operations, when mining plant will operate on Saddleback Ridge, a drainage wind of 2m/s and a 3ºC/100m temperature inversion was included in the modelling. Previous noise impact assessments for the Site have also considered the likelihood of drainage winds from various local escarpments and from various opposing directions. One commonality is the flow or drainage of Wollombi Brook to the north-northwest. This was therefore the chosen direction of the modelled drainage wind. The resultant effect was the enhancement of mine noise propagation to assessment locations west of the mine due to a modelled combined wind and temperature inversion. Importantly, drainage is also likely a likely feature of the escarpment west of Bulga and therefore would result in favourable (westerly) wind conditions at times for the properties of Bulga.

Table 10.6 Assessed INP meteorological conditions

Scenario	Wind direction	Wind speed (m/s)[1]
Day periods		
1	Calm	0
Evening period		
1	Calm	0
2	E	2.3
3	ESE	2.7
4	SE	2.6
5	SSE	2.5
6	S	2.5
7	SSW	2.3
8	SW	1.9
9	WSW	1.9
Night periods		
1	Calm	0
2	E	2.1
3	ESE	2.5
4	SE	2.7
5	SSE	2.7
6	S	2.6
7	SSW	2.3
8	SW	1.8
9	WSW	1.6
10[2]	SSE + 3 Deg Temp Inv	2.0

Notes: 1. Wind condition applies only to noise modelling for Year 3 and 9.

10.5 Predicted noise levels

The wind conditions in Table 10.6 were used in the modelled predictions of mining noise levels. The predictions of mining noise during periods of 'prevailing meteorology' are presented in Appendix D. The results presented in Appendix D are derived from considering the effect of only INP-assessable meteorological conditions (Table 10.6) and not all possible wind conditions that may be experienced at site.

These results are also presented in the form of coloured markers for indicative years 3, 9 and 14 (Figure 10.1, 10.2 and 10.3 respectively) which categorically represent predicted noise levels at assessment locations with respect to PSNL's. Assessment locations which meet PSNL are indicated with a black marker for the respective indicative mining year. Assessment locations with a green, blue or orange marker represent predicted minor (1 to 2 dB(A)), moderate (3 to 5dB(A)) or significant noise level exceedances (respectively) of the PSNL for the respective mining year. These data incorporate all 'prevailing' INP weather conditions (ie calm, INP winds and temperature inversions) for day, evening and night operations, as appropriate.

Figures 10.4 and 10.5 present coloured markers based on the worst case noise level predicted at each assessment location across the three indicative mining years (ie outer envelope or worst case for all years). For clarity, the markers are presented separately for assessment locations west and east of the site.

Noise during 'prevailing meteorological conditions' is below or at the EPA's PSNLs at 160 residences out of 221 assessed. Conversely, noise during 'prevailing meteorological conditions' are predicted to exceed the PSNL at 61 assessment locations, and in a single case, also exceed the site's applicable acquisition limit.

A summary of these noise level exceedances are provided in Table 10.7 for Bulga assessment locations and surrounding areas. Table 10.7 shows that predicted noise levels for all Bulga assessment locations will satisfy or be within 1-2 dB of PSNLs.

Table 10.7 Summary of operational PSNL exceedances – Bulga and surrounds

Extent of noise exceedance	Number of affected properties			
	Indicative Year 3	Indicative Year 9	Indicative Year 14	All years
Marginal (1-2dB(A))	53	0	0	53
Moderate (3-5 dB(A))	0	0	0	0
Significant (greater than 5 dB(A))	0	0	0	0

Table 10.8 summarises the exceedances for all other locations generally to the east of the mine, but includes Warkworth village and Maison Dieu locations to the north west and north. Table 10.8 indicates that operational noise levels will exceed the PSNLs by varying amounts at eight assessment locations as shown during prevailing meteorology. Seven of these locations have been afforded mitigation to dwellings by the applicant. One assessment location (149) has been predicted with a significant noise level exceedance during Year 9 operations.

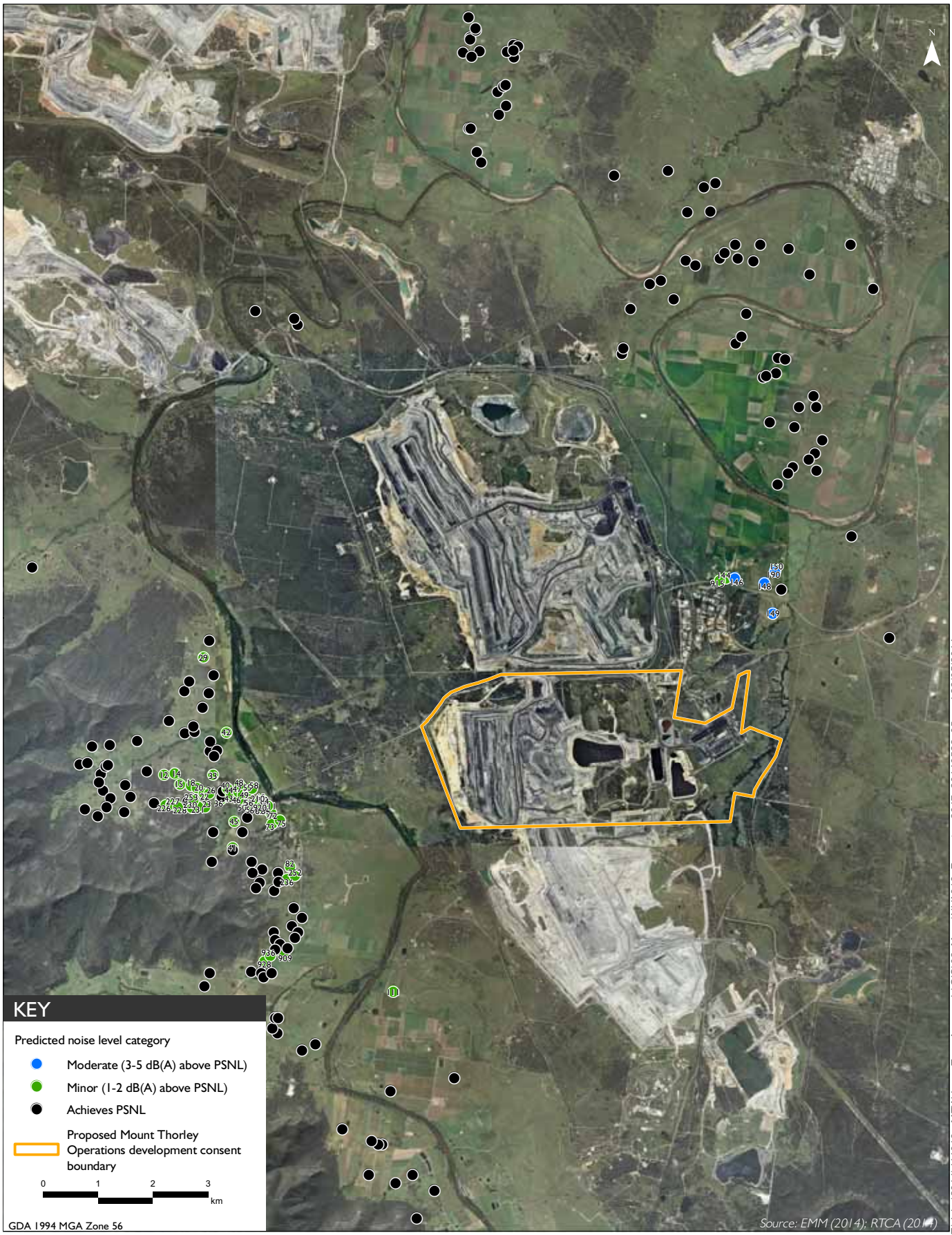
Table 10.8 Summary of operational PSNL exceedances – other assessment locations

Extent of noise exceedance	Number of affected properties			
	Year 3	Year 9	Year 14	All years[1]
Marginal (1-2dB(A))	3	5	5	4[2]
Moderate (3-5 dB(A))	4	2	1	3[2]
Significant (greater than 5 dB(A))	0	1	0	1

Notes: *1.The 'All years' column lists the assessment location by worst of marginal, moderate and significant and therefore does not double count or double assign a location in these three categories.*

2. These locations have had mitigation installed on dwellings.

It is also important to note that operational noise levels from the proposal are not expected to be materially different from current noise levels for locations east of the mine given relatively no changes to current activities in the eastern parts of the mine site.

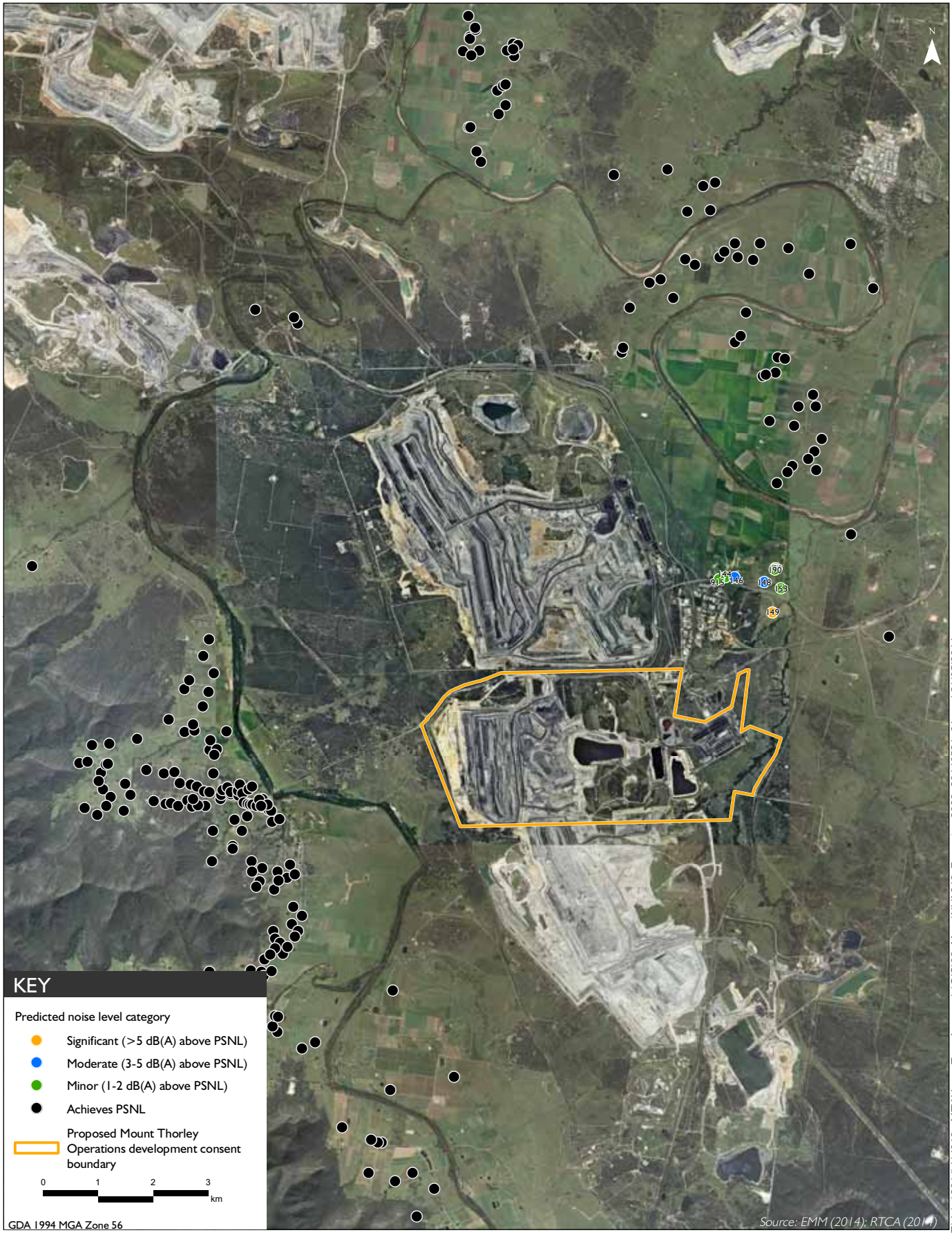


Year 3 worst case day, evening and night operational noise levels, INP weather (Leq,15min dB(A))

Mount Thorley Operations

Noise and vibration assessment

Figure 10.1

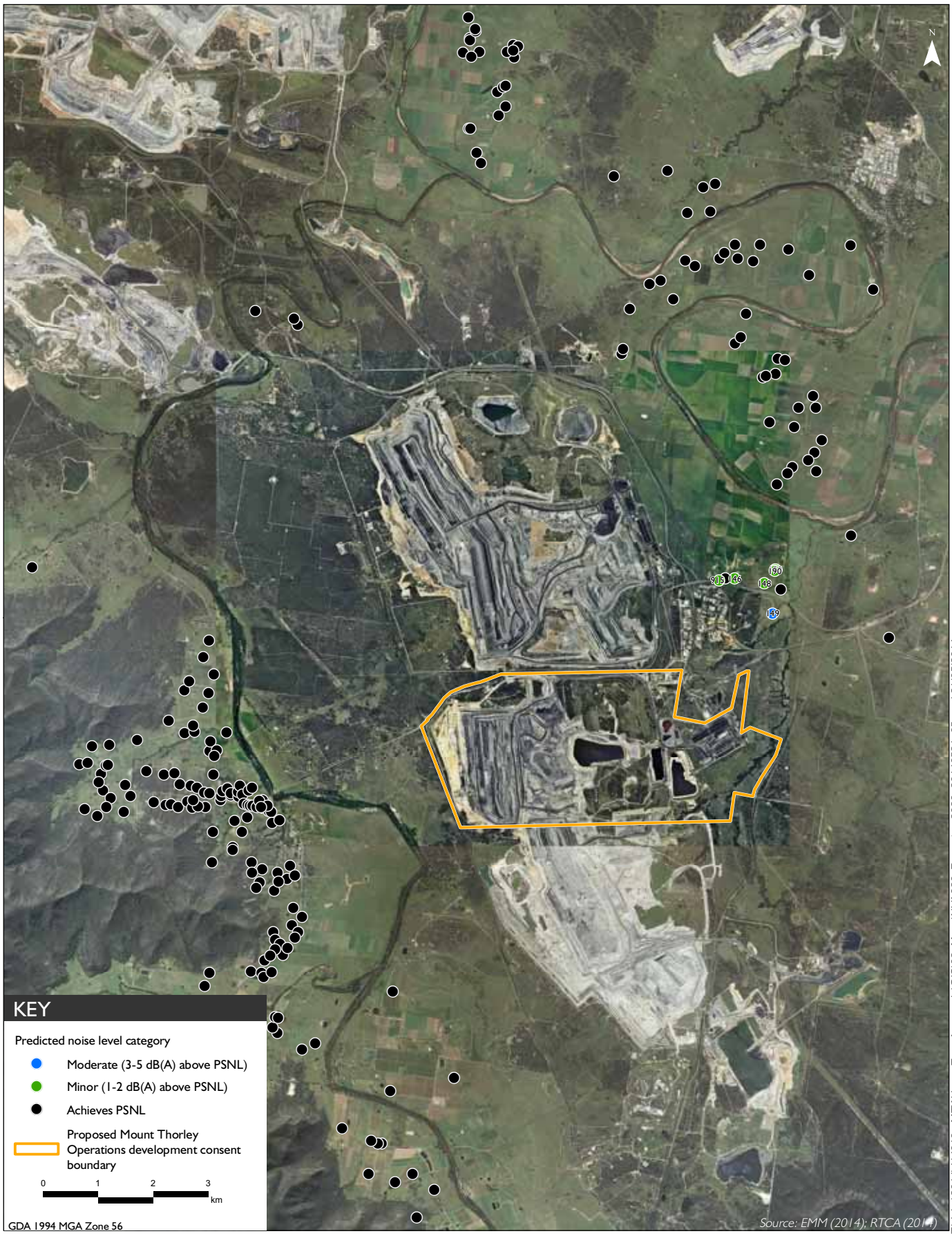


Year 9 worst case day, evening and night operational noise levels, INP weather (Leq,15min dB(A))

Mount Thorley Operations

Noise and vibration assessment

Figure 10.2



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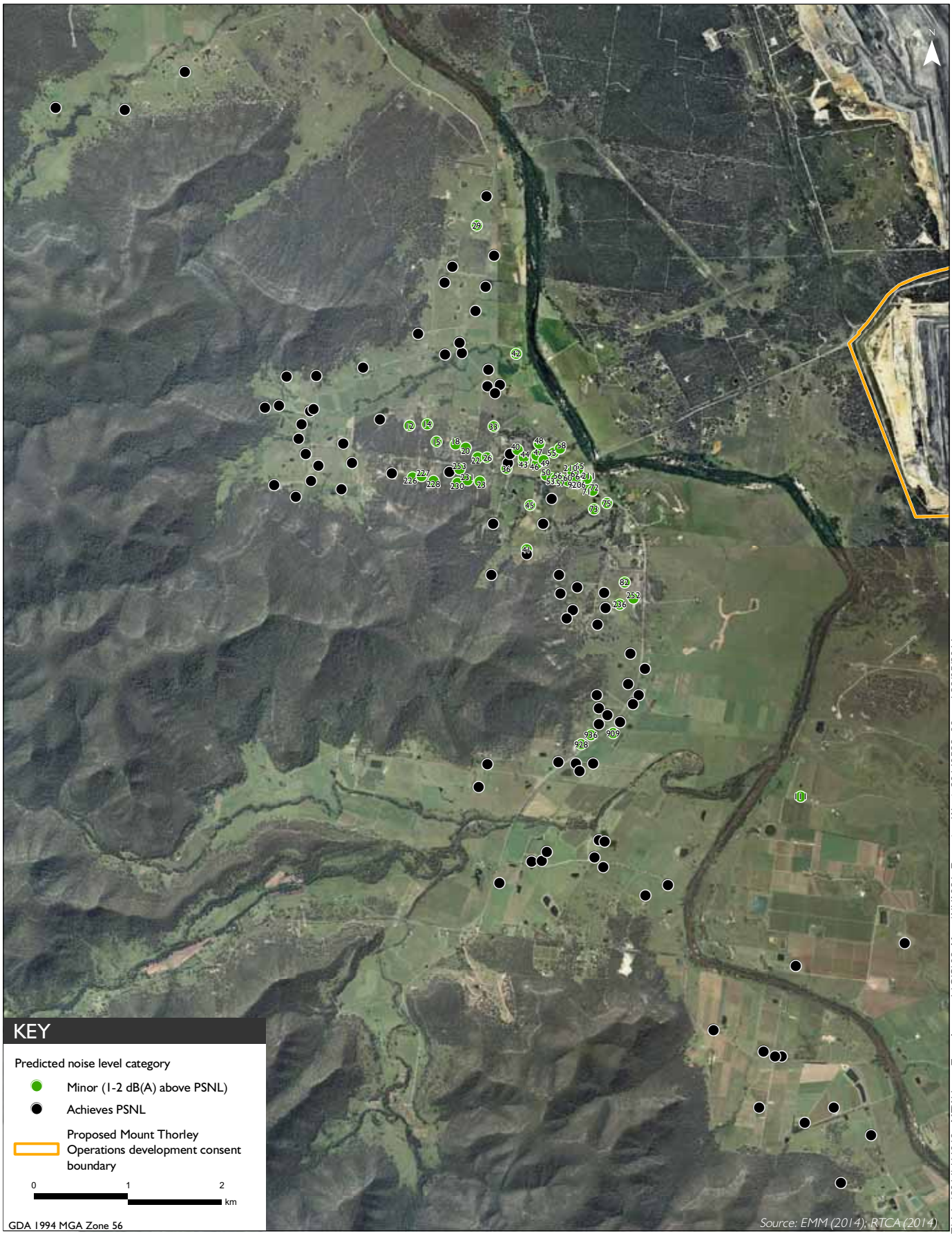
Year 14 worst case day, evening and night operational noise levels, INP weather (Leq,15min dB(A))

Mount Thorley Operations

Noise and vibration assessment

Figure 10.3



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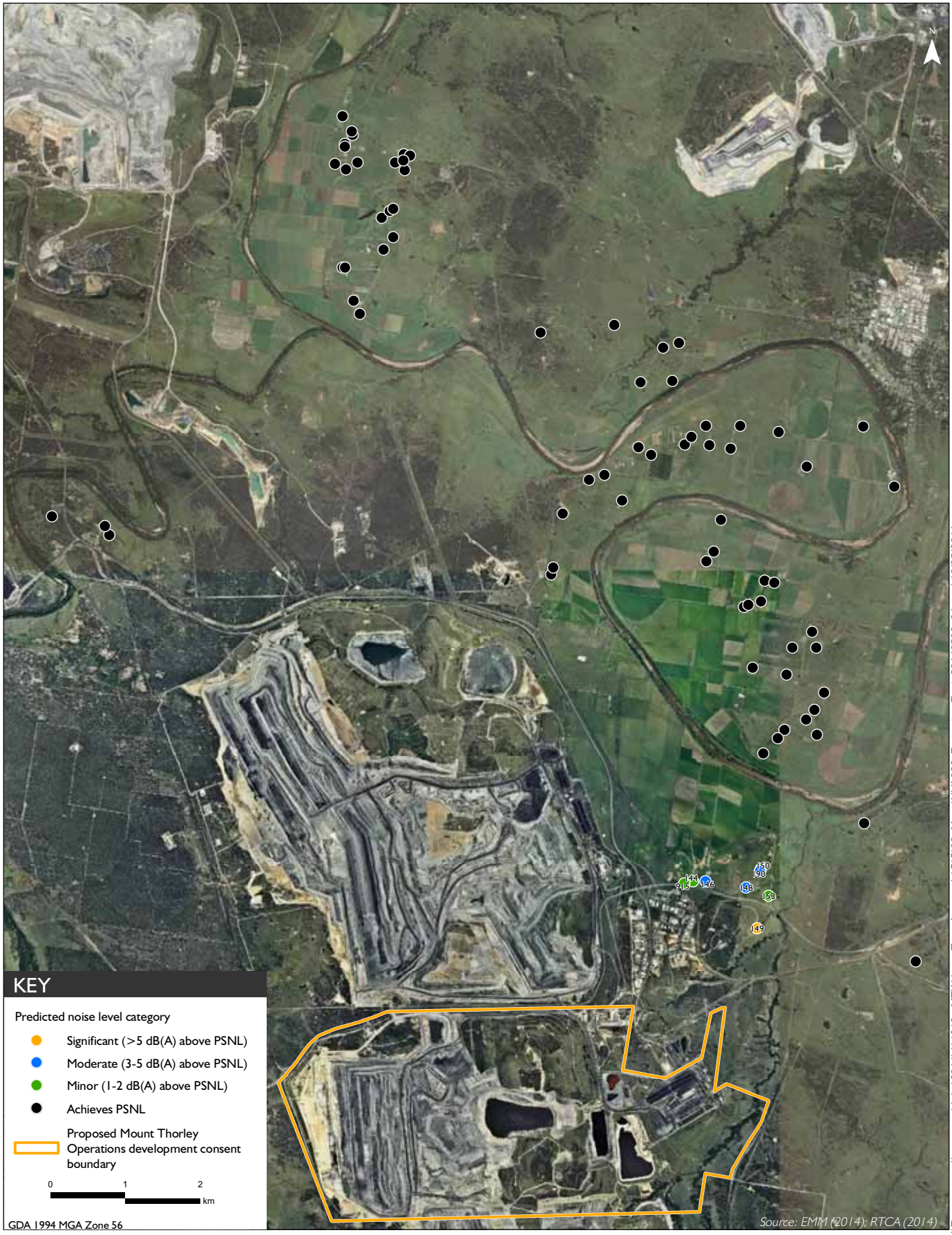
All years worst case day, evening and night operational noise levels, INP weather (Leq,15min dB(A)) – Western assessment locations

Mount Thorley Operations

Noise and vibration assessment

Figure 10.4



All years worst case day, evening and night operational noise levels, INP weather (Leq,15min dB(A)) – Eastern assessment locations

Mount Thorley Operations

Noise and vibration assessment

Figure 10.5

10.6 Residual level of impact (INP Section 8.2.1)

Section 8.2.1 of the INP lists issues to be considered if predicted noise levels exceed the PSNL's after reasonable and feasible mitigation has been applied. Table 10.9 provides an assessment of residual noise impacts (presented in Table 10.7 and 10.8) from the proposal.

Table 10.9 Residual level of impact

INP factors for consideration	Justification of the proposal
1. Characteristics of the area and receivers likely to be affected	The majority of the local area surrounding the proposal is characterised by mining and associated infrastructure and agricultural land, mainly pasture, with moderate sized stands of native woodland retained along the steeper hillsides and ridgelines and in patches along creek lines. The applicant owns a substantial area of land surrounding the Site. MTO has been in operation since 1981 and the originally approved mine has been modified several times. Immediately to the north of MTO is Warkworth Mine, which also commenced operations in 1981. The integrated operation of MTW has been ongoing since 2004. The Bulga Coal Complex, which is adjacent to the south, has been operating since the 1980s. Wambo Mine and Hunter Valley Operation South, to the north of Warkworth Mine, commenced operations in 1969 and 1971, respectively. The noise and vibration study predicted noise levels at 221 assessment locations surrounding the mine. The predicted noise levels are during worst case INP prevailing meteorological conditions and for the majority of the time actual noise levels are likely to be less than those predicted. Of the 221, three are predicted with moderate noise level exceedances (3-5 dB(A) above PSNL) and one is predicted with significant noise level exceedances (greater than 5 dB(A) above PSNL). Assessment locations with predicted moderate and significant noise level exceedances account for less than 2% of the total assessment locations considered. A total of 139 assessment locations within Bulga were considered. Of these, 53 are predicted with minor noise level exceedance during Year 3 operations only. A sleep disturbance assessment showed predicted noise levels to satisfy strict EPA criteria. Due to proposed attenuation of plant, noise from current and approved operations is expected to decrease. A cumulative noise assessment in accordance with the INP and Mining SEPP demonstrates criteria would be satisfied. There is a very large range of human reaction to noise, including those who are very sensitive to noise. This noise-sensitive sector of the population would react to intruding noises that are barely audible within the overall noise environment, or would have an expectation of very low environmental noise levels. On the other hand, there are those within the community who find living in noisy environments, such as near major industry, on main roads or under aircraft flight paths, an acceptable situation. The bulk of the population lies within these two spectrums, being unaffected by low levels of noise and being prepared to accept levels of noise commensurate with their surroundings.
2. Characteristics of the proposal and its noise or vibrations	The MTO is an existing and well established mine in the Hunter Valley. The proposal seeks a continuation of all aspects of the mine as it presently operates. MTO currently invests significantly in noise management and would continue to do so under the proposal. For example, attenuation of all major plant across the MTW would exceed $50M and will be completed by the end of 2016. The applicant has committed to managing noise levels to meet or be within 1-2 dB of PSNL at the majority of properties. Managing noise to this level is reasonable and feasible for the Site. Managing noise to PSNLs at all locations was tested and found not to be reasonable or feasible for the Site as it would result in the mine not being economically viable. The assessment has identified that noise levels predicted above PSNLs would only occur

Table 10.9 Residual level of impact

INP factors for consideration	Justification of the proposal
	during worst case prevailing metrological conditions. It has been demonstrated that with continued management of the mine, such as by implementing equipment fleet with best practice noise suppression, that INP PSNLs can be met for the majority of assessment locations. Further, with the proposed attenuation of mobile plant at the Site, it is expected that noise levels would improve for all assessment locations to the east of the Site. The noise modelling adopts area specific validation and, therefore, provides added confidence in the accuracy of predictions. Extensive monitoring to measure compliance would be continued under the proposal. The economic study for the proposal has identified that the direct economic benefit that can be attributed to MTO is around $151million in NPV terms. The economic flow-on effects from MTO amount to: • for NSW, around $39million in additional income (in NPV terms), additional annual employment of 15 full-time equivalent workers, and a contribution to NSW GSP of around $45million; • for the Mid and Upper Hunter region, around $23million in additional income in NPV terms, and additional annual employment of 16 full-time equivalent workers; and for the Singleton LGA, around $9million in additional income in NPV terms, and additional annual employment of 4 full-time equivalent workers.
3. The feasibility of additional mitigation or management measures: —Alternative sites or routes for the development —The technical and economic feasibility of alternative noise controls or management procedures	The MTO is an existing and well established mine in the Hunter Valley and relocation is not reasonable or feasible. The applicant has considered a range of noise management and mitigation measures for the proposal. Those that are considered reasonable and feasible have been included in this assessment. These include: a significant investment in providing best practice noise suppression on equipment fleet. These measures in combination with the established real-time noise monitoring and management system would assist in keeping noise levels to within or below 1-2 dB of PSNL for the majority of assessment locations - this is a reasonable and feasible outcome for the viability of the proposal.
4. Equity issues in relation to: —The costs borne by a few for the benefit of others —The long-term cumulative increase in noise levels —The opportunity to compensate effectively those affected	The applicant would be investing significantly in noise management and mitigation over the life of the proposal which would be of significant benefit to the surrounding communities. The cumulative noise assessment demonstrates that with reasonable and feasible mitigation and management in place that the INP recommended acceptable amenity noise limits can be achieved for the life of the mine. The applicant would appropriately address all assessment locations identified with noise level exceedance as negotiated with DP&E.

10.7 Assessment of potential sleep disturbance

As described in Chapter 9, sleep within residences may be disturbed by intermittent noises such as shovel gates banging, bulldozer track plates and heavy vehicle reversing alarms. Typical noise levels from the loudest of these events are presented in Table 10.10.

Table 10.10 Maximum noise from intermittent sources

Noise source	Measured L_{max} noise level, dB(A)
Haul truck	125
Shovel gate banging	120
Bulldozer with reversing alarm	115

Table 10.10 indicates that the highest maximum noise levels expected at residences would likely result from haul trucks. The maximum sound power level of unmitigated haul trucks has previously been measured to be typically 125 dB(A) L_{max}. Maximum noise levels at each residence were calculated under assessable worst case weather for the three indicative years of operations.

Table 10.11 provides the maximum predicted L_{max} noise levels from the proposal under adverse meteorology at select representative assessment locations based on the typical equipment locations used for mining operations. Predictions were based on a single event, rather than the simultaneous operation of a number of plant items because of the low probability of more than one peak noise event occurring concurrently. The criteria used to assess sleep disturbance are based on the EPA's requirement for the maximum L_{max} level of 'background noise level plus 15 dB'. This results in sleep disturbance criteria of 45 to 48 dB(A) L_{max} depending on the individual assessment location's background noise levels.

Table 10.11 indicates that predicted noise levels under prevailing weather conditions are within the EPA's sleep disturbance criterion at all representative assessment locations shown.

Table 10.11 Predicted maximum noise levels from site under prevailing meteorology

Property no.	External L_{max} noise level from on-site plant, dB(A)			L_{max} criterion, dB(A)
	Year 3	Year 9	Year 14	
1	33[1]	<30	<30	45
34	35[1]	32	<30	45
42	39[1]	36[1]	<30	48
58	39[1]	36	<30	48
72	39[1]	38	30	48
75	40[1]	38	30	48
118	<30	<30	<30	45
126	33	32[1]	<30	45
144	41	42	42	45
148	41	40	40	45
237	38[1]	34[1]	<30	45

Notes: 1. The L_{eq} operational noise level prediction from Appendix D has been adopted where it is higher than the predicted L_{max} noise level. This is because it is theoretically impossible to measure an L_{eq} greater than the L_{max}. However, the prediction method adopts the maximum noise level from a single source which can result in an L_{max} prediction less than the overall L_{eq} result, which includes all noise sources.

10.8 Low frequency noise

10.8.1 Review of external noise monitoring data

The applicant currently undertakes regular LFN monitoring as part of the noise management regime for MTO as outlined in Section 3 and 4. Monitoring data from the 2013 calendar year was reviewed in detail (total of 46 measurements) to provide a current representation of potential LFN impacts from the mine. This method is preferred and considered more comprehensive than an alternate theoretical noise modelling approach, as it provides a 'real-world' representation of noise levels received in the surrounding communities.

The data was reviewed and assessed using the INP and Broner assessment methods as outlined in Section 9.7. The review has been limited to data samples where a mining noise contribution was observed from MTO only.

Table 10.12 Review of LFN monitoring data - 2013

Monitoring location	Measured noise levels with MTO site noise contribution, dB		INP assessment, dB[2]	'Broner' criteria, dBC	Comment on audible noise sources
	L_{Aeq}	L_{Ceq}	L_{Ceq}- L_{Aeq}		
Bulga Village	41	52	11	60	MTO
Inlet Road West (Bulga)	32	51	**19**	60	MTO
South Bulga	33	56	**23**	60	MTO and wind
South Bulga	34	55	**21**	60	MTO
Wambo Road	35	50	**16**	60	MTO
Wollemi Peak Road	42	51	10	60	MTO
Wollemi Peak Road	35	51	**16**	60	MTO & Dogs
Wollemi Peak Road	43	54	12	60	MTO
		INP criteria	**15**		

Notes: *1. Values are shown in bold if they exceed the INP or 'Broner' low frequency assessment criteria.*

2. As per Sections 9.7.1, the INP low frequency assessment method is exceeded if the difference is greater than or equal to 15 dB.

3. Source is Global Acoustics reports (various) - EMM has not verified the raw data.

Table 10.10 indicates that there are no instances where the INP and 'Broner' assessment criteria are exceeded in the same measurement sample.

The dB(C) minus dB(A) difference of 20 dB as used in DIN45680 is achieved for all measurements with the exception of two measurements at South Bulga. One of these measurements is influenced by wind noise which is likely to influence a higher dB(C) value. The remaining measurement accounts for less than 5% of the total measurements taken in the Bulga locality (23).

10.8.2 Review of representative internal noise levels – DEFRA curve assessment

External and internal noise monitoring was undertaken at a mine owned residence on Putty Road during the night-time on 17 April 2014 to quantify representative internal mine levels and to apply the DEFRA reference curve to highlight any potential for internal LFN impacts.

The dwelling selected is located at 1916 Putty Road (E 315215, N 6386292) approximately 3 km west of MTO. The dwelling construction was relatively lightweight with external timber cladding and internal villaboard/plasterboard lining. The house is raised on brick footings with a timber floor and joist construction. Standard glazing (4 to 6 mm) in aluminium frames was observed. Overall, the building construction is typical of a light-weight rural dwelling, providing relatively low impedance to LFN, and therefore provides a conservative test case for this exercise.

Measurements were taken in two rooms, one representative of a living and dining room and the other representative of a bedroom. Three measurement positions were selected in the living and dining room and two in the bedroom. The schematic in Figure 10.6 shows the approximate measurement positions.

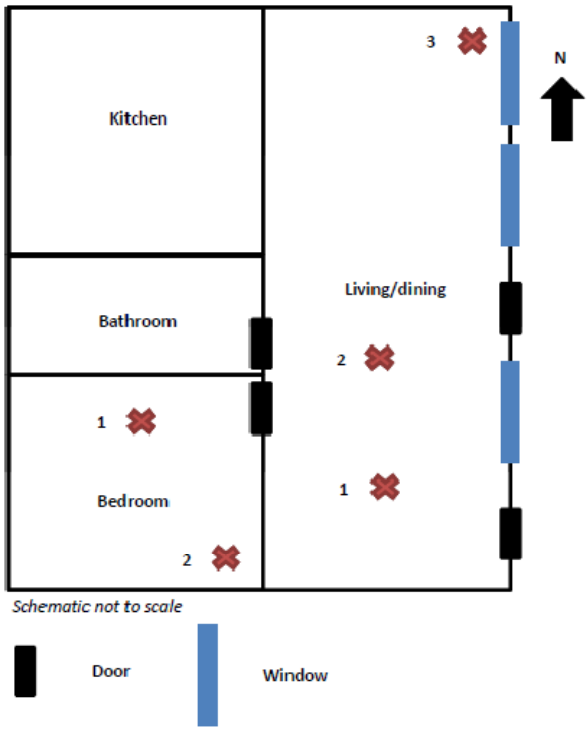


Figure 10.6 Dwelling schematic and internal noise measurement positions

The sound level meters used were set to record third octave band spectral noise level data continuously in one minute intervals over a period of approximately two hours. Calibration was checked before and after and the meters were found to be within an acceptable tolerance (+/- 0.5 dB(A)). A mine noise contribution was clearly audible externally throughout the measurement period.

i External noise levels

The level of mining noise externally was approximated from measured levels between the third octave frequency range of 10 Hz to 800Hz inclusive (ie low pass). The external low pass noise level was found to be in the range of 59 dB(L) to 64 dB(L), 54 dB(C) to 58 dB(C) and 40 dB(A) to 44 dB(A). The average of the external noise levels is presented in Figure 10.8. It was also found that corresponding dB(C) minus dB(A) readings did not exceed 14 dB throughout the two hours of monitoring. Other noise sources included occasional traffic on Putty Road and natural noise sources such as insects and crickets.

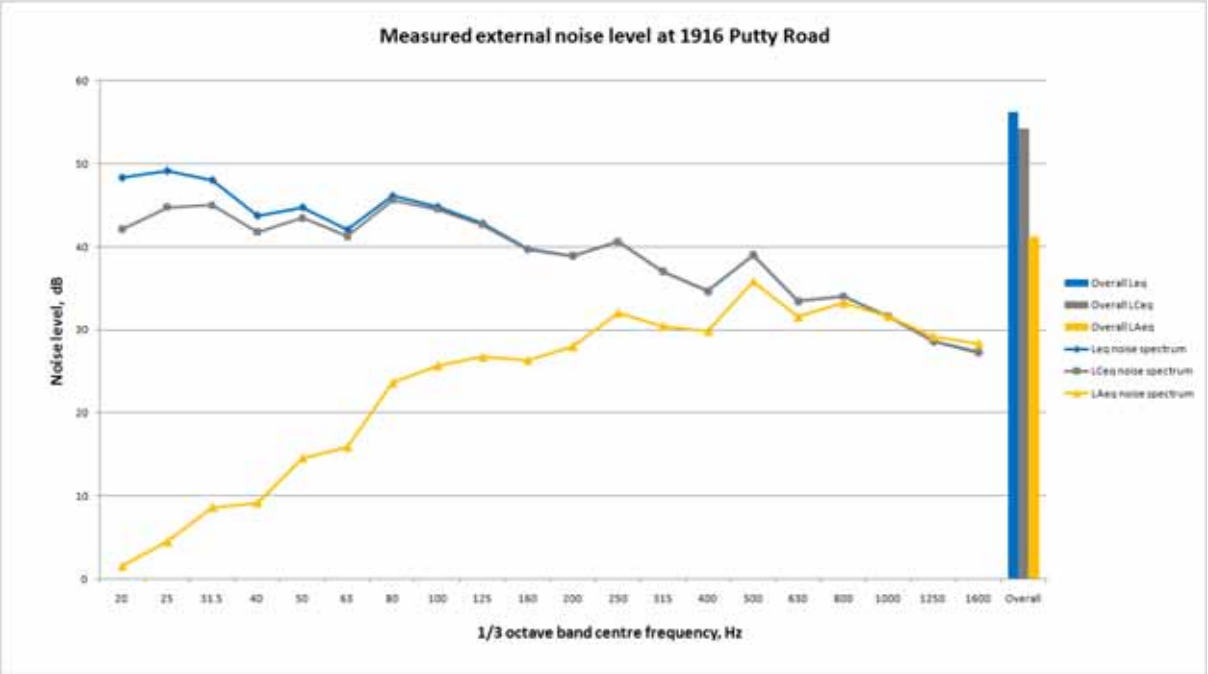


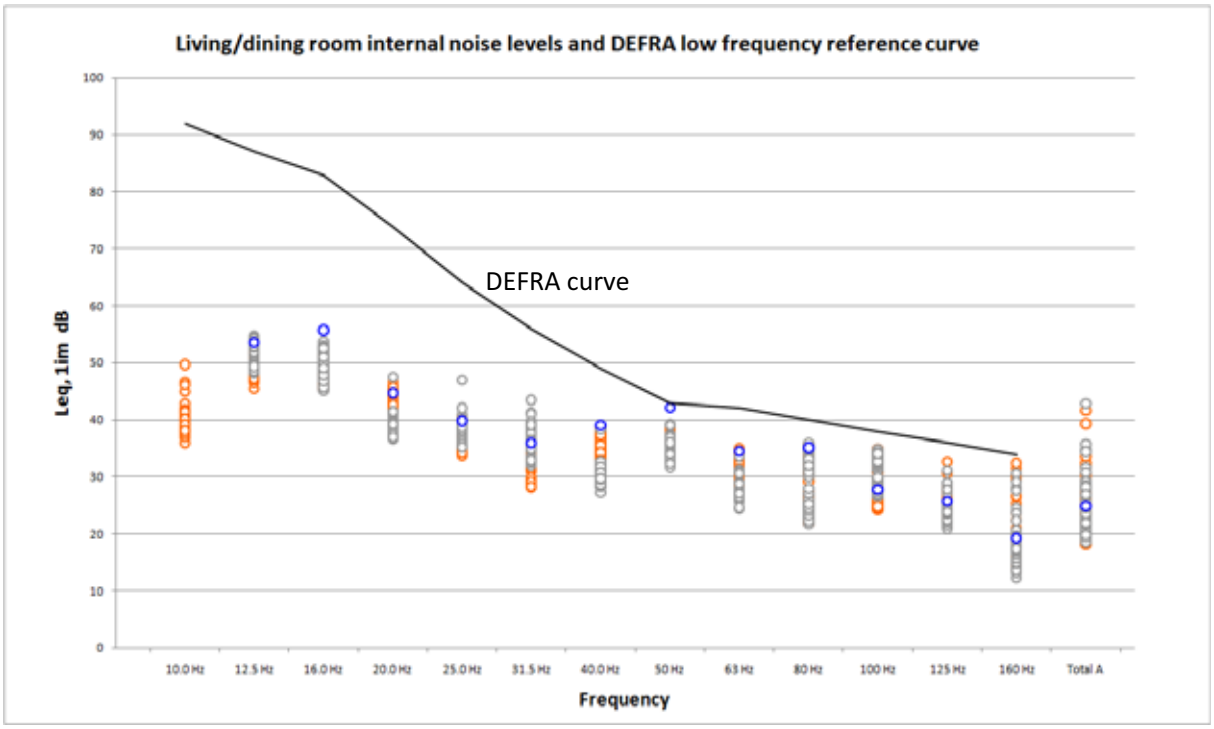
Figure 10.7 External noise levels at 1916 Putty Road

ii Internal noise levels

Whilst mining noise was audible, measurable and consistent outside this dwelling, internally mining noise was not audible in any areas or rooms. The dwelling where measurements were completed (1916 Putty Road) is relatively closer to MTO than Bulga village. To simulate noise levels at the closest private assessment locations in Bulga, the recorded internal noise levels were corrected by subtracting 3 dB to represent the loss in noise energy. This correction was calculated using MTO indicative Year 3 noise model, as the noise contribution from MTO operations was observed to be dominant externally during the measurement period.

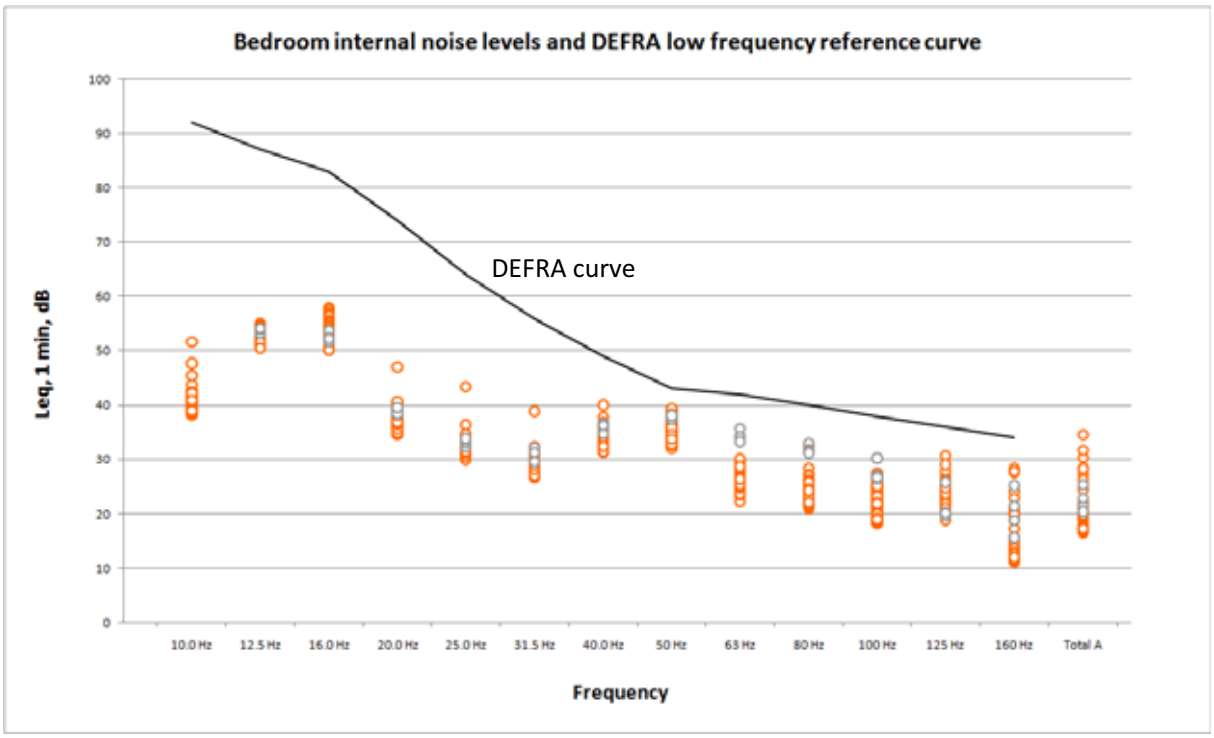
The results from the noise monitoring plotted against the DEFRA LFN reference curve are provided in Figure 10.8 and Figure 10.9 for the living/dining and bedroom, respectively. The charts exclude samples where extraneous noise was observed. A total of 88 one minute samples in the living/ dining room and 51 in the bedroom were captured.

It is clear from the charts that noise levels recorded in the living/dining and bedroom are below the DEFRA LFN reference curve for all measurements.



Note: orange marker represents position 1, grey marker represents position 2 and blue marker represents position 3.

Figure 10.8 Internal LFN monitoring results (living/dining room)



Note: orange marker represents position 1 and grey marker represents position 2.

Figure 10.9 Internal LFN monitoring results (bedroom)

10.9 Other activities

10.9.1 Construction

The proposal is for continuation of mining operations with no additional construction proposed. A construction noise impact assessment has therefore not been prepared in this report.

10.9.2 Road and rail traffic

The proposal will not result in any net increase in road and rail traffic volumes of that currently approved and therefore such impacts for the proposal have not been assessed.

10.9.3 Blasting

The proposal is for continuation of mining operations which will remain within the current approved boundaries. Blasting impacts will therefore remain as previously assessed in past noise and vibration impact assessments for the proposal.

11 Cumulative noise

This section provides an assessment of cumulative noise from all industrial sites to assess an area's amenity against the Mining SEPP's non-discretionary standards which adopt the INP's ANLs. The amenity criteria provide the over-arching goal that if achieved will mean a residence's amenity is not compromised.

The ambient noise at assessment locations in the vicinity of the proposal is also influenced by adjoining industrial premises, for example Wambo Mine, Hunter Valley Operations South Mine, MTO, Bulga Coal Complex, and to some extent Redbank Power Station.

The level of noise at residences from each of these surrounding industries was referenced from the following documents:

- an EIS for the expansion of Wambo Mine (Resource Strategies 2003);
- an Environmental Assessment Report for Hunter Valley Operations South Coal Project (ERM 2008);
- the EIS prepared for Mount Thorley Operations 2014 being exhibited concurrently with this proposal and corresponding noise assessment (EMM 2014); and
- the EIS for the Bulga Coal Complex optimisation project (Umwelt 2013).

Most of these assessments predict noise levels at residences under both calm and adverse weather conditions. To assess cumulative impacts, the L_{eq} noise levels predicted by this assessment were combined with the L_{eq} noise levels from relevant mining stages of each of the aforementioned assessments. For Redbank power station, EMM's attended noise measurements completed during a study in 2010 were adopted and are limited to assessment locations in Gouldsville and Long Point Road.

The cumulative impacts can be predicted for any given mining year, using the conservative approach of combining worst case adverse weather condition noise predictions from each of the mines. In some cases, this is a highly conservative strategy for at least the plausible scenario that for some assessment locations, meteorological conditions required to produce worst case noise levels from one mine will generally be different and are, in some cases, in opposition. For example, while westerly winds will serve to increase noise to residences in Warkworth village from Wambo Mine, they will also serve to decrease noise from the proposal.

In light of this, the assessment of cumulative noise impacts was undertaken on the basis of considering the following:

1. For assessment locations west of the proposal:

    a) adverse weather predictions from Wambo Mine and Redbank power station were combined with calm predictions from all other mines. This simulates north_westerly wind situations; and

    b) calm predictions from Wambo Mine where combined with adverse weather predictions from all other sites. This simulates easterly or south-easterly winds and therefore worst case for these assessment locations.

2. For assessment locations east and north of the proposal:

    a) adverse weather predictions from Bulga Optimisation Project (BOP) and the proposal where combined with calm predictions from all other sites. This simulates a southerly wind situation; and

    b) adverse predictions from all mines where combined with calm predictions from Hunter Valley South Operations. This simulates a conservative worst case situation for these assessment locations.

Table 11.1 summarises the cumulative noise levels at residences surrounding the proposal. As for the sleep disturbance assessment, a subset of representative assessment locations has been used to assess cumulative noise impacts. The results are presented as a range of noise levels in accordance with the approach described above.

The first number in the range relates to scenario (a) above, while the second number of the range relates to scenario (b). Also presented (in parentheses) within Table 11.1 is the respective percentage contribution to the total cumulative noise level from the Site. To estimate $L_{eq,period}$ noise levels from each site, the published $L_{eq,15minute}$ predictions were adjusted by subtracting 3dB to account for changes in operations and weather conditions between a “prevailing” worst case 15 minute and an average nine hour night period. This adjustment is conservative based on our experience in the field for this and other sites.

The results show that the INP's (and Mining SEPP) acceptable night time criteria are satisfied at most locations. The exception is location 77 in Warkworth village north-west of the Site (dominated by Wambo Mine operations worst case predictions). This assessment location is already entitled to acquisition rights upon request from a neighbouring mine. Given the magnitude of exceedance at location 77, and being representative of Warkworth village, through extrapolation the amenity criterion is likely to be exceeded at neighbouring locations 102 (the hall) and 264, due to Wambo Mine.

It is demonstrated that the non-discretionary Mining SEPP is satisfied for Bulga residences and, therefore, the area's amenity is not compromised as it meets the INP's ANL. Further, the amenity, which relates to cumulative noise from all industry, cannot worsen for this area because no new large scale industry will be able to physically exist in a position that could push amenity levels any higher for Bulga residences.

Refer to Figure 7.1 for assessment locations and to Figure 11.1 for predicted amenity noise criteria exceedances.

Table 11.1 Cumulative noise at properties, dB(A) $L_{eq,period}$

Property no.	MTO mine operating years			INP Amenity criteria
	Year 3	Year 9	Year 14	
1	26 (53%) - 33 (54%)	25 (21%) - 32 (23%)	23 (1%) - 32 (4%)	40
19	34 (9%) - 39 (27%)	34 (4%) - 38 (12%)	34 (0%) - 37 (3%)	40
32	32 (11%) - 38 (34%)	33 (3%) - 37 (20%)	33 (1%) - 36 (4%)	40
34	34 (6%) - 38 (14%)	34 (2%) - 40 (5%)	35 (0%) - 38 (1%)	40
37	34 (7%) - 38 (22%)	34 (2%) - 38 (17%)	34 (0%) - 37 (3%)	40
41	29 (58%) - 37 (39%)	29 (30%) - 37 (24%)	27 (0%) - 36 (3%)	40
42	32 (20%) - 38 (47%)	32 (14%) - 37 (34%)	31 (0%) - 36 (5%)	40
44	32 (29%) - 38 (42%)	33 (14%) - 38 (22%)	32 (0%) - 36 (4%)	40
58	32 (24%) - 38 (38%)	33 (14%) - 38 (21%)	32 (0%) - 36 (5%)	40
77	**53 (0%) - 57 (0%)**	**53 (0%) - 57 (0%)**	**53 (0%) - 57 (0%)**	**50**
84	29 (67%) - 37 (39%)	28 (27%) - 37 (20%)	25 (1%) - 33 (6%)	40
118	29 (2%) - 35 (10%)	28 (2%) - 35 (5%)	28 (1%) - 34 (1%)	40
128	34 (3%) - 39 (9%)	34 (3%) - 37 (12%)	33 (2%) - 37 (3%)	40
146	33 (35%) - 41 (33%)	32 (47%) - 40 (42%)	31 (43%) - 40 (25%)	50
149	34 (19%) - 39 (72%)	35 (28%) - 39 (70%)	31 (37%) - 38 (85%)	40
150	34 (8%) - 37 (50%)	34 (10%) - 36 (45%)	30 (14%) - 35 (66%)	40
155	32 (5%) - 36 (19%)	32 (4%) - 35 (15%)	31 (3%) - 35 (7%)	40
157	32 (4%) - 36 (17%)	32 (4%) - 35 (19%)	31 (2%) - 35 (6%)	40
237	29 (71%) - 38 (50%)	29 (33%) - 37 (18%)	27 (1%) - 36 (3%)	40

Notes: 1. Numbers in bold indicates levels above EPA's night Amenity Criterion.

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EMM

COAL & ALLIED

Cumulative noise assessment

Mount Thorley Operations

Noise and vibration assessment

Figure 11.1

12 INP Checklist

The INP provides nine steps for noise management at Section 1.4 'Applying the policy'. For reference, these steps are provided in Table 12.1 along with references within this report as to where these steps have been addressed.

Table 12.1 INP Checklist

INP Step	Reference section in this document
1 Determining the project specific noise levels for intrusiveness and amenity that are relevant to the site or the area (*Section 2*).	Section 9.1
2. Measuring and determining existing background and ambient noise levels, using the method relevant to the expected level of impact (as outlined in *Section 3)*.	Section 8
3. Where the proposed development is expected to produce annoying noise characteristics, adjustments are to be applied to the noise levels produced by the development in question (as outlined in *Section 4)*.	Section 9.7 and 10.8
4. Predicting or measuring the noise levels produced by the development in question, having regard to meteorological effects (such as wind, temperature inversions) (see *Section5*).	Section 10
5. Comparing the predicted or measured noise level with the project-specific noise levels and assessing impacts (*Section 6*).	Section 10.5, 10.6 and Appendix D
6. Considering feasible and reasonable noise mitigation strategies where the project specific noise levels are exceeded (*Section 7*).	Sections 3 to 6, 10.2.1 and 10.6
7. Negotiation between the regulatory/consent authority and the proponent and between the community and the proponent to evaluate the economic, social and environmental costs and benefits from the proposed development against the noise impacts (*Section 8*).	Refer EIS Chapter 7 'Stakeholder engagement', and Chapter 24 'Justification and conclusion'. Several meetings have been held between the applicant and the regulator in relation to noise, social and economic implications of the proposal.
8. The regulatory/consent authority sets statutory compliance levels that reflect the achievable and agreed noise limits for the development (*Section 9*).	To be completed by consent authority at the completion of the approval process.
9. Monitoring of environmental noise levels from the development to determine compliance with the consent/licence conditions (*Section 11*).	To be completed post approval for the proposal. Monitoring data for the current operations is provided in Section 6.

13 Conclusion

This study considers the potential for noise impacts to residences from the proposal, including:

- background noise level analysis in accordance with the INP;
- establishing PSNLs in accordance with the INP;
- detailed three-dimensional noise modelling and predictions;
- assessment against PSNLs;
- assessment of potential sleep disturbance;
- assessment of LFN (external and internal);
- best practice sound suppression on all major plant at an estimated capital cost exceeding $50M across MTW; and
- description of comprehensive management procedures adopted by the Site.

The assessment of the potential for noise impacts on 221 residences over the life of the proposal includes predictions of emissions based on an equipment fleet with best practice sound suppression on all major plant. Further, the Site has developed a first in the NSW industry for pre-emptive real time noise modelling interface (a first in the NSW mining industry) and is using best practice real time noise monitoring and management techniques. This constitutes all reasonable and feasible mitigation has and would be adopted as part of the proposal.

One of the study's aims was to demonstrate the effectiveness of managing off site noise to within the INP's requirements and as described below this has largely been achieved.

Operational noise at residences was predicted under varying meteorological conditions prevalent at the Site including calm, winds and temperature gradient conditions. Modelling has been validated in the past against monitoring results with strong correlations found.

The study developed a fairer approach to background noise level assignment for Bulga residences using long-term monitoring locations and transition of RBLs between these locations.

The assessment concludes that operational noise will comply with the INP's operational criteria for all assessment locations during calm weather conditions for day, evening and night periods.

Predictions during adverse weather indicate that operational noise levels from the proposal would likely present significant noise level exceedances at one assessment location (149) located to the east. To that end, operational noise to eastern assessment locations is expected to remain relatively unchanged from existing and approved activities. No significant exceedances are predicted for assessment locations in Bulga. Further, the proposal is likely to result in lower noise levels for eastern receivers than current and approved operations due to implementation of plant attenuation.

References

Bill Jordan & Associates (2009), Edinglassie Homestead & Rous Lench – Blast Vibration Vulnerability

British Standard 7385-2 and US Bureau of Mines Standard RI 8507 (2006)

Bulga Optimisation (Umwelt 2013); Project Environmental Impact Statement

International Organisation for Standardisation (1999); DIN 4150 Part 3 – Structural Vibration: Effects of Vibration Structures

Deutsche Norm (1999); DIN 4150 Structural Vibration Part 3: Effects of Vibration on Structures

Blastronics Pty Limited (1994); Drill & Blast Study, Mount Pleasant, prepared for Coal & Allied

Dr Norm Broner (2011); A Simple Outdoor Criterion for Assessment of Low Frequency Noise Emission Acoustics Australia Vol.39

Dr Moorhouse (2005); Proposed criteria for the assessment of low frequency noise disturbanceBill Jordan & Associates (2009); Edinglassie Homestead & Rous Lench – Blast Vibration Vulnerability

EMM (2010); Mount Thorley Warkworth Operations Modification - Proposed Warkworth Extension Acoustic Assessment report

Experimental Outdoor Sound Propagation' 13th International Congress on Sound & Vibration, (2006) and Experimental Outdoor Sound Propagation vs ENM Australian and New Zealand Acoustic Society Conference (2006)

Environment Protection Authority (2011); Road Noise Policy

Environment Protection Authority (2000); NSW Industrial Noise Policy

Australian and New Zealand Environment and Conservation Council (ANZECC) (1990); Technical Basis for Guidelines to Minimise Annoyance due to Blasting Overpressure and Ground Vibration

The Australian Standard, AS2187.2 (2006); Explosives - Storage and Use Part 2 Use of Explosives (Appendix J)

The State Environmental Planning Policy (2007); Mining, Petroleum Production and Extractive Industries (Mining SEPP)

Resource Strategies (2002); Wambo Development Project, Environmental Impact Statement

Appendix A

Assessment locations

Table A.1 Properties included in the noise assessment

Locality	Assessment location ID	MGA Coordinates	
		Easting	Northing
Bulga	1	310903	6386238
Bulga	2	311055	6386261
Bulga	3	311295	6386059
Bulga	4	311336	6385751
Bulga	5	311384	6386200
Bulga	6	311422	6386223
Bulga	7	311470	6385618
Bulga	8	311735	6385855
Bulga	9	311832	6385649
Bulga	10	311950	6386665
Bulga	12	312442	6386044
Bulga	13	312532	6387028
Bulga	14	312632	6386066
Bulga	15	312729	6385875
Bulga	16	312822	6386804
Bulga	17	312814	6387573
Bulga	18	312935	6385847
Bulga	19	312900	6387741
Bulga	20	313041	6385812
Bulga	21	312998	6386821
Bulga	22	313169	6385713
Bulga	23	313193	6385453
Bulga	24	313145	6387267
Bulga	26	313266	6385706
Bulga	28	313335	6385003
Bulga	29	313160	6388183
Bulga	30	313270	6386465
Bulga	31	313281	6386646
Bulga	32	313252	6387528
Bulga	33	313338	6386039
Bulga	34	313265	6388491
Bulga	35	313406	6386485
Bulga	36	313473	6385589
Bulga	37	313345	6387861
Bulga	38	313489	6385650
Bulga	39	313511	6385747
Bulga	40	313595	6385794
Bulga	41	313690	6384726
Bulga	42	313580	6386816
Bulga	43	313658	6385668
Bulga	44	313658	6385708
Bulga	45	313725	6385198

Table A.1 Properties included in the noise assessment

Locality	Assessment location ID	MGA Coordinates	
		Easting	Northing
Bulga	46	313798	6385640
Bulga	47	313793	6385729
Bulga	48	313823	6385853
Bulga	49	313872	6385678
Bulga	50	313898	6385517
Bulga	52	313956	6385265
Bulga	53	313965	6385488
Bulga	54	314037	6384456
Bulga	55	313981	6385757
Bulga	56	314005	6385480
Bulga	57	314055	6385470
Bulga	58	314046	6385804
Bulga	60	314128	6385459
Bulga	61	314231	6384325
Bulga	62	314225	6385443
Bulga	63	314229	6385540
Bulga	64	314242	6385504
Bulga	65	314239	6385584
Bulga	66	314258	6385447
Bulga	67	314434	6383176
Bulga	70	314462	6383042
Bulga	71	314354	6385377
Bulga	72	314392	6385359
Bulga	73	314407	6385160
Bulga	74	314514	6384263
Bulga	75	314546	6385220
Bulga	80	314769	6383296
Bulga	82	314734	6384379
Bulga	84	314796	6383618
Bulga	89	314951	6383454
Bulga	210	314178	6385559
Bulga	211	314331	6385481
Bulga	215	313354	6386390
Bulga	217	312125	6386110
Bulga	218	311450	6386578
Bulga	219	311134	6386568
Bulga	220	311258	6385905
Bulga	221	311001	6385414
Bulga	222	311233	6385294
Bulga	223	311393	6385458
Bulga	224	311716	6385367
Bulga	225	312256	6385540

Table A.1 Properties included in the noise assessment

Locality	Assessment location ID	MGA Coordinates	
		Easting	Northing
Bulga	226	312474	6385495
Bulga	227	312569	6385509
Bulga	228	312698	6385457
Bulga	229	312866	6385557
Bulga	230	312952	6385439
Bulga	231	313060	6385467
Bulga	234	314048	6384261
Bulga	235	314181	6384088
Bulga	236	314679	6384143
Bulga	237	314116	6383992
Bulga	238	314448	6383932
Bulga	243	314883	6383176
Bulga	252	314827	6384207
Bulga	253	312973	6385584
Bulga	254	314529	6384103
Bulga	255	312973	6386930
Bulga	266	310048	6389815
Bulga	267	309407	6389413
Bulga	268	308672	6389436
Bulga	903	314821	6383080
Bulga	904	314024	6382465
Bulga	905	313176	6382198
Bulga	909	314611	6382770
Bulga	911	313271	6382442
Bulga	917	314549	6382967
Bulga	918	314686	6382893
Bulga	919	313866	6385003
Bulga	920	314208	6385455
Bulga	921	313692	6384676
Bulga	922	313313	6384456
Bulga	927	314213	6382445
Bulga	927	314251	6382364
Bulga	927	314400	6382451
Bulga	927	314414	6381446
Bulga	927	314462	6381631
Bulga	927	314521	6381618
Bulga	927	313398	6381173
Bulga	927	313742	6381405
Bulga	927	313851	6381411
Bulga	927	313902	6381509
Bulga	928	314270	6382655
Bulga	929	314462	6382864

Table A.1 Properties included in the noise assessment

Locality	Assessment location ID	MGA Coordinates	
		Easting	Northing
Bulga	936	314376	6382753
Gouldsville/Long Point	126	320764	6393699
Gouldsville/Long Point	127	320624	6396932
Gouldsville/Long Point	128	320916	6394511
Gouldsville/Long Point	130	321271	6394970
Gouldsville/Long Point	134	321472	6395034
Gouldsville/Long Point	139	321707	6394686
Gouldsville/Long Point	141	321604	6397030
Gouldsville/Long Point	167	322254	6396725
Gouldsville/Long Point	168	322468	6396793
Gouldsville/Long Point	169	321959	6396271
Gouldsville/Long Point	170	322379	6396285
Gouldsville/Long Point	172	321925	6395400
Gouldsville/Long Point	173	322099	6395301
Gouldsville/Long Point	174	322545	6395438
Gouldsville/Long Point	175	322633	6395534
Gouldsville/Long Point	176	322830	6395688
Gouldsville/Long Point	177	323156	6395384
Gouldsville/Long Point	178	323801	6395607
Gouldsville/Long Point	179	324177	6395141
Gouldsville/Long Point	248	322876	6395431
Gouldsville/Long Point	249	323284	6395685
Gouldsville/Long Point	250	324927	6395679
Gouldsville/Long Point	251	325339	6394874
Gouldsville/Long Point	262	320794	6393794
Hambledon Hill/Wylies Flat	152	323454	6392457
Hambledon Hill/Wylies Flat	155	323565	6393343
Hambledon Hill/Wylies Flat	156	323610	6393617
Hambledon Hill/Wylies Flat	157	323739	6393594
Hambledon Hill/Wylies Flat	180	324246	6392934
Hambledon Hill/Wylies Flat	181	323983	6392725
Hambledon Hill/Wylies Flat	182	324296	6392725
Hambledon Hill/Wylies Flat	183	323903	6392368
Hambledon Hill/Wylies Flat	184	324407	6392127
Hambledon Hill/Wylies Flat	185	324272	6391894
Hambledon Hill/Wylies Flat	186	324164	6391772
Hambledon Hill/Wylies Flat	187	324308	6391565
Hambledon Hill/Wylies Flat	191	323873	6391630
Hambledon Hill/Wylies Flat	192	323595	6391320
Hambledon Hill/Wylies Flat	263	323786	6391522
Hambledon Hill/Wylies Flat	937	322832	6393883
Hambledon Hill/Wylies Flat	937	322935	6394004

Table A.1 Properties included in the noise assessment

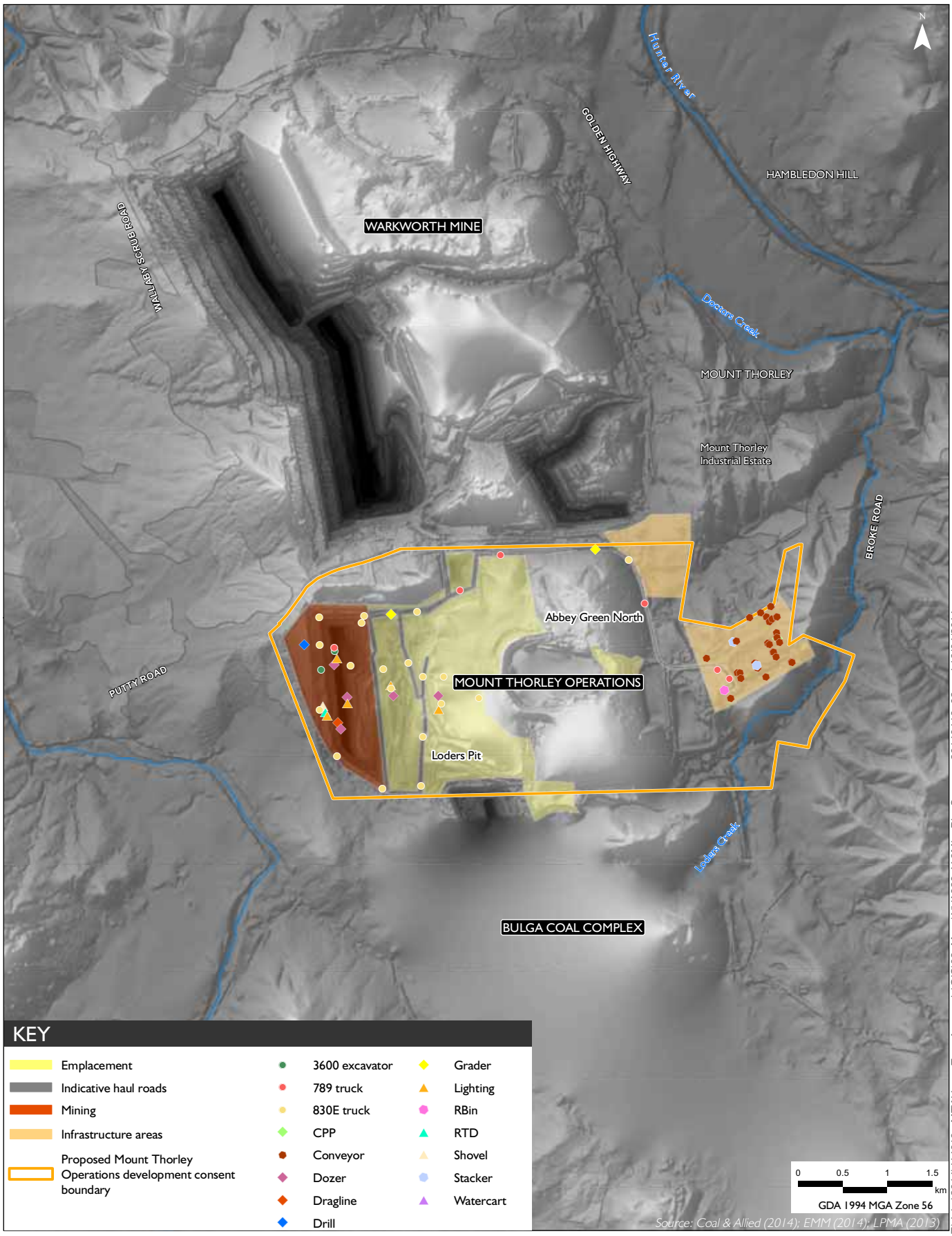
Locality	Assessment location ID	MGA Coordinates	
		Easting	Northing
Hambledon Hill/Wylies Flat	937	323028	6394431
Hambledon Hill/Wylies Flat	937	323333	6393272
Hambledon Hill/Wylies Flat	937	323391	6393295
Maison Dieu	117	317982	6397794
Maison Dieu	118	318128	6397356
Maison Dieu	120	318504	6398457
Maison Dieu	121	318530	6398039
Maison Dieu	122	318608	6398554
Maison Dieu	123	318658	6398205
Maison Dieu	124	318655	6398582
Maison Dieu	160	317883	6399178
Maison Dieu	161	318010	6399448
Maison Dieu	162	318011	6399407
Maison Dieu	163	318114	6399572
Maison Dieu	244	318808	6399092
Maison Dieu	245	318679	6399194
Maison Dieu	246	318795	6399314
Maison Dieu	247	318879	6399292
Maison Dieu	256	317979	6399821
Maison Dieu	257	318793	6399221
Maison Dieu	258	318104	6399611
Maison Dieu	259	318211	6397178
Maison Dieu	260	318180	6399198
Maison Dieu	261	318030	6399106
Maison Dieu	265	318014	6397793
Milbrodale	111	316609	6382098
Milbrodale	193	316558	6380293
Milbrodale	197	317716	6380532
Milbrodale	199	317036	6377983
Milbrodale	200	317360	6378494
Milbrodale	201	316963	6378778
Milbrodale	202	316649	6378621
Milbrodale	203	316167	6378781
Milbrodale	204	316407	6379326
Milbrodale	205	316333	6379327
Milbrodale	206	316214	6379385
Milbrodale	207	315682	6379608
Milbrodale	208	314955	6381041
Milbrodale	923	314505	6381343
Milbrodale	926	315197	6381155
Mount Thorley	144	322654	6389614
Mount Thorley	146	322820	6389611

Table A.1 Properties included in the noise assessment

Locality	Assessment location ID	MGA Coordinates	
		Easting	Northing
Mount Thorley	148	323360	6389527
Mount Thorley	149	323510	6388982
Mount Thorley	150	323560	6389775
Mount Thorley	153	323662	6389415
Mount Thorley	188	324940	6390387
Mount Thorley	190	323552	6389746
Mount Thorley	915	322542	6389581
Mount Thorley	932	325626	6388538
Warkworth	77	314103	6394482
Warkworth	102	314808	6394346
Warkworth	264	314870	6394227

Appendix B

Mine plans and modelled equipment locations



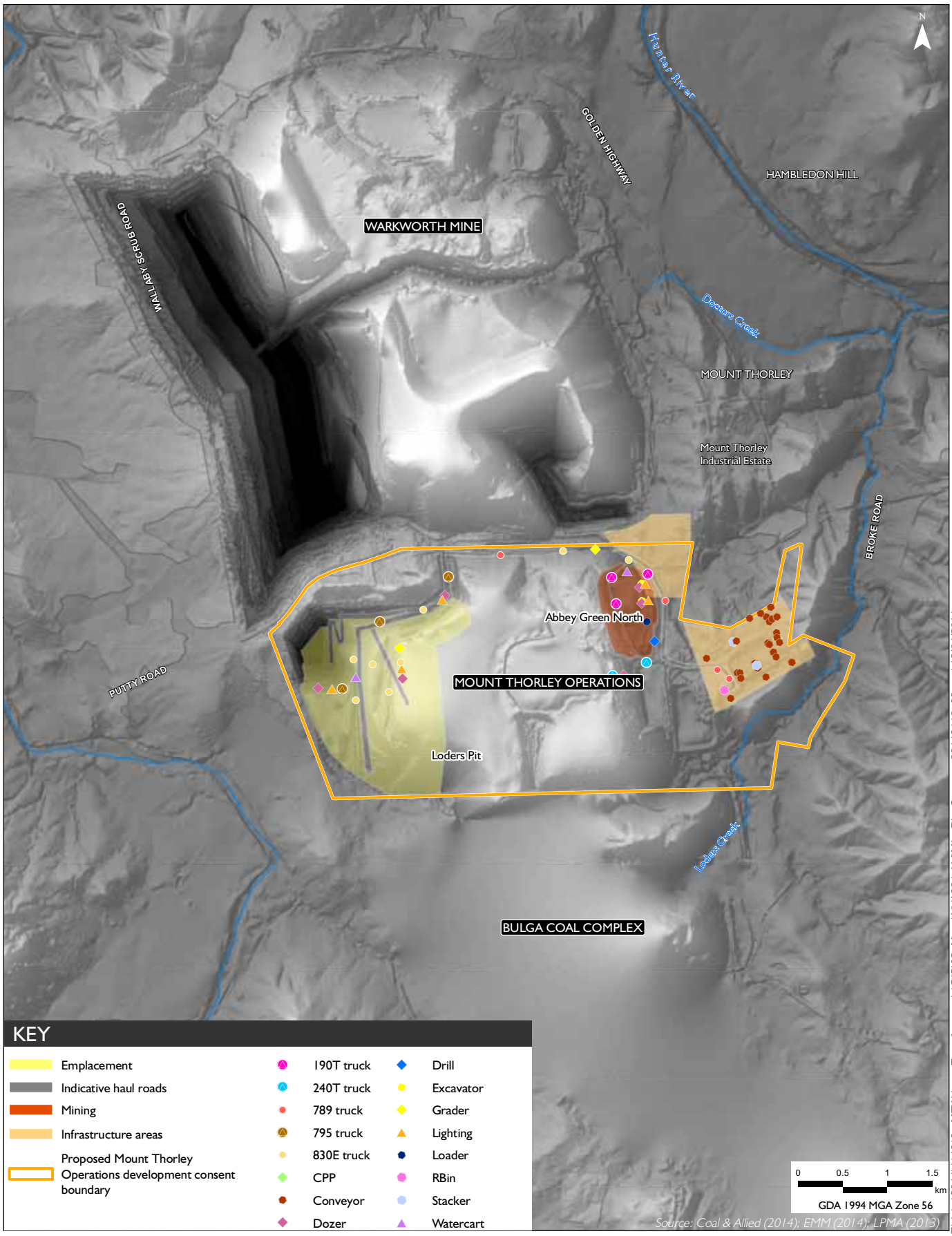
T:\Jobs\2014\J14013 - MTW Long Term Approvals\GIS\02_Maps\NVA323_Yr3MinePlanSources_20140416_02.mxd 16/04/2014

Year 3 mine plan and equipment locations

Mount Thorley Operations

Noise and vibration assessment

Figure B1



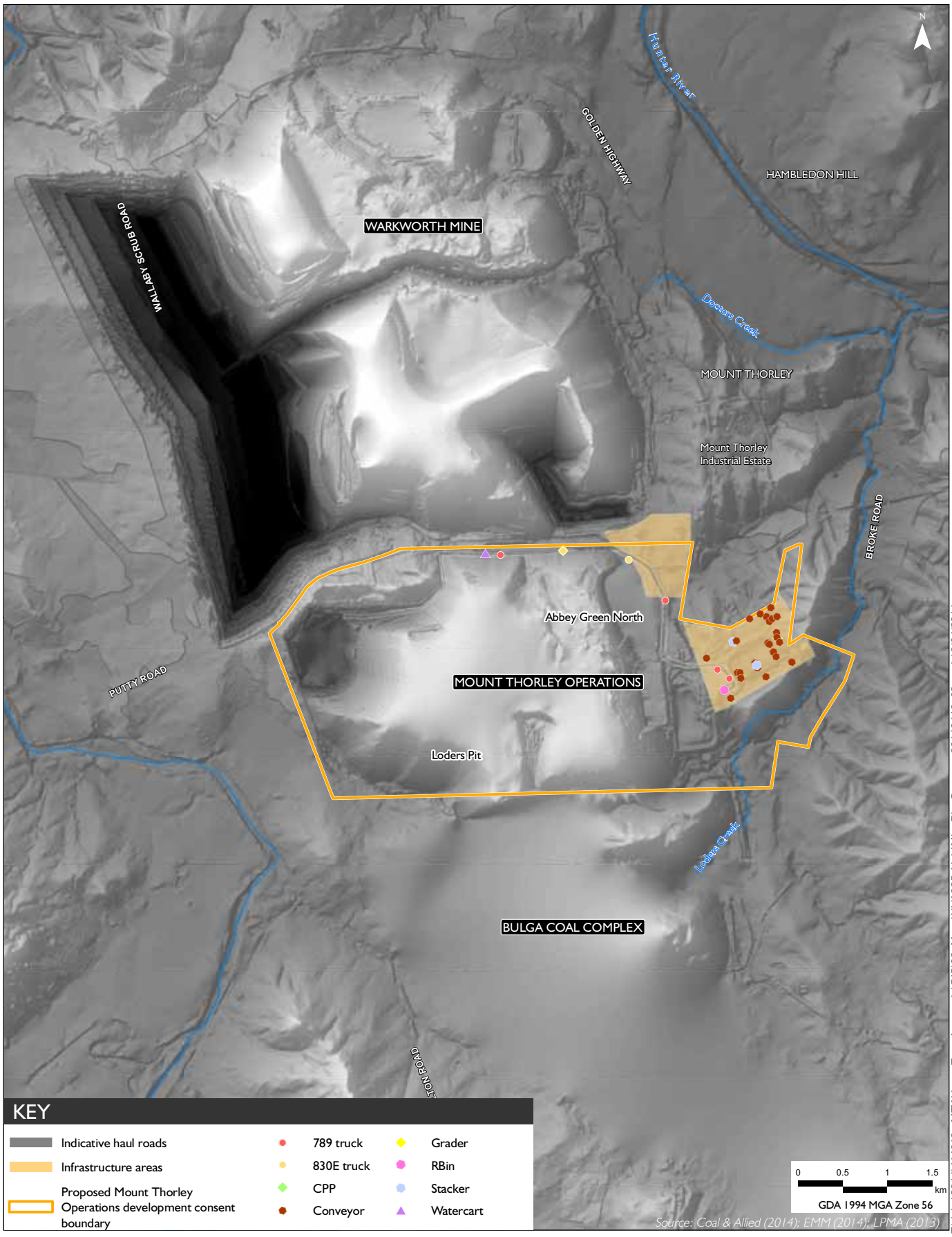
T:\Jobs\2014\J14013 - MTW Long Term Approvals\GIS\02_Maps\NVA324_Yr9MinePlanSources_20140416_02.mxd 16/04/2014

Year 9 mine plan and equipment locations

Mount Thorley Operations

Noise and vibration assessment

Figure B2



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Year 14 mine plan and equipment locations

Mount Thorley Operations

Noise and vibration assessment

Figure B3

Appendix C

INP wind analysis

Table C.1 Day percentage of wind speed (vector at 22.5o intervals)

Direction	Winter	Autumn	Spring	Summer
22.5°	17.4	23.6	21.9	21
45 °	20.8	23.3	17.6	22.2
67.5 °	23	21.6	12.9	22
90 °	25.7	24.6	12.9	21.1
112 .5 °	27.8	28.9	15.3	22.1
135 °	27.2	29.3	16	21.7
157.5 °	24.9	28	16	19.7
180 °	21.5	24.9	15.5	16.3
202.5 °	16.8	21	14.6	13
225 °	12.4	17.5	13.4	10.1
247.5 °	6.4	12.5	13.3	7.3
270 °	5.6	14	16.9	8.3
292.5 °	9.3	19.1	22.5	13.1
315 °	11.3	20	23.3	15.2
337.5 °	12.7	20.8	23.6	16.6
360 °	14.6	22	23.3	18.6

Notes: 1. Bold highlight denotes occurrence of 30 % and greater.

Table C.2 Evening percentage of wind speed (vector at 22.5o intervals)

Direction	Winter	Autumn	Spring	Summer
22.5°	8.6	8.2	9	13
45 °	13	13.3	7.7	17.4
67.5 °	18.1	20.3	8.1	24.3
90 °	22	**30.6**	16.4	28.7
112 .5 °	22.8	**44.8**	**33.6**	**31.7**
135 °	22.7	**48.7**	**41.1**	**31.8**
157.5 °	21.8	**48.3**	**42.9**	**30.5**
180 °	18.9	**46.4**	**43.9**	28.1
202.5 °	13.6	**40.3**	**43.1**	21.8
225 °	8.2	**32.2**	**41.4**	13.9
247.5 °	5.1	20.8	**32.1**	10.7
270 °	4.3	9.4	18.1	9.6
292.5 °	4.3	7.4	15.3	9.9
315 °	4.4	7.1	14.4	9.8
337.5 °	5.3	7.1	13	10
360 °	6.4	6.9	11.2	10.8

Notes: 1. Bold highlight denotes occurrence of 30 % and greater.

Table C.3 Night percentage of wind speed (vector at 22.5o intervals)

Direction	Winter	Autumn	Spring	Summer
22.5°	7.2	9.8	17.4	13.6
45 °	9.4	7.1	10	10.9
67.5 °	18	7.6	4.2	12.3
90 °	**32**	23.1	9.7	25.4
112 .5 °	**44**	**43.1**	21.2	**39.3**
135 °	**46.8**	**47**	25.8	**43.6**
157.5 °	**47.1**	**48.5**	27.8	**45**
180 °	**46.2**	**49**	29.3	**45.1**
202.5 °	**41.9**	**48.6**	**31.3**	**43.6**
225 °	**30.8**	**44.4**	**33.1**	**38.1**
247.5 °	16	27.9	**30.6**	25.8
270 °	7.3	16	27.3	19.4
292.5 °	7	16.1	28	19.6
315 °	7.1	15.3	27.3	19
337.5 °	7.2	14.4	25.7	18
360 °	7.2	12.8	22.7	16.2

Notes: 1. Bold highlight denotes occurrence of 30 % and greater.

Appendix D

Predicted noise levels during calm and INP prevailing meteorological conditions

Table D.1 Predicted operational noise levels during calm and prevailing meteorological conditions, dB(A)

Locality	Assessment location	RBL	Indicative Year 3, $L_{eq,15min}$			Indicative Year 9, $L_{eq,15min}$			Indicative Year 14, $L_{eq,15min}$			INP PSNL, $L_{eq,15min}$	Potential acquisition criteria, $L_{eq,15min}$
			Calm		Prevailing	Calm		Prevailing	Calm		Prevailing		
			Day	Eve/Night	Eve/Night	Day	Eve/Night	Eve/Night	Day	Eve/Night	Eve/Night		
Bulga	1	30	≤35	≤35	≤35	≤35	≤35	≤35	≤35	≤35	≤35	35	40
	2	30	≤35	≤35	≤35	≤35	≤35	≤35	≤35	≤35	≤35	35	40
	3	30	≤35	≤35	≤35	≤35	≤35	≤35	≤35	≤35	≤35	35	40
	4	30	≤35	≤35	≤35	≤35	≤35	≤35	≤35	≤35	≤35	35	40
	5	30	≤35	≤35	≤35	≤35	≤35	≤35	≤35	≤35	≤35	35	40
	6	30	≤35	≤35	≤35	≤35	≤35	≤35	≤35	≤35	≤35	35	40
	7	30	≤35	≤35	≤35	≤35	≤35	≤35	≤35	≤35	≤35	35	40
	8	30	≤35	≤35	≤35	≤35	≤35	≤35	≤35	≤35	≤35	35	40
	9	30	≤35	≤35	≤35	≤35	≤35	≤35	≤35	≤35	≤35	35	40
	10	30	≤35	≤35	≤35	≤35	≤35	≤35	≤35	≤35	≤35	35	40
	12	30	≤35	≤35	36	≤35	≤35	≤35	≤35	≤35	≤35	35	40
	13	33	≤38	≤38	≤38	≤38	≤38	≤38	≤38	≤38	≤38	38	43
	14	30	≤35	≤35	36	≤35	≤35	≤35	≤35	≤35	≤35	35	40
	15	30	≤35	≤35	36	≤35	≤35	≤35	≤35	≤35	≤35	35	40
	16	33	≤38	≤38	≤38	≤38	≤38	≤38	≤38	≤38	≤38	38	43
	17	33	≤38	≤38	≤38	≤38	≤38	≤38	≤38	≤38	≤38	38	43
	18	31	≤36	≤36	37	≤36	≤36	≤36	≤36	≤36	≤36	36	41
	19	33	≤38	≤38	≤38	≤38	≤38	≤38	≤38	≤38	≤38	38	43
	20	31	≤36	≤36	37	≤36	≤36	≤36	≤36	≤36	≤36	36	41
	21	33	≤38	≤38	≤38	≤38	≤38	≤38	≤38	≤38	≤38	38	43
	22	31	≤36	≤36	37	≤36	≤36	≤36	≤36	≤36	≤36	36	41
	23	31	≤36	≤36	37	≤36	≤36	≤36	≤36	≤36	≤36	36	41
	24	33	≤38	≤38	≤38	≤38	≤38	≤38	≤38	≤38	≤38	38	43
	26	31	≤36	≤36	37	≤36	≤36	≤36	≤36	≤36	≤36	36	41
	28	32	≤37	≤37	≤37	≤37	≤37	≤37	≤37	≤37	≤37	37	42
	29	30	≤35	≤35	37	≤35	≤35	≤35	≤35	≤35	≤35	35	40

Table D.1 Predicted operational noise levels during calm and prevailing meteorological conditions, dB(A)

Locality	Assessment location	RBL	Indicative Year 3, $L_{eq,15min}$			Indicative Year 9, $L_{eq,15min}$			Indicative Year 14, $L_{eq,15min}$			INP PSNL, $L_{eq,15min}$	Potential acquisition criteria, $L_{eq,15min}$
			Calm		Prevailing	Calm		Prevailing	Calm		Prevailing		
			Day	Eve/Night	Eve/Night	Day	Eve/Night	Eve/Night	Day	Eve/Night	Eve/Night		
	30	33	≤38	≤38	≤38	≤38	≤38	≤38	≤38	≤38	≤38	38	43
	31	33	≤38	≤38	≤38	≤38	≤38	≤38	≤38	≤38	≤38	38	43
	32	33	≤38	≤38	≤38	≤38	≤38	≤38	≤38	≤38	≤38	38	43
	33	32	≤37	≤37	38	≤37	≤37	≤37	≤37	≤37	≤37	37	42
	35	33	≤38	≤38	≤38	≤38	≤38	≤38	≤38	≤38	≤38	38	43
	36	32	≤37	≤37	38	≤37	≤37	≤37	≤37	≤37	≤37	37	42
	37	33	≤38	≤38	≤38	≤38	≤38	≤38	≤38	≤38	≤38	38	43
	38	32	≤37	≤37	≤37	≤37	≤37	≤37	≤37	≤37	≤37	37	42
	39	32	≤37	≤37	≤37	≤37	≤37	≤37	≤37	≤37	≤37	37	42
	40	32	≤37	≤37	38	≤37	≤37	≤37	≤37	≤37	≤37	37	42
	41	32	≤37	≤37	38	≤37	≤37	≤37	≤37	≤37	≤37	37	42
	42	33	≤38	≤38	39	≤38	≤38	≤38	≤38	≤38	≤38	38	43
	43	32	≤37	≤37	38	≤37	≤37	≤37	≤37	≤37	≤37	37	42
	44	32	≤37	≤37	38	≤37	≤37	≤37	≤37	≤37	≤37	37	42
	45	32	≤37	≤37	38	≤37	≤37	≤37	≤37	≤37	≤37	37	42
	46	32	≤37	≤37	38	≤37	≤37	≤37	≤37	≤37	≤37	37	42
	47	32	≤37	≤37	38	≤37	≤37	≤37	≤37	≤37	≤37	37	42
	48	32	≤37	≤37	38	≤37	≤37	≤37	≤37	≤37	≤37	37	42
	49	32	≤37	≤37	38	≤37	≤37	≤37	≤37	≤37	≤37	37	42
	50	32	≤37	≤37	38	≤37	≤37	≤37	≤37	≤37	≤37	37	42
	52	33	≤38	≤38	≤38	≤38	≤38	≤38	≤38	≤38	≤38	38	43
	53	33	≤38	≤38	39	≤38	≤38	≤38	≤38	≤38	≤38	38	43
	54	33	≤38	≤38	≤38	≤38	≤38	≤38	≤38	≤38	≤38	38	43
	55	33	≤38	≤38	39	≤38	≤38	≤38	≤38	≤38	≤38	38	43
	56	33	≤38	≤38	39	≤38	≤38	≤38	≤38	≤38	≤38	38	43
	57	33	≤38	≤38	39	≤38	≤38	≤38	≤38	≤38	≤38	38	43

Table D.1 Predicted operational noise levels during calm and prevailing meteorological conditions, dB(A)

Locality	Assessment location	RBL	Indicative Year 3, $L_{eq,15min}$			Indicative Year 9, $L_{eq,15min}$			Indicative Year 14, $L_{eq,15min}$			INP PSNL, $L_{eq,15min}$	Potential acquisition criteria, $L_{eq,15min}$
			Calm		Prevailing	Calm		Prevailing	Calm		Prevailing		
			Day	Eve/Night	Eve/Night	Day	Eve/Night	Eve/Night	Day	Eve/Night	Eve/Night		
	58	33	≤38	≤38	39	≤38	≤38	≤38	≤38	≤38	≤38	38	43
	60	33	≤38	≤38	39	≤38	≤38	≤38	≤38	≤38	≤38	38	43
	61	33	≤38	≤38	≤38	≤38	≤38	≤38	≤38	≤38	≤38	38	43
	62	33	≤38	≤38	39	≤38	≤38	≤38	≤38	≤38	≤38	38	43
	63	33	≤38	≤38	39	≤38	≤38	≤38	≤38	≤38	≤38	38	43
	64	33	≤38	≤38	39	≤38	≤38	≤38	≤38	≤38	≤38	38	43
	65	33	≤38	≤38	39	≤38	≤38	≤38	≤38	≤38	≤38	38	43
	66	33	≤38	≤38	39	≤38	≤38	≤38	≤38	≤38	≤38	38	43
	67	33	≤38	≤38	≤38	≤38	≤38	≤38	≤38	≤38	≤38	38	43
	70	33	≤38	≤38	≤38	≤38	≤38	≤38	≤38	≤38	≤38	38	43
	71	33	≤38	≤38	39	≤38	≤38	≤38	≤38	≤38	≤38	38	43
	72	33	≤38	≤38	39	≤38	≤38	≤38	≤38	≤38	≤38	38	43
	73	33	≤38	≤38	39	≤38	≤38	≤38	≤38	≤38	≤38	38	43
	74	33	≤38	≤38	≤38	≤38	≤38	≤38	≤38	≤38	≤38	38	43
	75	33	≤38	≤38	40	≤38	≤38	≤38	≤38	≤38	≤38	38	43
	80	33	≤38	≤38	≤38	≤38	≤38	≤38	≤38	≤38	≤38	38	43
	82	33	≤38	≤38	39	≤38	≤38	≤38	≤38	≤38	≤38	38	43
	84	33	≤38	≤38	≤38	≤38	≤38	≤38	≤38	≤38	≤38	38	43
	89	33	≤38	≤38	≤38	≤38	≤38	≤38	≤38	≤38	≤38	38	43
	210	33	≤38	≤38	39	≤38	≤38	≤38	≤38	≤38	≤38	38	43
	211	33	≤38	≤38	39	≤38	≤38	≤38	≤38	≤38	≤38	38	43
	215	33	≤38	≤38	≤38	≤38	≤38	≤38	≤38	≤38	≤38	38	43
	217	30	≤35	≤35	≤35	≤35	≤35	≤35	≤35	≤35	≤35	35	40
	218	30	≤35	≤35	≤35	≤35	≤35	≤35	≤35	≤35	≤35	35	40
	219	30	≤35	≤35	≤35	≤35	≤35	≤35	≤35	≤35	≤35	35	40
	220	30	≤35	≤35	≤35	≤35	≤35	≤35	≤35	≤35	≤35	35	40

Table D.1 Predicted operational noise levels during calm and prevailing meteorological conditions, dB(A)

Locality	Assessment location	RBL	Indicative Year 3, $L_{eq,15min}$			Indicative Year 9, $L_{eq,15min}$			Indicative Year 14, $L_{eq,15min}$			INP PSNL, $L_{eq,15min}$	Potential acquisition criteria, $L_{eq,15min}$
			Calm		Prevailing	Calm		Prevailing	Calm		Prevailing		
			Day	Eve/Night	Eve/Night	Day	Eve/Night	Eve/Night	Day	Eve/Night	Eve/Night		
	221	30	≤35	≤35	≤35	≤35	≤35	≤35	≤35	≤35	≤35	35	40
	222	30	≤35	≤35	≤35	≤35	≤35	≤35	≤35	≤35	≤35	35	40
	223	30	≤35	≤35	≤35	≤35	≤35	≤35	≤35	≤35	≤35	35	40
	224	30	≤35	≤35	≤35	≤35	≤35	≤35	≤35	≤35	≤35	35	40
	225	30	≤35	≤35	≤35	≤35	≤35	≤35	≤35	≤35	≤35	35	40
	226	30	≤35	≤35	36	≤35	≤35	≤35	≤35	≤35	≤35	35	40
	227	30	≤35	≤35	36	≤35	≤35	≤35	≤35	≤35	≤35	35	40
	228	30	≤35	≤35	36	≤35	≤35	≤35	≤35	≤35	≤35	35	40
	229	31	≤36	≤36	≤36	≤36	≤36	≤36	≤36	≤36	≤36	36	41
	230	31	≤36	≤36	37	≤36	≤36	≤36	≤36	≤36	≤36	36	41
	231	31	≤36	≤36	37	≤36	≤36	≤36	≤36	≤36	≤36	36	41
	234	33	≤38	≤38	≤38	≤38	≤38	≤38	≤38	≤38	≤38	38	43
	235	33	≤38	≤38	≤38	≤38	≤38	≤38	≤38	≤38	≤38	38	43
	236	33	≤38	≤38	39	≤38	≤38	≤38	≤38	≤38	≤38	38	43
	237	33	≤38	≤38	≤38	≤38	≤38	≤38	≤38	≤38	≤38	38	43
	238	33	≤38	≤38	≤38	≤38	≤38	≤38	≤38	≤38	≤38	38	43
	243	33	≤38	≤38	≤38	≤38	≤38	≤38	≤38	≤38	≤38	38	43
	252	33	≤38	≤38	39	≤38	≤38	≤38	≤38	≤38	≤38	38	43
	253	31	≤36	≤36	37	≤36	≤36	≤36	≤36	≤36	≤36	36	41
	254	33	≤38	≤38	≤38	≤38	≤38	≤38	≤38	≤38	≤38	38	43
	255	33	≤38	≤38	≤38	≤38	≤38	≤38	≤38	≤38	≤38	38	43
	266	30	≤35	≤35	≤35	≤35	≤35	≤35	≤35	≤35	≤35	35	40
	267	30	≤35	≤35	≤35	≤35	≤35	≤35	≤35	≤35	≤35	35	40
	268	30	≤35	≤35	≤35	≤35	≤35	≤35	≤35	≤35	≤35	35	40
	903	33	≤38	≤38	≤38	≤38	≤38	≤38	≤38	≤38	≤38	38	43
	904	30	≤35	≤35	≤35	≤35	≤35	≤35	≤35	≤35	≤35	35	40

Table D.1 Predicted operational noise levels during calm and prevailing meteorological conditions, dB(A)

Locality	Assessment location	RBL	Indicative Year 3, $L_{eq,15min}$			Indicative Year 9, $L_{eq,15min}$			Indicative Year 14, $L_{eq,15min}$			INP PSNL, $L_{eq,15min}$	Potential acquisition criteria, $L_{eq,15min}$
			Calm		Prevailing	Calm		Prevailing	Calm		Prevailing		
			Day	Eve/Night	Eve/Night	Day	Eve/Night	Eve/Night	Day	Eve/Night	Eve/Night		
	905	30	≤35	≤35	≤35	≤35	≤35	≤35	≤35	≤35	≤35	35	40
	909	30	≤35	≤35	36	≤35	≤35	≤35	≤35	≤35	≤35	35	40
	911	30	≤35	≤35	≤35	≤35	≤35	≤35	≤35	≤35	≤35	35	40
	917	33	≤38	≤38	≤38	≤38	≤38	≤38	≤38	≤38	≤38	38	43
	918	33	≤38	≤38	≤38	≤38	≤38	≤38	≤38	≤38	≤38	38	43
	919	33	≤38	≤38	≤38	≤38	≤38	≤38	≤38	≤38	≤38	38	43
	920	33	≤38	≤38	39	≤38	≤38	≤38	≤38	≤38	≤38	38	43
	921	32	≤37	≤37	≤37	≤37	≤37	≤37	≤37	≤37	≤37	37	42
	922	32	≤37	≤37	≤37	≤37	≤37	≤37	≤37	≤37	≤37	37	42
	927	30	≤35	≤35	≤35	≤35	≤35	≤35	≤35	≤35	≤35	35	40
	927	30	≤35	≤35	≤35	≤35	≤35	≤35	≤35	≤35	≤35	35	40
	927	30	≤35	≤35	≤35	≤35	≤35	≤35	≤35	≤35	≤35	35	40
	927	30	≤35	≤35	≤35	≤35	≤35	≤35	≤35	≤35	≤35	35	40
	927	30	≤35	≤35	≤35	≤35	≤35	≤35	≤35	≤35	≤35	35	40
	927	30	≤35	≤35	≤35	≤35	≤35	≤35	≤35	≤35	≤35	35	40
	927	30	≤35	≤35	≤35	≤35	≤35	≤35	≤35	≤35	≤35	35	40
	927	30	≤35	≤35	≤35	≤35	≤35	≤35	≤35	≤35	≤35	35	40
	927	30	≤35	≤35	≤35	≤35	≤35	≤35	≤35	≤35	≤35	35	40
	927	30	≤35	≤35	≤35	≤35	≤35	≤35	≤35	≤35	≤35	35	40
	928	30	≤35	≤35	36	≤35	≤35	≤35	≤35	≤35	≤35	35	40
	929	33	≤38	≤38	≤38	≤38	≤38	≤38	≤38	≤38	≤38	38	43
	936	30	≤35	≤35	36	≤35	≤35	≤35	≤35	≤35	≤35	35	40
Gouldsville/ Long Point	126	33	≤38	≤38	≤38	≤38	≤38	≤38	≤38	≤38	≤38	38	43
	127	30	≤35	≤35	≤35	≤35	≤35	≤35	≤35	≤35	≤35	35	40
	128	30	≤35	≤35	≤35	≤35	≤35	≤35	≤35	≤35	≤35	35	40
	130	30	≤35	≤35	≤35	≤35	≤35	≤35	≤35	≤35	≤35	35	40

Table D.1 Predicted operational noise levels during calm and prevailing meteorological conditions, dB(A)

Locality	Assessment location	RBL	Indicative Year 3, $L_{eq,15min}$			Indicative Year 9, $L_{eq,15min}$			Indicative Year 14, $L_{eq,15min}$			INP PSNL, $L_{eq,15min}$	Potential acquisition criteria, $L_{eq,15min}$
			Calm		Prevailing	Calm		Prevailing	Calm		Prevailing		
			Day	Eve/Night	Eve/Night	Day	Eve/Night	Eve/Night	Day	Eve/Night	Eve/Night		
	134	30	≤35	≤35	≤35	≤35	≤35	≤35	≤35	≤35	≤35	35	40
	139	30	≤35	≤35	≤35	≤35	≤35	≤35	≤35	≤35	≤35	35	40
	141	30	≤35	≤35	≤35	≤35	≤35	≤35	≤35	≤35	≤35	35	40
	167	30	≤35	≤35	≤35	≤35	≤35	≤35	≤35	≤35	≤35	35	40
	168	30	≤35	≤35	≤35	≤35	≤35	≤35	≤35	≤35	≤35	35	40
	169	30	≤35	≤35	≤35	≤35	≤35	≤35	≤35	≤35	≤35	35	40
	170	30	≤35	≤35	≤35	≤35	≤35	≤35	≤35	≤35	≤35	35	40
	172	30	≤35	≤35	≤35	≤35	≤35	≤35	≤35	≤35	≤35	35	40
	173	30	≤35	≤35	≤35	≤35	≤35	≤35	≤35	≤35	≤35	35	40
	174	30	≤35	≤35	≤35	≤35	≤35	≤35	≤35	≤35	≤35	35	40
	175	30	≤35	≤35	≤35	≤35	≤35	≤35	≤35	≤35	≤35	35	40
	176	30	≤35	≤35	≤35	≤35	≤35	≤35	≤35	≤35	≤35	35	40
	177	30	≤35	≤35	≤35	≤35	≤35	≤35	≤35	≤35	≤35	35	40
	178	30	≤35	≤35	≤35	≤35	≤35	≤35	≤35	≤35	≤35	35	40
	179	30	≤35	≤35	≤35	≤35	≤35	≤35	≤35	≤35	≤35	35	40
	248	30	≤35	≤35	≤35	≤35	≤35	≤35	≤35	≤35	≤35	35	40
	249	30	≤35	≤35	≤35	≤35	≤35	≤35	≤35	≤35	≤35	35	40
	250	30	≤35	≤35	≤35	≤35	≤35	≤35	≤35	≤35	≤35	35	40
	251	30	≤35	≤35	≤35	≤35	≤35	≤35	≤35	≤35	≤35	35	40
	262	33	≤38	≤38	≤38	≤38	≤38	≤38	≤38	≤38	≤38	38	43
Hambledon Hill/Wylies Flat	152	30	≤35	≤35	≤35	≤35	≤35	≤35	≤35	≤35	≤35	35	40
	155	30	≤35	≤35	≤35	≤35	≤35	≤35	≤35	≤35	≤35	35	40
	156	30	≤35	≤35	≤35	≤35	≤35	≤35	≤35	≤35	≤35	35	40
	157	30	≤35	≤35	≤35	≤35	≤35	≤35	≤35	≤35	≤35	35	40
	180	30	≤35	≤35	≤35	≤35	≤35	≤35	≤35	≤35	≤35	35	40
	181	30	≤35	≤35	≤35	≤35	≤35	≤35	≤35	≤35	≤35	35	40

Table D.1 Predicted operational noise levels during calm and prevailing meteorological conditions, dB(A)

Locality	Assessment location	RBL	Indicative Year 3, $L_{eq,15min}$			Indicative Year 9, $L_{eq,15min}$			Indicative Year 14, $L_{eq,15min}$			INP PSNL, $L_{eq,15min}$	Potential acquisition criteria, $L_{eq,15min}$
			Calm		Prevailing	Calm		Prevailing	Calm		Prevailing		
			Day	Eve/Night	Eve/Night	Day	Eve/Night	Eve/Night	Day	Eve/Night	Eve/Night		
	182	30	≤35	≤35	≤35	≤35	≤35	≤35	≤35	≤35	≤35	35	40
	183	30	≤35	≤35	≤35	≤35	≤35	≤35	≤35	≤35	≤35	35	40
	184	30	≤35	≤35	≤35	≤35	≤35	≤35	≤35	≤35	≤35	35	40
	185	30	≤35	≤35	≤35	≤35	≤35	≤35	≤35	≤35	≤35	35	40
	186	30	≤35	≤35	≤35	≤35	≤35	≤35	≤35	≤35	≤35	35	40
	187	30	≤35	≤35	≤35	≤35	≤35	≤35	≤35	≤35	≤35	35	40
	191	30	≤35	≤35	≤35	≤35	≤35	≤35	≤35	≤35	≤35	35	40
	192	30	≤35	≤35	≤35	≤35	≤35	≤35	≤35	≤35	≤35	35	40
	263	30	≤35	≤35	≤35	≤35	≤35	≤35	≤35	≤35	≤35	35	40
	937	30	≤35	≤35	≤35	≤35	≤35	≤35	≤35	≤35	≤35	35	40
	937	30	≤35	≤35	≤35	≤35	≤35	≤35	≤35	≤35	≤35	35	40
	937	30	≤35	≤35	≤35	≤35	≤35	≤35	≤35	≤35	≤35	35	40
	937	30	≤35	≤35	≤35	≤35	≤35	≤35	≤35	≤35	≤35	35	40
	937	30	≤35	≤35	≤35	≤35	≤35	≤35	≤35	≤35	≤35	35	40
Maison Dieu	117	30	≤35	≤35	≤35	≤35	≤35	≤35	≤35	≤35	≤35	35	40
	118	30	≤35	≤35	≤35	≤35	≤35	≤35	≤35	≤35	≤35	35	40
	120	30	≤35	≤35	≤35	≤35	≤35	≤35	≤35	≤35	≤35	35	40
	121	30	≤35	≤35	≤35	≤35	≤35	≤35	≤35	≤35	≤35	35	40
	122	30	≤35	≤35	≤35	≤35	≤35	≤35	≤35	≤35	≤35	35	40
	123	30	≤35	≤35	≤35	≤35	≤35	≤35	≤35	≤35	≤35	35	40
	124	30	≤35	≤35	≤35	≤35	≤35	≤35	≤35	≤35	≤35	35	40
	160	30	≤35	≤35	≤35	≤35	≤35	≤35	≤35	≤35	≤35	35	40
	161	30	≤35	≤35	≤35	≤35	≤35	≤35	≤35	≤35	≤35	35	40
	162	30	≤35	≤35	≤35	≤35	≤35	≤35	≤35	≤35	≤35	35	40
	163	30	≤35	≤35	≤35	≤35	≤35	≤35	≤35	≤35	≤35	35	40
	244	30	≤35	≤35	≤35	≤35	≤35	≤35	≤35	≤35	≤35	35	40

Table D.1 Predicted operational noise levels during calm and prevailing meteorological conditions, dB(A)

Locality	Assessment location	RBL	Indicative Year 3, $L_{eq,15min}$			Indicative Year 9, $L_{eq,15min}$			Indicative Year 14, $L_{eq,15min}$			INP PSNL, $L_{eq,15min}$	Potential acquisition criteria, $L_{eq,15min}$
			Calm		Prevailing	Calm		Prevailing	Calm		Prevailing		
			Day	Eve/Night	Eve/Night	Day	Eve/Night	Eve/Night	Day	Eve/Night	Eve/Night		
	245	30	≤35	≤35	≤35	≤35	≤35	≤35	≤35	≤35	≤35	35	40
	246	30	≤35	≤35	≤35	≤35	≤35	≤35	≤35	≤35	≤35	35	40
	247	30	≤35	≤35	≤35	≤35	≤35	≤35	≤35	≤35	≤35	35	40
	256	30	≤35	≤35	≤35	≤35	≤35	≤35	≤35	≤35	≤35	35	40
	257	30	≤35	≤35	≤35	≤35	≤35	≤35	≤35	≤35	≤35	35	40
	258	30	≤35	≤35	≤35	≤35	≤35	≤35	≤35	≤35	≤35	35	40
	259	30	≤35	≤35	≤35	≤35	≤35	≤35	≤35	≤35	≤35	35	40
	260	30	≤35	≤35	≤35	≤35	≤35	≤35	≤35	≤35	≤35	35	40
	261	30	≤35	≤35	≤35	≤35	≤35	≤35	≤35	≤35	≤35	35	40
	265	30	≤35	≤35	≤35	≤35	≤35	≤35	≤35	≤35	≤35	35	40
Milbrodale	111	30	≤35	≤35	37	≤35	≤35	≤35	≤35	≤35	≤35	35	40
	193	30	≤35	≤35	≤35	≤35	≤35	≤35	≤35	≤35	≤35	35	40
	197	30	≤35	≤35	≤35	≤35	≤35	≤35	≤35	≤35	≤35	35	40
	199	30	≤35	≤35	≤35	≤35	≤35	≤35	≤35	≤35	≤35	35	40
	200	30	≤35	≤35	≤35	≤35	≤35	≤35	≤35	≤35	≤35	35	40
	201	30	≤35	≤35	≤35	≤35	≤35	≤35	≤35	≤35	≤35	35	40
	202	30	≤35	≤35	≤35	≤35	≤35	≤35	≤35	≤35	≤35	35	40
	203	30	≤35	≤35	≤35	≤35	≤35	≤35	≤35	≤35	≤35	35	40
	204	30	≤35	≤35	≤35	≤35	≤35	≤35	≤35	≤35	≤35	35	40
	205	30	≤35	≤35	≤35	≤35	≤35	≤35	≤35	≤35	≤35	35	40
	206	30	≤35	≤35	≤35	≤35	≤35	≤35	≤35	≤35	≤35	35	40
	207	30	≤35	≤35	≤35	≤35	≤35	≤35	≤35	≤35	≤35	35	40
	208	30	≤35	≤35	≤35	≤35	≤35	≤35	≤35	≤35	≤35	35	40
	923	30	≤35	≤35	≤35	≤35	≤35	≤35	≤35	≤35	≤35	35	40
	926	30	≤35	≤35	≤35	≤35	≤35	≤35	≤35	≤35	≤35	35	40
Mount Thorley	144[2]	n/a	≤39	≤39	40	≤39	≤39	41	≤39	≤39	≤39	n/a	44[1]

Table D.1 Predicted operational noise levels during calm and prevailing meteorological conditions, dB(A)

Locality	Assessment location	RBL	Indicative Year 3, $L_{eq,15min}$			Indicative Year 9, $L_{eq,15min}$			Indicative Year 14, $L_{eq,15min}$			INP PSNL, $L_{eq,15min}$	Potential acquisition criteria, $L_{eq,15min}$
			Calm		Prevailing	Calm		Prevailing	Calm		Prevailing		
			Day	Eve/Night	Eve/Night	Day	Eve/Night	Eve/Night	Day	Eve/Night	Eve/Night		
	146[2]	n/a	≤37	≤37	40	≤37	≤37	40	≤37	≤37	39	n/a	42[1]
	148	30	≤35	≤35	39	≤35	≤35	39	≤35	≤35	37	35	40
	149	30	≤35	≤35	40	≤35	≤35	41	≤35	≤35	40	35	40
	150	30	≤35	≤35	37	≤35	≤35	37	≤35	≤35	36	35	40
	153	30	≤35	≤35	≤35	≤35	≤35	37	≤35	≤35	≤35	35	40
	188	30	≤35	≤35	≤35	≤35	≤35	≤35	≤35	≤35	≤35	35	40
	190	30	≤35	≤35	38	≤35	≤35	37	≤35	≤35	36	35	40
	915[2]	n/a	≤39	≤39	40	≤39	≤39	41	≤39	≤39	40	n/a	44[1]
	932	30	≤35	≤35	≤35	≤35	≤35	≤35	≤35	≤35	≤35	35	40
Warkworth	77	33	≤38	≤38	≤38	≤38	≤38	≤38	≤38	≤38	≤38	38	43
	102	33	≤38	≤38	≤38	≤38	≤38	≤38	≤38	≤38	≤38	38	43
	264	33	≤38	≤38	≤38	≤38	≤38	≤38	≤38	≤38	≤38	38	43

Notes: *1. Current acquisition limit in development consent*

2. The colouring (green, blue, orange) has been assigned relative to the development consent current acquisition limit rather than the RBL which was undetermined at these locations.

Appendix E

ABLs used to derive RBLs

Table E.1 Location A - Wollemi Peak Road - MTO filtered out ABLs and RBLs

Date	ABL Day	ABL Evening	ABL Night
Thursday, 20-06-13	0	29.7	32.4
Friday, 21-06-13	30.6	36.4	34.3
Saturday, 22-06-13	30.4	28.9	31.8
Sunday, 23-06-13	0	35.8	27.8
Monday, 24-06-13	29.1	19.7	19.9
Tuesday, 25-06-13	27.7	31	31.4
Wednesday, 26-06-13	39.2	38.2	39.3
Thursday, 27-06-13	0	43.7	42.8
Friday, 28-06-13	37.1	0	0
Monday, 01-07-13	37.7	45.5	43.2
Tuesday, 02-07-13	36.7	43	40.1
Wednesday, 03-07-13	40.1	0	40.1
Thursday, 04-07-13	37.5	38	35
Friday, 12-07-13	33.3	38.3	37.2
Saturday, 13-07-13	30.9	0	0
Monday, 15-07-13	33.3	0	38.9
Tuesday, 16-07-13	34	0	39.9
Wednesday, 17-07-13	35	0	40
Thursday, 18-07-13	36.3	0	0
Friday, 19-07-13	0	36.3	0
Saturday, 20-07-13	37.1	34.5	29.7
Sunday, 21-07-13	33.2	32.8	33.7
Monday, 22-07-13	33.6	29.6	31.4
Tuesday, 23-07-13	31	28.9	26.8
Wednesday, 24-07-13	31.5	30	0
Thursday, 25-07-13	0	0	37.7
Friday, 26-07-13	34.9	33.2	34.6
Saturday, 27-07-13	34	34.8	37.6
Sunday, 28-07-13	34.1	36	39.2
Monday, 29-07-13	30.7	35.5	37.7
Tuesday, 30-07-13	31.2	0	34.8
Wednesday, 31-07-13	32.5	31.9	0
Thursday, 01-08-13	31.6	35.8	38
Friday, 02-08-13	32.5	28.9	27.5
Saturday, 03-08-13	33.6	30.6	0
Sunday, 04-08-13	0	25.4	0
Monday, 05-08-13	33.8	29.5	32.3
Tuesday, 06-08-13	35.5	31.3	32.3
Wednesday, 07-08-13	31.8	0	34

Table E.1 Location A - Wollemi Peak Road - MTO filtered out ABLs and RBLs

Date	ABL Day	ABL Evening	ABL Night
Thursday, 08-08-13	33	32.7	31.2
Friday, 09-08-13	33.6	32	30.1
Saturday, 10-08-13	32.4	32.3	0
Monday, 12-08-13	0	30.7	30.8
Tuesday, 13-08-13	32.2	0	32.3
Rating Background Level (RBL)	**33.3**	**32.7**	**34.3**

Notes: 1. '0' Values indicate excluded data due to weather or inadequate sampling as per the INP. When calculating the median value, these '0' samples are ignored as per the INP.

Table E.2 Location B - 367 Wambo Road - MTO filtered out ABLs and RBLs

Date	ABL Day	ABL Evening	ABL Night
Wednesday, 07-12-11	0	28	28.1
Thursday, 08-12-11	32.5	36.3	35.2
Friday, 09-12-11	29	36.4	37
Saturday, 10-12-11	28	32	34.8
Sunday, 11-12-11	28	36.4	35.9
Monday, 12-12-11	34.2	34.3	36.1
Tuesday, 13-12-11	28.3	36.4	36.3
Wednesday, 14-12-11	30.4	36.5	34.7
Thursday, 15-12-11	28.5	33.6	35.9
Friday, 16-12-11	0	0	0
Saturday, 17-12-11	0	34.6	34.3
Sunday, 18-12-11	27	31.7	37.3
Monday, 19-12-11	33.6	32.6	34.3
Tuesday, 20-12-11	31.4	35.7	0
Wednesday, 21-12-11	0	0	0
Thursday, 22-12-11	0	0	31.8
Friday, 23-12-11	0	0	0
Saturday, 24-12-11	0	36	0
Sunday, 25-12-11	0	0	0
Monday, 26-12-11	0	31.9	0
Wednesday, 28-12-11	0	35.8	33.4
Thursday, 29-12-11	34.3	35.7	34.2
Friday, 30-12-11	31.4	34.7	0
Saturday, 31-12-11	29.8	32.9	0
Sunday, 01-01-12	27.7	31.5	30.9
Monday, 02-01-12	28.9	32.9	34.5
Tuesday, 03-01-12	32.7	32.7	37.5
Wednesday, 04-01-12	28.9	29.6	34.1
Thursday, 05-01-12	30.3	29.3	0
Friday, 06-01-12	31	30.3	28.2
Saturday, 07-01-12	32.8	33.3	36
Sunday, 08-01-12	32	0	0
Monday, 09-01-12	35.1	34.6	34.3
Tuesday, 10-01-12	28	28	0
Tuesday, 17-01-12	0	34.9	35.8
Wednesday, 18-01-12	32.2	0	35.3
Thursday, 19-01-12	0	34	33.3
Friday, 20-01-12	32.2	31.4	34.3
Saturday, 21-01-12	32.3	0	35

Table E.2 Location B - 367 Wambo Road - MTO filtered out ABLs and RBLs

Date	ABL Day	ABL Evening	ABL Night
Sunday, 22-01-12	37	35.3	33.5
Monday, 23-01-12	0	33.7	35
Tuesday, 24-01-12	32.3	0	0
Thursday, 26-01-12	0	0	39.8
Friday, 27-01-12	37.9	37.3	38.2
Saturday, 28-01-12	32.5	30.5	37.9
Sunday, 29-01-12	32.6	31.4	0
Monday, 30-01-12	34.7	0	38
Friday, 03-02-12	0	44.6	45.7
Saturday, 04-02-12	31.8	39	44.5
Sunday, 05-02-12	31.8	35.7	43.3
Monday, 06-02-12	34	36.6	37.5
Tuesday, 07-02-12	34.1	35.8	0
Wednesday, 08-02-12	36.8	37.5	39.4
Thursday, 09-02-12	33.8	37.7	40.1
Friday, 10-02-12	0	38.3	0
Saturday, 11-02-12	31.1	0	38.4
Sunday, 12-02-12	29.3	33	40.6
Monday, 13-02-12	32.6	0	40.7
Tuesday, 14-02-12	35.6	40.2	40.9
Wednesday, 15-02-12	32.4	40.1	37.9
Thursday, 16-02-12	27.4	36.1	38.1
Friday, 17-02-12	27.5	36.6	41.1
Saturday, 18-02-12	29.7	0	44
Sunday, 19-02-12	27.4	33.1	0
Monday, 20-02-12	34.9	0	0
Tuesday, 21-02-12	38.8	43.8	48.4
Wednesday, 22-02-12	37	44.1	46
Thursday, 23-02-12	28.8	39.9	46.4
Friday, 24-02-12	31.2	40.3	42.2
Saturday, 25-02-12	32.5	38.3	40.1
Sunday, 26-02-12	34.2	37.5	41.3
Monday, 27-02-12	30.1	35.5	41.6
Tuesday, 28-02-12	28.3	35.1	42.3
Thursday, 01-03-12	36.9	0	0
Saturday, 03-03-12	0	46.6	48.3
Sunday, 04-03-12	34.1	46.1	47.3
Monday, 05-03-12	0	43.4	47.5
Tuesday, 06-03-12	32.2	44.3	44.4

Table E.2 Location B - 367 Wambo Road - MTO filtered out ABLs and RBLs

Date	ABL Day	ABL Evening	ABL Night
Wednesday, 07-03-12	33.4	0	0
Saturday, 10-03-12	28.2	41.3	0
Sunday, 11-03-12	0	40.6	0
Saturday, 17-03-12	0	40.6	0
Wednesday, 21-03-12	0	38	41.2
Thursday, 22-03-12	29.4	39.6	38
Friday, 23-03-12	36.5	40.9	34.1
Saturday, 24-03-12	27.8	42.7	36.5
Sunday, 25-03-12	31.6	40.7	39.4
Monday, 26-03-12	28.9	39.8	36.3
Tuesday, 27-03-12	31.7	38.9	41.2
Thursday, 29-03-12	0	42	34.4
Wednesday, 18-04-12	0	34.7	29.4
Thursday, 19-04-12	28.2	31.9	31.8
Friday, 20-04-12	31.7	36.1	23.5
Saturday, 21-04-12	26	33.5	27.5
Sunday, 22-04-12	26.1	0	31.3
Monday, 23-04-12	0	29.8	26.1
Tuesday, 24-04-12	0	26.5	22.8
Wednesday, 25-04-12	26.2	22.8	0
Thursday, 26-04-12	31.2	35.1	0
Tuesday, 01-05-12	25.2	32.2	34.1
Saturday, 05-05-12	0	28	0
Sunday, 06-05-12	24.5	0	24.5
Tuesday, 08-05-12	0	0	29.6
Saturday, 12-05-12	0	0	21.4
Sunday, 13-05-12	26.7	0	0
Tuesday, 15-05-12	0	0	29.6
Friday, 18-05-12	22.9	0	31.3
Tuesday, 22-05-12	26.4	22.3	25.7
Wednesday, 23-05-12	28.2	29.2	32.3
Friday, 25-05-12	27.8	34.9	31.7
Saturday, 26-05-12	31.2	30.4	24.3
Sunday, 27-05-12	22.9	29.2	27.5
Monday, 28-05-12	24.7	27	29
Tuesday, 29-05-12	26.3	28.1	24.3
Wednesday, 30-05-12	26.7	30.4	31.3
Thursday, 31-05-12	26.9	35	0
Friday, 01-06-12	31.6	34.3	36

Table E.2 Location B - 367 Wambo Road - MTO filtered out ABLs and RBLs

Date	ABL Day	ABL Evening	ABL Night
Monday, 04-06-12	31.1	28.4	29.3
Tuesday, 05-06-12	29	0	35
Wednesday, 06-06-12	34	31.4	34.6
Sunday, 10-06-12	0	0	27.4
Tuesday, 12-06-12	0	34.5	0
Wednesday, 13-06-12	0	33.5	0
Saturday, 16-06-12	0	28.5	0
Sunday, 17-06-12	0	0	28.8
Tuesday, 19-06-12	0	0	31
Wednesday, 20-06-12	0	29.4	31.3
Thursday, 21-06-12	35.6	33.7	36
Friday, 22-06-12	0	25	26.4
Saturday, 23-06-12	28.6	26.4	30.5
Sunday, 24-06-12	0	31.6	33.3
Monday, 25-06-12	33.5	32.5	31.3
Tuesday, 26-06-12	0	29.8	32.9
Wednesday, 27-06-12	29.8	0	36.5
Thursday, 28-06-12	27.4	34.5	28.9
Friday, 29-06-12	29.4	32.2	27.7
Saturday, 30-06-12	25.3	32.3	0
Sunday, 01-07-12	0	32.2	26.4
Monday, 02-07-12	29.2	22.4	25
Tuesday, 03-07-12	30.4	22.8	25.3
Wednesday, 04-07-12	0	25.6	0
Thursday, 05-07-12	0	28.3	0
Saturday, 07-07-12	0	35.4	0
Monday, 09-07-12	29	0	0
Tuesday, 10-07-12	36.5	0	0
Saturday, 14-07-12	28.4	0	0
Sunday, 15-07-12	30	0	28.5
Wednesday, 18-07-12	0	32.2	0
Thursday, 19-07-12	0	35	0
Friday, 20-07-12	25.8	31.7	33.1
Saturday, 21-07-12	31.4	31.8	34.9
Sunday, 22-07-12	27.8	31.6	33
Monday, 23-07-12	31.1	33.5	34.1
Tuesday, 24-07-12	24.7	33	32.5
Wednesday, 25-07-12	26.8	36.4	35
Thursday, 26-07-12	33.7	33	27

Table E.2 Location B - 367 Wambo Road - MTO filtered out ABLs and RBLs

Date	ABL Day	ABL Evening	ABL Night
Friday, 27-07-12	27.6	25.2	22.8
Saturday, 28-07-12	23.5	22.4	25.7
Sunday, 29-07-12	23.8	24.9	23.1
Monday, 30-07-12	29.1	27.6	28.9
Tuesday, 31-07-12	32.1	33	0
Friday, 03-08-12	25	0	0
Monday, 13-08-12	0	31.7	0
Tuesday, 14-08-12	25.2	29.9	0
Wednesday, 15-08-12	0	0	23.1
Thursday, 16-08-12	0	26.3	0
Sunday, 19-08-12	0	24.1	0
Thursday, 30-08-12	0	32.1	21.8
Friday, 31-08-12	27.6	21.3	0
Saturday, 01-09-12	0	22.7	24.6
Sunday, 02-09-12	25.6	26	27.8
Monday, 03-09-12	23.3	28.9	32
Tuesday, 04-09-12	23.7	25	34.4
Wednesday, 05-09-12	36	38	28.7
Thursday, 06-09-12	29.9	21.8	25.9
Friday, 07-09-12	29.8	22.9	22.5
Saturday, 08-09-12	30.9	19.8	21.2
Sunday, 09-09-12	23.8	29.8	31.4
Monday, 10-09-12	23.1	25.1	28.7
Tuesday, 11-09-12	32	33.8	28.9
Wednesday, 12-09-12	26.2	29.4	32.4
Thursday, 13-09-12	33.7	19.6	19.6
Friday, 14-09-12	0	22	0
Saturday, 15-09-12	0	25	0
Sunday, 23-09-12	0	33.5	0
Monday, 24-09-12	25.5	0	0
Tuesday, 25-09-12	0	35	0
Friday, 28-09-12	0	32.6	0
Saturday, 29-09-12	0	0	20.3
Sunday, 30-09-12	24.6	19.6	0
Monday, 01-10-12	26.1	0	0
Friday, 05-10-12	0	36.9	29.7
Tuesday, 09-10-12	26.3	0	0
Wednesday, 10-10-12	25.9	0	0
Thursday, 11-10-12	0	29.6	0

Table E.2 Location B - 367 Wambo Road - MTO filtered out ABLs and RBLs

Date	ABL Day	ABL Evening	ABL Night
Tuesday, 16-10-12	0	34.1	0
Thursday, 18-10-12	29.9	37.2	0
Friday, 19-10-12	25.6	0	0
Saturday, 20-10-12	0	38.2	0
Monday, 22-10-12	26.7	36.3	0
Tuesday, 23-10-12	34.7	34	0
Friday, 26-10-12	0	30.7	0
Wednesday, 31-10-12	0	28	0
Friday, 02-11-12	0	32.9	0
Saturday, 03-11-12	29.6	0	0
Monday, 05-11-12	0	30.4	33.5
Friday, 09-11-12	0	29.2	0
Saturday, 10-11-12	0	32.9	0
Monday, 12-11-12	0	0	28
Tuesday, 13-11-12	0	32.2	0
Wednesday, 14-11-12	0	34.9	0
Tuesday, 20-11-12	34.2	0	0
Wednesday, 21-11-12	22.9	23	0
Friday, 23-11-12	29.5	0	0
Saturday, 24-11-12	0	0	30.4
Rating Background Level (RBL)	**29.6**	**33.0**	**33.5**

Notes: 1. '0' Values indicate excluded data due to weather or inadequate sampling as per the INP. When calculating the median value, these '0' samples are ignored as per the INP.

Table E.3 Location C - 128 Wambo Road – MTO filtered out ABLs and RBLs

Date	ABL Day	ABL Evening	ABL Night
Tuesday, 01-01-13	35	33.8	36.9
Wednesday, 02-01-13	37.5	0	0
Thursday, 03-01-13	0	37.4	0
Friday, 04-01-13	35.4	37.5	0
Saturday, 05-01-13	36.3	35.6	0
Sunday, 06-01-13	38.4	40.2	0
Monday, 07-01-13	39.9	37.9	0
Tuesday, 08-01-13	37.7	37.1	39
Wednesday, 09-01-13	39.6	38.6	0
Thursday, 10-01-13	38	39.9	0
Friday, 11-01-13	38.3	37.3	37.8
Saturday, 12-01-13	37.4	38.7	38.9
Sunday, 13-01-13	36.5	0	0
Monday, 14-01-13	35.9	37	35.7
Tuesday, 15-01-13	36	38.3	36.8
Wednesday, 16-01-13	35.8	38.5	0
Thursday, 17-01-13	0	36.8	0
Friday, 18-01-13	37.4	37.1	37.6
Saturday, 19-01-13	36.5	35.6	0
Sunday, 20-01-13	0	0	38.8
Monday, 21-01-13	35.9	37.6	39.6
Tuesday, 22-01-13	0	0	0
Wednesday, 23-01-13	0	36.2	39.3
Thursday, 24-01-13	35.6	36.8	40.9
Friday, 25-01-13	36.7	36.7	40.1
Saturday, 26-01-13	38.1	39.3	0
Tuesday, 29-01-13	36.2	39.9	0
Wednesday, 30-01-13	0	38.7	0
Thursday, 31-01-13	37.9	38	0
Saturday, 02-02-13	37.1	41.4	0
Sunday, 03-02-13	36.3	0	0
Monday, 04-02-13	0	39.9	0
Tuesday, 05-02-13	36.3	0	0
Wednesday, 06-02-13	35.3	38.2	41.4
Thursday, 07-02-13	35.9	36.3	41
Friday, 08-02-13	0	0	40.4
Saturday, 09-02-13	34.6	36.9	38.2
Sunday, 10-02-13	35.9	0	0
Monday, 11-02-13	0	39.9	0

Table E.3 Location C - 128 Wambo Road – MTO filtered out ABLs and RBLs

Date	ABL Day	ABL Evening	ABL Night
Tuesday, 12-02-13	35.7	39.1	0
Wednesday, 13-02-13	0	40.2	0
Thursday, 14-02-13	36.4	40.3	40.7
Friday, 15-02-13	35.6	39	0
Saturday, 16-02-13	35.7	40.8	40.1
Sunday, 17-02-13	36	38.9	0
Monday, 18-02-13	37	39.2	0
Tuesday, 19-02-13	35.9	37.6	0
Wednesday, 20-02-13	37.8	38.5	0
Thursday, 21-02-13	38.7	37.9	36.8
Saturday, 23-02-13	0	0	44.2
Sunday, 24-02-13	39.8	41.6	0
Monday, 25-02-13	38	37	45.1
Tuesday, 26-02-13	38.3	39.5	0
Wednesday, 27-02-13	38.3	38.6	0
Thursday, 28-02-13	39	40	0
Sunday, 03-03-13	40.4	43.6	0
Monday, 04-03-13	0	44.3	0
Tuesday, 05-03-13	38.8	42.9	0
Wednesday, 06-03-13	37.8	43.1	0
Thursday, 07-03-13	39.2	42.1	0
Friday, 08-03-13	36.3	42.4	0
Saturday, 09-03-13	38.2	41.7	0
Sunday, 10-03-13	38.5	40.6	0
Monday, 11-03-13	38.1	40.4	0
Tuesday, 12-03-13	37.5	41.5	0
Wednesday, 13-03-13	39	41.5	0
Thursday, 14-03-13	37.1	40.3	39.8
Friday, 15-03-13	36.8	38.8	39.2
Saturday, 16-03-13	0	38.6	37.8
Sunday, 17-03-13	37.7	40.9	0
Monday, 18-03-13	36.7	39.3	37.9
Tuesday, 19-03-13	36.4	40.3	0
Wednesday, 20-03-13	36.7	41.2	0
Thursday, 21-03-13	38.3	39.2	0
Friday, 22-03-13	39.5	37.2	36.3
Saturday, 23-03-13	37.3	0	39.9
Sunday, 24-03-13	35.8	39.1	0
Monday, 25-03-13	37.8	38.9	38.6

Table E.3 Location C - 128 Wambo Road – MTO filtered out ABLs and RBLs

Date	ABL Day	ABL Evening	ABL Night
Tuesday, 26-03-13	34.5	37.4	37.8
Wednesday, 27-03-13	32.9	37.2	38.2
Thursday, 28-03-13	33.4	0	0
Friday, 29-03-13	34.9	38	34.9
Saturday, 30-03-13	32.8	35.9	33.8
Sunday, 31-03-13	31.1	34.7	0
Monday, 01-04-13	32	39.6	31.4
Tuesday, 02-04-13	32	0	31.9
Wednesday, 03-04-13	35	33.8	32.8
Thursday, 04-04-13	32.5	0	37.1
Friday, 05-04-13	34	0	36.6
Saturday, 06-04-13	31.3	0	31.6
Sunday, 07-04-13	30.6	39.1	30.8
Monday, 08-04-13	31.9	37	31.1
Tuesday, 09-04-13	31.2	37.4	35
Wednesday, 10-04-13	31.4	38.5	29.9
Thursday, 11-04-13	30.9	37.3	37
Friday, 12-04-13	33.1	37.4	36.2
Saturday, 13-04-13	30.9	37.5	30.7
Sunday, 14-04-13	30.9	36.5	30.9
Monday, 15-04-13	30.6	0	0
Wednesday, 17-04-13	31	34.1	28.6
Thursday, 18-04-13	30.8	33.2	28.2
Friday, 19-04-13	34.1	30.6	27.7
Saturday, 20-04-13	0	34.8	30
Sunday, 21-04-13	0	36.1	31.6
Monday, 22-04-13	31.6	30.8	29.3
Tuesday, 23-04-13	31.1	30.4	29.1
Wednesday, 24-04-13	31.9	34.3	29.2
Thursday, 25-04-13	30.8	30.3	29.9
Friday, 26-04-13	31.5	33.3	31.5
Saturday, 27-04-13	30.9	0	30.6
Sunday, 28-04-13	31.1	32.3	30
Monday, 29-04-13	29.4	37.1	31.7
Tuesday, 30-04-13	30.4	37.5	0
Tuesday, 01-05-12	30.8	32.3	29.5
Wednesday, 02-05-12	32.6	30.9	0
Thursday, 03-05-12	0	34.5	29.7
Friday, 04-05-12	29.9	31.4	28.4

Table E.3 Location C - 128 Wambo Road – MTO filtered out ABLs and RBLs

Date	ABL Day	ABL Evening	ABL Night
Saturday, 05-05-12	30	32.1	31.5
Sunday, 06-05-12	31.2	30	31.1
Monday, 07-05-12	31	0	33.3
Tuesday, 08-05-12	30.9	34.1	34.2
Wednesday, 09-05-12	30.1	35.5	31.8
Thursday, 10-05-12	30	33.7	31.8
Friday, 11-05-12	29.5	36.2	35.4
Saturday, 12-05-12	29.9	36.5	33.3
Sunday, 13-05-12	31.6	31.8	28.6
Monday, 14-05-12	29.2	30	29
Tuesday, 15-05-12	30.8	28.2	28
Wednesday, 16-05-12	30.3	27.8	28.4
Thursday, 17-05-12	30.3	28.3	29
Friday, 18-05-12	30.1	27	26.9
Saturday, 19-05-12	29.3	27.7	27.3
Sunday, 20-05-12	30.6	28.6	28.8
Monday, 21-05-12	31.8	29.3	30.8
Tuesday, 22-05-12	0	39.9	0
Wednesday, 23-05-12	41.3	41.3	42
Friday, 25-05-12	27.1	0	32.7
Saturday, 26-05-12	27.4	35	33.1
Sunday, 27-05-12	30.8	30.8	32.2
Monday, 28-05-12	30.3	37.6	29.3
Tuesday, 29-05-12	28.9	36.5	0
Wednesday, 30-05-12	28.5	37.3	34.9
Thursday, 31-05-12	27.7	36.8	0
Saturday, 01-06-13	32.8	34.6	0
Sunday, 02-06-13	0	30.3	28.2
Monday, 03-06-13	26.4	31.7	31.2
Tuesday, 04-06-13	26.8	34.1	36.8
Wednesday, 05-06-13	28.8	33	31.1
Thursday, 06-06-13	31.8	0	30.7
Friday, 07-06-13	31.3	33.3	32.6
Saturday, 08-06-13	27.7	0	37.1
Sunday, 09-06-13	27.5	36.9	34
Monday, 10-06-13	30.5	29.7	30.6
Tuesday, 11-06-13	28	33.9	36.4
Wednesday, 12-06-13	0	29.3	28.5
Thursday, 13-06-13	29.7	28.1	27.6

Table E.3 Location C - 128 Wambo Road – MTO filtered out ABLs and RBLs

Date	ABL Day	ABL Evening	ABL Night
Friday, 14-06-13	0	29.1	26.5
Saturday, 15-06-13	27.5	30.1	30.7
Sunday, 16-06-13	25.6	29.6	29
Monday, 17-06-13	25.5	26.7	25
Tuesday, 18-06-13	26.4	0	25.3
Wednesday, 19-06-13	29.1	0	33.7
Thursday, 20-06-13	26	31.1	29
Friday, 21-06-13	27.2	33.8	30.8
Saturday, 22-06-13	27.2	27.2	26.5
Sunday, 23-06-13	0	0	28.7
Monday, 24-06-13	27	31.1	30.3
Tuesday, 25-06-13	0	28.8	30
Wednesday, 26-06-13	0	34.7	33.9
Friday, 28-06-13	30.9	0	0
Sunday, 30-06-13	31.1	35.2	0
Tuesday, 02-07-13	0	37.9	0
Wednesday, 03-07-13	28.8	38	33.6
Thursday, 04-07-13	0	34.2	0
Friday, 05-07-13	0	30	27.8
Saturday, 06-07-13	30.6	35.6	0
Sunday, 07-07-13	34.4	36.2	35.4
Monday, 08-07-13	0	38.1	0
Tuesday, 09-07-13	0	34.7	37.3
Wednesday, 10-07-13	0	34.8	34.7
Thursday, 11-07-13	31.4	40.4	0
Friday, 12-07-13	0	38.1	35.6
Saturday, 13-07-13	0	40.3	37.7
Sunday, 14-07-13	33.3	39.2	0
Monday, 15-07-13	33.1	38.3	37.8
Tuesday, 16-07-13	33	42.1	39
Wednesday, 17-07-13	33.1	42.1	38.3
Thursday, 18-07-13	33.8	41.3	38
Friday, 19-07-13	0	37.5	0
Saturday, 20-07-13	35.3	37.2	34.1
Sunday, 21-07-13	35.4	33.8	34.8
Monday, 22-07-13	36.4	32.8	32.9
Tuesday, 23-07-13	0	34.5	0
Wednesday, 24-07-13	33.4	0	0
Thursday, 25-07-13	33.4	36.7	36.4

Table E.3 Location C - 128 Wambo Road – MTO filtered out ABLs and RBLs

Date	ABL Day	ABL Evening	ABL Night
Friday, 26-07-13	34.4	0	34.5
Saturday, 27-07-13	34	0	0
Sunday, 28-07-13	33.6	36.2	36.8
Monday, 29-07-13	32.7	35.9	36.4
Tuesday, 30-07-13	33.1	0	0
Wednesday, 31-07-13	0	36.4	0
Rating Background Level (RBL)	**33.1**	**37.1**	**33.3**

Notes: 1. '0' Values indicate excluded data due to weather or inadequate sampling as per the INP. When calculating the median value, these '0' samples are ignored as per the INP.

Table E.4 Location D - 193 Inlet Road – MTO filtered out ABLs and RBLs

Date	ABL Day	ABL Evening	ABL Night
Friday, 09-12-11	0	32.6	0
Saturday, 10-12-11	29.7	29.8	0
Sunday, 11-12-11	0	33.4	37
Monday, 12-12-11	29.8	33.7	34.8
Tuesday, 13-12-11	28.3	32.7	0
Wednesday, 14-12-11	29.8	35.2	35.9
Thursday, 15-12-11	0	32.5	36.1
Saturday, 17-12-11	0	33.7	0
Sunday, 18-12-11	29.8	32.4	39.1
Monday, 19-12-11	30.9	32	37.9
Tuesday, 20-12-11	32.4	33.6	35
Wednesday, 21-12-11	31.3	0	0
Thursday, 22-12-11	28.8	0	36.5
Saturday, 24-12-11	0	34.4	0
Monday, 26-12-11	0	30.2	39.2
Tuesday, 27-12-11	32.2	33.3	35
Wednesday, 28-12-11	32.2	31	37.1
Thursday, 29-12-11	32.8	32.1	38.1
Friday, 30-12-11	33.6	32	0
Saturday, 31-12-11	32.7	32.4	0
Sunday, 01-01-12	33.6	33.9	32.9
Monday, 02-01-12	34.7	33.4	35.6
Tuesday, 03-01-12	34.8	33.4	36.4
Wednesday, 04-01-12	37.8	35.3	35
Thursday, 05-01-12	30.9	31	0
Friday, 06-01-12	0	30.4	32.9
Saturday, 07-01-12	37.8	34.9	39.1
Sunday, 08-01-12	37.8	0	0
Monday, 09-01-12	39.4	36	37.5
Tuesday, 10-01-12	35.8	31.5	34.4
Wednesday, 11-01-12	35.6	34.5	21.5
Thursday, 12-01-12	28.7	32.6	29.7
Friday, 13-01-12	35.8	34.5	33.5
Saturday, 14-01-12	32.1	33.5	35.1
Sunday, 15-01-12	31.7	35.8	38.3
Monday, 16-01-12	39.4	38.5	40.2
Tuesday, 17-01-12	37.9	37	39.6
Wednesday, 18-01-12	39.7	36.7	38.1
Thursday, 19-01-12	39.9	37	39.4

Table E.4 Location D - 193 Inlet Road – MTO filtered out ABLs and RBLs

Date	ABL Day	ABL Evening	ABL Night
Friday, 20-01-12	36.2	34.5	33.5
Saturday, 21-01-12	31.3	31.5	33.8
Sunday, 22-01-12	35.7	35.1	36
Monday, 23-01-12	0	37.2	37.6
Tuesday, 24-01-12	32.9	33.3	39.7
Thursday, 26-01-12	0	39.3	42.1
Friday, 27-01-12	37.9	37.6	0
Saturday, 28-01-12	36.7	33.7	39.1
Sunday, 29-01-12	36.2	33.1	0
Monday, 30-01-12	36	34.1	39.7
Friday, 03-02-12	0	43.4	44
Saturday, 04-02-12	33.4	38.6	0
Sunday, 05-02-12	33.9	33	0
Monday, 06-02-12	32.5	32.3	38.1
Tuesday, 07-02-12	29.1	35.7	38.4
Wednesday, 08-02-12	31.2	37.3	40
Thursday, 09-02-12	35.1	38.3	40.2
Friday, 10-02-12	0	37.8	39.4
Saturday, 11-02-12	33.5	36.2	35
Sunday, 12-02-12	32.1	35.4	39
Monday, 13-02-12	0	0	38.1
Tuesday, 14-02-12	32.9	33.6	36.5
Wednesday, 15-02-12	30.4	38.1	36.1
Thursday, 16-02-12	30.1	34.9	34.9
Friday, 17-02-12	30.7	36.4	36
Saturday, 18-02-12	30.5	0	36
Sunday, 19-02-12	30.4	29.2	0
Monday, 20-02-12	27.6	0	0
Tuesday, 21-02-12	0	30.6	42.7
Wednesday, 22-02-12	30.2	31.2	33.8
Thursday, 23-02-12	30.3	31.2	33.8
Friday, 24-02-12	0	33.4	0
Saturday, 25-02-12	31.5	31.4	0
Sunday, 26-02-12	28.6	28.4	32.6
Monday, 27-02-12	28.8	27.4	33.8
Tuesday, 28-02-12	29.5	26.7	0
Wednesday, 29-02-12	30.9	0	0
Thursday, 01-03-12	33.6	0	0
Saturday, 03-03-12	0	35.1	37.3

Table E.4 Location D - 193 Inlet Road – MTO filtered out ABLs and RBLs

Date	ABL Day	ABL Evening	ABL Night
Sunday, 04-03-12	32.3	31.7	33.2
Monday, 05-03-12	30	34.2	30.3
Tuesday, 06-03-12	31.5	29.2	28
Wednesday, 07-03-12	30.4	29.6	0
Thursday, 08-03-12	30.1	31.5	23.5
Friday, 09-03-12	30.1	28.7	28.2
Saturday, 10-03-12	0	33.5	24.9
Sunday, 11-03-12	30.2	29	30.4
Monday, 12-03-12	31.3	32.6	32.8
Tuesday, 13-03-12	29.9	31.8	23.6
Wednesday, 14-03-12	27.5	29.1	28.1
Thursday, 15-03-12	29.7	28.5	30
Friday, 16-03-12	29.9	34.1	0
Saturday, 17-03-12	0	29.3	26.2
Sunday, 18-03-12	31.8	0	0
Monday, 19-03-12	34.7	0	32.3
Tuesday, 20-03-12	30.2	31.4	30.8
Wednesday, 21-03-12	30.5	28	27.8
Thursday, 22-03-12	27.2	30.2	28
Friday, 23-03-12	30.5	25.6	18.7
Saturday, 24-03-12	28.1	25.6	26.1
Sunday, 25-03-12	32.5	34.3	30.6
Monday, 26-03-12	27.9	34	27.7
Tuesday, 27-03-12	29.5	34.4	33
Wednesday, 28-03-12	27.4	33	25.7
Thursday, 29-03-12	0	29.8	24
Friday, 30-03-12	27.4	32.8	24
Saturday, 31-03-12	27.5	31.4	0
Sunday, 01-04-12	28	27.2	0
Monday, 02-04-12	27.3	31.3	30.7
Tuesday, 03-04-12	27.5	29.9	30.5
Wednesday, 04-04-12	0	31.8	31.4
Thursday, 05-04-12	31.3	33.9	30.8
Friday, 06-04-12	27.8	31.8	30.4
Saturday, 07-04-12	0	24.9	28.1
Sunday, 08-04-12	0	0	25
Monday, 09-04-12	26.5	23.3	22.3
Tuesday, 10-04-12	30.2	23.9	28.7
Wednesday, 11-04-12	0	25.1	25.8

Table E.4 Location D - 193 Inlet Road – MTO filtered out ABLs and RBLs

Date	ABL Day	ABL Evening	ABL Night
Thursday, 12-04-12	27.7	24.9	27.7
Friday, 13-04-12	0	33	30.1
Saturday, 14-04-12	27.1	32.4	21.9
Sunday, 15-04-12	27.3	28.8	25.8
Monday, 16-04-12	28.6	27.9	28.6
Tuesday, 17-04-12	0	0	28.5
Wednesday, 18-04-12	0	29.8	28.7
Thursday, 19-04-12	28.7	29.9	22.7
Friday, 20-04-12	29.6	32.6	20.1
Saturday, 21-04-12	28.3	31.1	27.9
Sunday, 22-04-12	28.1	31.5	29
Monday, 23-04-12	0	27.6	22.6
Tuesday, 24-04-12	0	25.4	19.2
Wednesday, 25-04-12	27.2	22.3	20
Thursday, 26-04-12	25.3	30	29.6
Friday, 27-04-12	28.5	31.6	28.6
Saturday, 28-04-12	28.6	29.2	24.1
Sunday, 29-04-12	27.7	26.5	31.1
Monday, 30-04-12	28.3	31.3	0
Tuesday, 01-05-12	29.3	29.6	30.5
Wednesday, 02-05-12	28.2	27	20.4
Thursday, 03-05-12	0	32.8	25.3
Friday, 04-05-12	27.1	29.7	25.5
Saturday, 05-05-12	26.2	26.8	26
Sunday, 06-05-12	25.9	24	20.9
Monday, 07-05-12	23.6	28.9	26.7
Tuesday, 08-05-12	0	27.5	25
Wednesday, 09-05-12	26.6	28.6	26.4
Thursday, 10-05-12	27.6	31.3	27
Friday, 11-05-12	28.8	26.6	23.3
Saturday, 12-05-12	26.7	23.4	19.2
Sunday, 13-05-12	24	21.6	18.8
Monday, 14-05-12	23.9	23.8	24.6
Tuesday, 15-05-12	25.6	24.1	24.2
Wednesday, 16-05-12	25.7	29.5	30.5
Thursday, 17-05-12	25.3	29.9	30.8
Friday, 18-05-12	25.7	27.8	27.1
Saturday, 19-05-12	25.8	28.4	26

Table E.4 Location D - 193 Inlet Road – MTO filtered out ABLs and RBLs

Date	ABL Day	ABL Evening	ABL Night
Monday, 21-05-12	24.4	28.1	27.3
Tuesday, 22-05-12	25.8	21.5	24.8
Wednesday, 23-05-12	25	26.6	31.3
Friday, 25-05-12	29.4	33.4	25.4
Saturday, 26-05-12	29.9	25.2	23.9
Sunday, 27-05-12	26.9	26.7	27
Rating Background Level (RBL)	**30.0**	**31.6**	**30.5**

Notes: 1. '0' Values indicate excluded data due to weather or inadequate sampling as per the INP. When calculating the median value, these '0' samples are ignored as per the INP.

Table E.5 Location E - 339 Inlet Road - MTO filtered out ABLs and RBLs

Date	ABL Day	ABL Evening	ABL Night
Monday, 18-03-13	0	31	31.8
Tuesday, 19-03-13	31.7	0	29.1
Thursday, 21-03-13	30.4	30.5	30.5
Friday, 22-03-13	31.6	29.9	0
Saturday, 23-03-13	0	32.4	0
Sunday, 24-03-13	0	0	28.4
Monday, 25-03-13	30.2	31.1	31
Wednesday, 27-03-13	29.9	0	0
Thursday, 28-03-13	30.7	0	0
Friday, 29-03-13	0	30	31.9
Saturday, 30-03-13	31	0	0
Sunday, 31-03-13	29.1	0	0
Monday, 01-04-13	0	30.6	0
Tuesday, 02-04-13	29.4	27.2	0
Wednesday, 03-04-13	30.5	32.8	32.4
Thursday, 04-04-13	0	30.9	0
Friday, 05-04-13	31.9	0	0
Saturday, 06-04-13	34.1	32.2	0
Sunday, 07-04-13	0	29.6	0
Monday, 08-04-13	0	30	29.5
Tuesday, 09-04-13	0	29	0
Wednesday, 10-04-13	0	29.3	0
Thursday, 11-04-13	28.9	0	0
Friday, 12-04-13	0	29	28.5
Saturday, 13-04-13	27.3	0	0
Sunday, 14-04-13	27.4	26.9	25.1
Monday, 15-04-13	28.1	0	0
Tuesday, 16-04-13	0	27.8	0
Wednesday, 17-04-13	29	28.9	0
Thursday, 18-04-13	29.6	0	21
Friday, 19-04-13	0	24.5	0
Saturday, 20-04-13	0	30.1	27.6
Sunday, 21-04-13	0	0	26.8
Monday, 22-04-13	26.6	23.2	21.2
Tuesday, 23-04-13	0	26.6	0
Wednesday, 24-04-13	25.8	22.7	22.6
Thursday, 25-04-13	26	0	0
Friday, 26-04-13	0	21.8	23.4
Saturday, 27-04-13	0	27.8	0

Table E.5 Location E - 339 Inlet Road - MTO filtered out ABLs and RBLs

Date	ABL Day	ABL Evening	ABL Night
Sunday, 28-04-13	0	22.4	0
Monday, 29-04-13	27.9	0	0
Tuesday, 30-04-13	0	28.3	0
Wednesday, 01-05-13	27.1	0	20.7
Thursday, 02-05-13	0	0	31
Friday, 03-05-13	0	26.3	0
Saturday, 04-05-13	0	29.8	18
Sunday, 05-05-13	26	25.4	26.7
Monday, 06-05-13	28.8	23.5	0
Wednesday, 08-05-13	27.4	29.5	31.1
Thursday, 09-05-13	27.1	0	27
Friday, 10-05-13	0	0	29.4
Saturday, 11-05-13	27.8	28	28.3
Sunday, 12-05-13	27.4	28.1	0
Monday, 13-05-13	0	0	17
Tuesday, 14-05-13	0	0	18.8
Wednesday, 15-05-13	24.8	18.8	18.6
Thursday, 16-05-13	25.5	18.7	18.3
Friday, 17-05-13	0	17.9	0
Saturday, 18-05-13	0	18.7	0
Sunday, 19-05-13	23.5	17.7	0
Monday, 20-05-13	0	19	20.8
Tuesday, 21-05-13	25.6	17.3	20.4
Wednesday, 22-05-13	31.1	28.7	34
Thursday, 23-05-13	0	33.6	0
Friday, 24-05-13	0	34.5	0
Saturday, 25-05-13	0	28	0
Sunday, 26-05-13	0	30	29.2
Monday, 27-05-13	30.2	0	0
Tuesday, 28-05-13	0	28.7	25.8
Wednesday, 29-05-13	0	29.6	0
Thursday, 30-05-13	29	27.9	28.4
Friday, 31-05-13	0	26.7	0
Saturday, 01-06-13	28.6	30.5	0
Sunday, 02-06-13	0	29.4	27.2
Monday, 03-06-13	0	24.1	25.7
Tuesday, 04-06-13	0	28.1	0
Wednesday, 05-06-13	28.2	23.1	21.6
Thursday, 06-06-13	0	24.3	20.8

Table E.5 Location E - 339 Inlet Road - MTO filtered out ABLs and RBLs

Date	ABL Day	ABL Evening	ABL Night
Friday, 07-06-13	0	22.8	21.6
Saturday, 08-06-13	29.5	29.4	0
Sunday, 09-06-13	0	28.6	27.1
Monday, 10-06-13	28.1	21.7	21.3
Wednesday, 12-06-13	0	0	20.3
Thursday, 13-06-13	0	0	21
Friday, 14-06-13	26.5	0	20.4
Saturday, 15-06-13	25.5	0	20.7
Sunday, 16-06-13	26.6	0	19.8
Tuesday, 18-06-13	25.9	0	0
Wednesday, 19-06-13	0	21.8	0
Thursday, 20-06-13	28.1	21.8	23.5
Friday, 21-06-13	28.4	0	26
Saturday, 22-06-13	25	23.4	0
Monday, 24-06-13	0	20.6	0
Tuesday, 25-06-13	0	0	20.8
Wednesday, 26-06-13	0	31.5	0
Friday, 28-06-13	31.2	0	0
Sunday, 30-06-13	29.3	0	0
Rating Background Level (RBL)	**28.2**	**28.1**	**25.7**

Notes: 1. '0' Values indicate excluded data due to weather or inadequate sampling as per the INP. When calculating the median value, these '0' samples are ignored as per the INP.

Table E.6 Location F – Scout Hall - MTO filtered out ABLs and RBLs

Date	ABL Day	ABL Evening	ABL Night
Wednesday, 07-12-11	0	32.8	38.7
Thursday, 08-12-11	37.3	36.5	42
Friday, 09-12-11	34.4	38.2	39.6
Saturday, 10-12-11	31.7	35	36.3
Sunday, 11-12-11	0	38.3	42.5
Monday, 12-12-11	34.9	37.5	40.8
Tuesday, 13-12-11	0	38	39.3
Wednesday, 14-12-11	31.1	41.3	39.2
Thursday, 15-12-11	32.8	39.2	40.8
Saturday, 17-12-11	0	40.8	44
Sunday, 18-12-11	32.7	37.7	42.2
Monday, 19-12-11	36.2	36.3	39.7
Tuesday, 20-12-11	0	38.6	40.3
Wednesday, 21-12-11	33.2	0	0
Thursday, 22-12-11	34.7	0	42.7
Saturday, 24-12-11	0	39.7	0
Monday, 26-12-11	0	0	44.5
Tuesday, 27-12-11	0	38.9	43.3
Wednesday, 28-12-11	33.4	0	41.4
Thursday, 29-12-11	35.6	0	41.4
Saturday, 31-12-11	33.5	37.4	0
Sunday, 01-01-12	0	0	39.1
Monday, 02-01-12	0	0	38.9
Friday, 06-01-12	0	33.2	38.3
Saturday, 07-01-12	0	0	39.9
Tuesday, 10-01-12	0	0	38.3
Thursday, 12-01-12	0	37	35
Wednesday, 18-01-12	0	0	38.6
Friday, 20-01-12	0	0	35.3
Saturday, 21-01-12	0	31.1	37.6
Sunday, 22-01-12	0	0	37.8
Monday, 23-01-12	0	35.7	40
Tuesday, 24-01-12	34.4	33.3	42.7
Thursday, 26-01-12	0	0	45.2
Friday, 27-01-12	0	0	42.8
Friday, 03-02-12	0	41.8	44.9
Saturday, 04-02-12	0	0	42.1
Monday, 06-02-12	0	35.3	41
Tuesday, 07-02-12	31.1	32.9	39.8

Table E.6 Location F – Scout Hall - MTO filtered out ABLs and RBLs

Date	ABL Day	ABL Evening	ABL Night
Wednesday, 08-02-12	0	35.6	40.4
Thursday, 09-02-12	35.2	38.6	39.7
Saturday, 11-02-12	0	35	37.2
Sunday, 12-02-12	0	0	38.3
Monday, 13-02-12	0	0	38.3
Tuesday, 14-02-12	32.7	38	38.6
Wednesday, 15-02-12	33	36.8	40.2
Thursday, 16-02-12	0	0	37.3
Saturday, 18-02-12	0	0	38.4
Tuesday, 21-02-12	31.9	35.3	39.9
Wednesday, 22-02-12	30.3	36.4	39.1
Saturday, 25-02-12	35.7	36.4	38
Sunday, 26-02-12	33.5	33.6	38.8
Monday, 27-02-12	34.3	0	0
Saturday, 03-03-12	0	42.4	44.4
Sunday, 04-03-12	37	40.5	44.9
Monday, 05-03-12	36.6	41.8	41.1
Tuesday, 06-03-12	34.5	39.6	0
Thursday, 08-03-12	0	39.7	35
Friday, 09-03-12	34.4	37.3	37.8
Saturday, 10-03-12	31.3	0	37.2
Sunday, 11-03-12	32.8	40.4	39.2
Monday, 12-03-12	34.6	41.3	40.5
Tuesday, 13-03-12	33.3	0	37.7
Wednesday, 14-03-12	33.4	0	38.2
Thursday, 15-03-12	33.8	41.2	39.4
Friday, 16-03-12	36.2	0	0
Saturday, 17-03-12	0	39.1	38.3
Sunday, 18-03-12	37.6	0	38.5
Monday, 19-03-12	0	0	39.9
Tuesday, 20-03-12	33.7	0	0
Wednesday, 21-03-12	33.6	0	38.2
Thursday, 22-03-12	33.4	0	37
Friday, 23-03-12	0	39.2	29.5
Saturday, 24-03-12	33.2	38.7	33
Sunday, 25-03-12	33.2	0	38.3
Monday, 26-03-12	32.5	41.1	35.9
Tuesday, 27-03-12	31.2	0	40.1
Wednesday, 28-03-12	33.9	42.1	37

Table E.6 Location F – Scout Hall - MTO filtered out ABLs and RBLs

Date	ABL Day	ABL Evening	ABL Night
Thursday, 29-03-12	0	39.2	35.6
Friday, 30-03-12	31.7	39.6	34.1
Saturday, 31-03-12	31	40.8	0
Sunday, 01-04-12	31.3	39.8	0
Monday, 02-04-12	31.3	41.2	36.8
Tuesday, 03-04-12	30.4	40.9	37
Wednesday, 04-04-12	33.4	44.8	39.5
Thursday, 05-04-12	34.5	44.1	39.4
Friday, 06-04-12	33.3	39.8	36.2
Saturday, 07-04-12	0	39.9	35.1
Sunday, 08-04-12	32.1	0	33.3
Monday, 09-04-12	33.5	37.8	30.1
Tuesday, 10-04-12	0	34.1	0
Wednesday, 11-04-12	33.1	33.7	34.1
Thursday, 12-04-12	30.7	38.1	34.8
Friday, 13-04-12	31.2	41	35.6
Saturday, 14-04-12	31	39.7	33.2
Sunday, 15-04-12	31.1	43	35.8
Monday, 16-04-12	32.2	39.5	0
Tuesday, 17-04-12	0	0	35.2
Wednesday, 18-04-12	0	41.5	37.1
Thursday, 19-04-12	32	42.6	33.9
Friday, 20-04-12	31.4	42.5	31.8
Saturday, 21-04-12	29.5	40.9	33.5
Sunday, 22-04-12	31.8	42.1	36.3
Monday, 23-04-12	0	41.3	36.6
Tuesday, 24-04-12	0	37.1	0
Wednesday, 25-04-12	0	30.1	0
Thursday, 26-04-12	29.2	36.8	34.8
Friday, 27-04-12	30.8	40.3	33.4
Saturday, 28-04-12	31.2	37.2	33.7
Sunday, 29-04-12	0	37.9	33.1
Monday, 30-04-12	30.8	41.2	0
Tuesday, 01-05-12	30.8	36.5	35.5
Wednesday, 02-05-12	30.3	32.5	32
Thursday, 03-05-12	0	41.2	33.7
Friday, 04-05-12	29.6	37	31.3
Saturday, 05-05-12	29.6	35.5	32.6
Sunday, 06-05-12	31.9	31.7	29.9

Table E.6 Location F – Scout Hall - MTO filtered out ABLs and RBLs

Date	ABL Day	ABL Evening	ABL Night
Monday, 07-05-12	30.3	35.2	34.1
Tuesday, 08-05-12	31.3	34.8	33.7
Wednesday, 09-05-12	0	34.3	33.7
Thursday, 10-05-12	30.2	36.6	33.2
Friday, 11-05-12	33.1	34.5	32.6
Saturday, 12-05-12	32.2	0	0
Monday, 14-05-12	0	32.1	31.2
Tuesday, 15-05-12	28.6	34.4	31.5
Wednesday, 16-05-12	28.1	37.3	33.4
Thursday, 17-05-12	28.9	38.3	34.2
Friday, 18-05-12	31	37.2	34.1
Saturday, 19-05-12	33.1	37.5	34.2
Sunday, 20-05-12	30.2	35.1	30.4
Monday, 21-05-12	31.2	37.3	34.8
Tuesday, 22-05-12	32.6	26.2	31.3
Wednesday, 23-05-12	33	34.7	37.2
Saturday, 26-05-12	0	29	31.2
Sunday, 27-05-12	28.8	33.8	30.5
Monday, 28-05-12	30.3	32.3	31.8
Tuesday, 29-05-12	29.3	32.2	28.9
Wednesday, 30-05-12	30.3	34.6	33.9
Thursday, 31-05-12	30.1	36.1	0
Friday, 01-06-12	31.9	34.4	37.5
Wednesday, 06-06-12	0	0	36.7
Thursday, 07-06-12	31.5	38.8	0
Friday, 08-06-12	33.5	40.6	36.1
Saturday, 09-06-12	30.6	40.4	35.4
Tuesday, 12-06-12	0	39.4	35.5
Wednesday, 13-06-12	32.2	37.9	35.6
Thursday, 14-06-12	30.5	40.8	37.6
Friday, 15-06-12	35.9	38	36.4
Saturday, 16-06-12	36.9	0	0
Monday, 18-06-12	0	33.1	32.3
Tuesday, 19-06-12	0	33	34.1
Wednesday, 20-06-12	35.1	32.7	32.3
Saturday, 23-06-12	34.6	31.9	32.2
Sunday, 24-06-12	34.3	34.5	34
Tuesday, 26-06-12	0	33.7	0
Wednesday, 27-06-12	0	38.2	0

Table E.6 Location F – Scout Hall - MTO filtered out ABLs and RBLs

Date	ABL Day	ABL Evening	ABL Night
Thursday, 28-06-12	33.1	0	0
Friday, 29-06-12	34.8	40.6	36.2
Saturday, 30-06-12	33.4	38.5	0
Sunday, 01-07-12	0	31.6	0
Monday, 02-07-12	0	28	28.1
Tuesday, 03-07-12	32.9	28.7	30.6
Wednesday, 04-07-12	31.7	31.5	29.9
Thursday, 05-07-12	0	32	33.5
Friday, 06-07-12	0	34.7	33.9
Saturday, 07-07-12	30.5	38	33.7
Sunday, 08-07-12	30.8	41.7	36.6
Monday, 09-07-12	30.6	41.3	39.5
Tuesday, 10-07-12	36.2	38.5	0
Wednesday, 11-07-12	0	43	40.3
Thursday, 12-07-12	0	39.4	0
Friday, 13-07-12	0	0	38.1
Saturday, 14-07-12	0	39.2	0
Monday, 16-07-12	32.4	41.8	38.3
Tuesday, 17-07-12	37.2	40.6	37.4
Wednesday, 18-07-12	34.6	37.3	34.7
Thursday, 19-07-12	34	36.5	32.2
Friday, 20-07-12	31.9	37.3	0
Sunday, 22-07-12	0	37.9	37.4
Monday, 23-07-12	34.2	39.4	38.6
Tuesday, 24-07-12	28.9	41.9	38.1
Wednesday, 25-07-12	34.3	43.8	39.6
Thursday, 26-07-12	34.3	39.6	34.7
Friday, 27-07-12	33.9	31.4	29.5
Saturday, 28-07-12	30.9	29.2	28.2
Sunday, 29-07-12	33.1	28.7	28.6
Monday, 30-07-12	0	33.1	31.2
Tuesday, 31-07-12	31	33.8	0
Wednesday, 01-08-12	31.8	31.7	31.5
Thursday, 02-08-12	31.7	36.9	33.6
Friday, 03-08-12	34.2	31.4	33.2
Saturday, 04-08-12	0	29.6	33.9
Sunday, 05-08-12	0	29.5	0
Monday, 06-08-12	0	24.2	27.2
Tuesday, 07-08-12	33.1	33.6	32.5

Table E.6 Location F – Scout Hall - MTO filtered out ABLs and RBLs

Date	ABL Day	ABL Evening	ABL Night
Monday, 13-08-12	0	37.8	34.6
Tuesday, 14-08-12	0	36.2	33.5
Wednesday, 15-08-12	0	32.7	27.5
Thursday, 16-08-12	0	29.7	0
Friday, 17-08-12	0	29.2	0
Sunday, 19-08-12	36.1	29.4	0
Monday, 20-08-12	31.4	0	0
Wednesday, 22-08-12	0	34.8	34.7
Friday, 24-08-12	0	0	32.1
Saturday, 25-08-12	0	0	33.9
Sunday, 26-08-12	0	32.1	33.3
Monday, 27-08-12	32.3	0	0
Tuesday, 28-08-12	32.6	37.1	0
Wednesday, 29-08-12	0	33.4	32.6
Thursday, 30-08-12	0	24	23.6
Friday, 31-08-12	0	0	24.4
Saturday, 01-09-12	27.1	25.9	25.6
Sunday, 02-09-12	0	29.7	31.1
Monday, 03-09-12	25.8	34.7	0
Tuesday, 04-09-12	0	28.4	0
RBL	**32.6**	**37.3**	**36.2**

Notes: 1. '0' Values indicate excluded data due to weather or inadequate sampling as per the INP. When calculating the median value, these '0' samples are ignored as per the INP.

Appendix F

Ombudsman letter regarding low frequency noise

Ombudsman
New South Wales

ABN 76 325 886 267
Level 24, 580 George Street, Sydney NSW 2000
T 02 9286 1000 | F 02 9283 2911
Tollfree 1800 451 524 | TTY 02 9264 8050
www.ombo.nsw.gov.au

22 January 2014

Our reference: C/2013/6408
Your reference: 13/17860
Contact: Veronica Brogden
Telephone: (02) 9286 0933

Mr Sam Haddad
Director-General
Department of Planning and Infrastructure
GPO Box 39
SYDNEY NSW 2001

Dear Mr Haddad

Complaint by EDO NSW on behalf of Bulga Milbrodale Progress Association (BMPA)

We wrote to your office on 23 October 2013 seeking response to a number of questions about a complaint by BMPA. A/Director General, Mr Richard Pearson responded on 27 November 2013.

I have now completed my assessment of that matter, and have written to the NSW EDO advising that I do not propose to take any further action. My letter, with reasons for my decision is attached for your records.

Please pass on my thanks to all staff involved in responding to our inquiries.

Yours sincerely

Veronica Brogden
Senior Investigation Officer, Local Government

Ombudsman
New South Wales

ABN 76 325 886 267
Level 24, 580 George Street, Sydney NSW 2000
T 02 9286 1000 | F 02 9283 2911
Tollfree 1800 451 524 | TTY 02 9264 8050
www.ombo.nsw.gov.au

22 January 2014

Our reference: C/2013/6408
Contact: Veronica Brogden
Telephone: (02) 9286 0933

Sue Higginson
Principal Solicitor
Environmental Defenders Office, NSW
Level 5, 263 Clarence Street
SYDNEY NSW 2000

COPY

Dear Ms Higginson

Complaint by Bulga Milbrodale Progress Association Inc (BMPA) about NSW Department of Planning and Infrastructure (DPI)

I refer to your letter dated 22 August 2013 in which you forward a complaint on behalf of the BMPA, about the DPI's decision to refuse to apply Low Frequency Noise (LFN) data in accordance with the Industrial Noise Policy (INP) and condition of consent for Mount Thorley and Warkworth coal mines.

As you are aware, Bryce Purches of this office had made inquiries with the DPI and the NSW Office of Environment and Heritage (OEH). Mr Purches has recently left, and the file has been reallocated to me for assessment of the information received by those agencies.

The Ombudsman is primarily concerned to ensure government agencies are fair and reasonable in their dealings. It is clear that opinions, even by experts, may differ. We are unwilling in such situations to question expert opinion, except in those rare cases where the opinion appears so unsupportable that it suggests something improper may have occurred. It is seldom appropriate for us to decide between differing technical views, nor do we have the resources to routinely obtain our own independent expert opinion.

To this end, we sought information from DPI and OEH about the review of the INP, and the application of LFN data to the operations of Mount Thorley Warkworth open cut mine in accordance with the conditions of consent DA 300-9-2002-I.

DPI has provided information and evidence to demonstrate that the (then) DECCW (OEH) had from 2010 made a commitment to revise the INP in relation to low frequency noise, and to review the INP as a whole. While progress on this has been slower than expected, our verbal interactions with OEH has confirmed that they anticipate a review will be completed later this year.

Assessment of LFN appears to be quite contentious, especially in rural settings. I do not propose to develop a view as to which position is most likely accurate, as I have explained above, we do not have that expertise, or the resources to seek that expertise.

It would appear to me, however, that the following points have been agreed by DPI and OEH:

- There may be technical merit as to the difficulty in applying the low frequency modifying factor in rural areas, subject to further study. OEH has commissioned a comprehensive study of LFN as a part of the INP review, titled *Low Frequency Noise & Infrasound*, still underway;
- That OEH would not include conditions about LFN in Environment Protection Licences; and
- A review of the INP would be conducted, and LFN would be a priority issue.

When we receive complaints about compliance and enforcement, failure to take action alone is generally not sufficient grounds to justify an investigation by this office. We look closely at the facts of each case, including the agency's reasons for its decisions.

In this case, there appears to be appropriate consideration of professional advice from qualified staff and experts about LFN that casts doubt as to the practicality of strict enforcement of the condition of consent. Notwithstanding this, OEH has also acknowledged that any review of LFN in the INP will include consultation with NSW Health given the health issues said to be associated with LFN.

Noise monitoring continues to be a high priority issue, and a Noise Management Plan and Noise Monitoring Programme for the whole mining complex are in place. Further, DPI has advised that there will be a requirement to provide separate noise management and monitoring documents for the Mount Thorley and Warkworth mines, in consultation with OEH and DPI due to a Land and Environment Court decision.

For the reasons outlined above, it appears to me the information and evidence provided by the agencies is sufficient to satisfy me that the DPI has provided adequate reasons for its decision and has properly considered all relevant issues, and there is no other evidence of wrong conduct that requires intervention by this office.

I appreciate why you forwarded this matter to this office, and I acknowledge the importance of noise monitoring and the impacts of noise on the local community. BMPA should continue to engage with the agencies and the mine operators as is appropriate and participate in community consultation and engagement as opportunities arise.

I will now close this file and take no further action.

Yours sincerely

COPY

Veronica Brogden
Senior Investigation Officer, Local Government

NSW GOVERNMENT | Planning & Infrastructure

Office of the Director General

Mr Bruce Barbour
NSW Ombudsman
Lvl 24, 580 George St
Sydney NSW 2000

13/17860

Attention: Mr Bryce Purches

Dear Mr Barbour

I refer to your letter requesting information about the regulation of low frequency noise at the Mt Thorley and Warkworth Coal Mines (MTW) following a complaint from the NSW Environmental Defender's Office on behalf of the Bulga Milbrodale Progress Association.

I understand that the request from the NSW Ombudsman is part of a preliminary investigation in accordance with s13AA of the *Ombudsman Act 1974,* to determine whether this matter should be formally investigated.

I have responded to each of the questions you have raised in the attachment to this letter.

Should you have any further enquiries about this matter, I have arranged for Mike Young, Manager Mining and Industry Projects, to assist you. Mr Young can be contacted on 02 9228 2091.

Yours sincerely

27/11/13

Richard Pearson
A/Director General

Enclosed:

- Attachment addressing information request from NSW Ombudsman
- Mount Thorley Warkworth *Noise Management Plan*
- Mount Thorley Warkworth *Interim Noise Monitoring Programme*
- Mount Thorley Warkworth Annual Environmental Management Report (extract)
- Mount Thorley Warkworth *Independent Noise Monitoring Report*
- Letter from Director General of DECCW, dated 20 December 2010

Bridge St Office 23-33 Bridge St Sydney NSW 2000 GPO Box 39 Sydney NSW 2001 DX 22 Sydney
Telephone: (02) 9228 6111 Facsimile: (02) 9228 6191 Website planning.nsw.gov.au

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Response to Questions Raised by NSW Ombudsman

1) *Please provide a copy of the current Noise Management Plan and Noise Monitoring Programme which apply to the consent.*

As requested, copies of the Noise Management Plan and the Noise Monitoring Programme for MTW are enclosed. However, these documents apply to the MTW complex as a whole, and Coal & Allied will be required to prepare and implement separate documents for the Mount Thorley and Warkworth mines in the near future as a result of the NSW Land & Environment Court decision to disallow the application of complex-wide noise criteria. The revised plans will need to be developed in consultation with the NSW Environmental Protection Authority (EPA), and will require approval from the Department.

2) *Is live monitoring of low frequency noise currently undertaken by either the operators of the mine or the Department in relation to cl.28 of the consent? If not, please explain why?*

The real time monitoring is undertaken using an automated system installed in various locations around the mine by Coal & Allied. However, the real time monitoring is limited to the assessment of A-weighted noise levels only, and hence it is not possible to apply the low frequency modifying factors which require C-weighted noise levels to be measured. Furthermore, the real time monitoring is only used for proactive management of noise on the site, and is not used to determine compliance with the noise criteria in condition 28 of the Warkworth consent.

Instead, attended monitoring undertaken by the operators of the mine is used to determine compliance with the noise criteria in the consent. Attended monitoring can measure both A-weighted and C-weighted noise levels and is therefore used to determine if the modifying factor should be applied to the monitoring data.

3) *Are the modification factors for low frequency noise in Section 4 of the INP currently applied to all the reported/measured noise levels relating to the monitoring of the consent?*

The low frequency modifying factor is only applied to the monitoring data where a low frequency impact is identified during the attended monitoring. Under Section 4 of the INP, this modifying factor should be applied if the difference between the C weighted and A weighted noise level is greater than 15 dB.

In the case of Warkworth, Coal & Allied has been applying the low frequency modifying factor since 2010. The most recent *Annual Environmental Management Report* (AEMR), shows that the low frequency penalty was applied on 7 occasions out of a total of 130 attended noise measurements undertaken during 2012 (see extract from the 2012 AEMR attached).

4) *If the modification factors for low frequency noise in Section 4 of the INP have been applied, please provide a document, by way of example which shows how these modification factors have been applied and reported.*

The 2012 AEMR provides an example of how the low frequency modifying factor has been applied and reported. The AEMR is submitted to the Department, and made available on the company's website.

A further example is the *Independent Noise Monitoring Report* prepared by SKM in April 2012 for the Mount Thorley and Warkworth mines. The Independent Noise Monitoring Report provides a comprehensive discussion about low frequency noise and the difficulties of measuring low frequency noise generated by mines, particularly at distances greater than 3 km (see page 12 of the attached report). I understand that presentations were given to the community about the outcomes of the independent monitoring undertaken by SKM.

5) *If the modification factors have not been applied please explain why*

The low frequency modification factor for the Warkworth mine is applied and reported as described above.

6) *Are the modification factors for low frequency noise in Section 4 of the INP currently applied to the data contained in the Annual Environmental Management Reports submitted to the Department by the operators of the mine?*

The low frequency modifying factor is applied to the data at the time of the attended monitoring, and then reported in the AEMR that is submitted to the Department.

7) *Please explain on what basis the Department formed the view that the OEH or EPA has been conducting a review of the relevant sections of the INP in 2011 and 2012.*

There has been ongoing collaboration between the Department and the EPA regarding the assessment of low frequency noise and the need to review the applicable sections of the INP since 2009.

For example, enclosed is a letter from the Director General of the Department of Environment, Climate Change and Water (formerly OEH and EPA) dated December 2010. This letter highlights:

- the difficulties in applying the low frequency modification factor in rural settings;
- that the EPA did not intend to include conditions regarding low frequency noise in Environment Protections Licences; and
- a commitment to review the policy in regard to low frequency noise as a priority ahead of a full review of the INP.

Furthermore, the *Upper Hunter Strategic Regional Land Use Plan* (SRLUP) issued by the NSW Government in September 2012, indicates that a review of the INP as it relates to mining projects was already underway at that time (see page 62 of the SRLUP which is available on the Department's website).

Finally, the EPA has commissioned SKM to prepare a comprehensive study of low frequency noise as part of the review of the INP. The report is titled *Low Frequency Noise & Infrasound*, and is expected to be finalised in the near future.

8) *Please provide copies of any correspondence between the OEH or EPA which confirms that a review of Section 4 of the INP has been ongoing since at least the 15 December 2011.*

A copy of the letter from the Director General of DECCW, dated 20 December 2010, is enclosed.

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EMGA Mitchell McLennan

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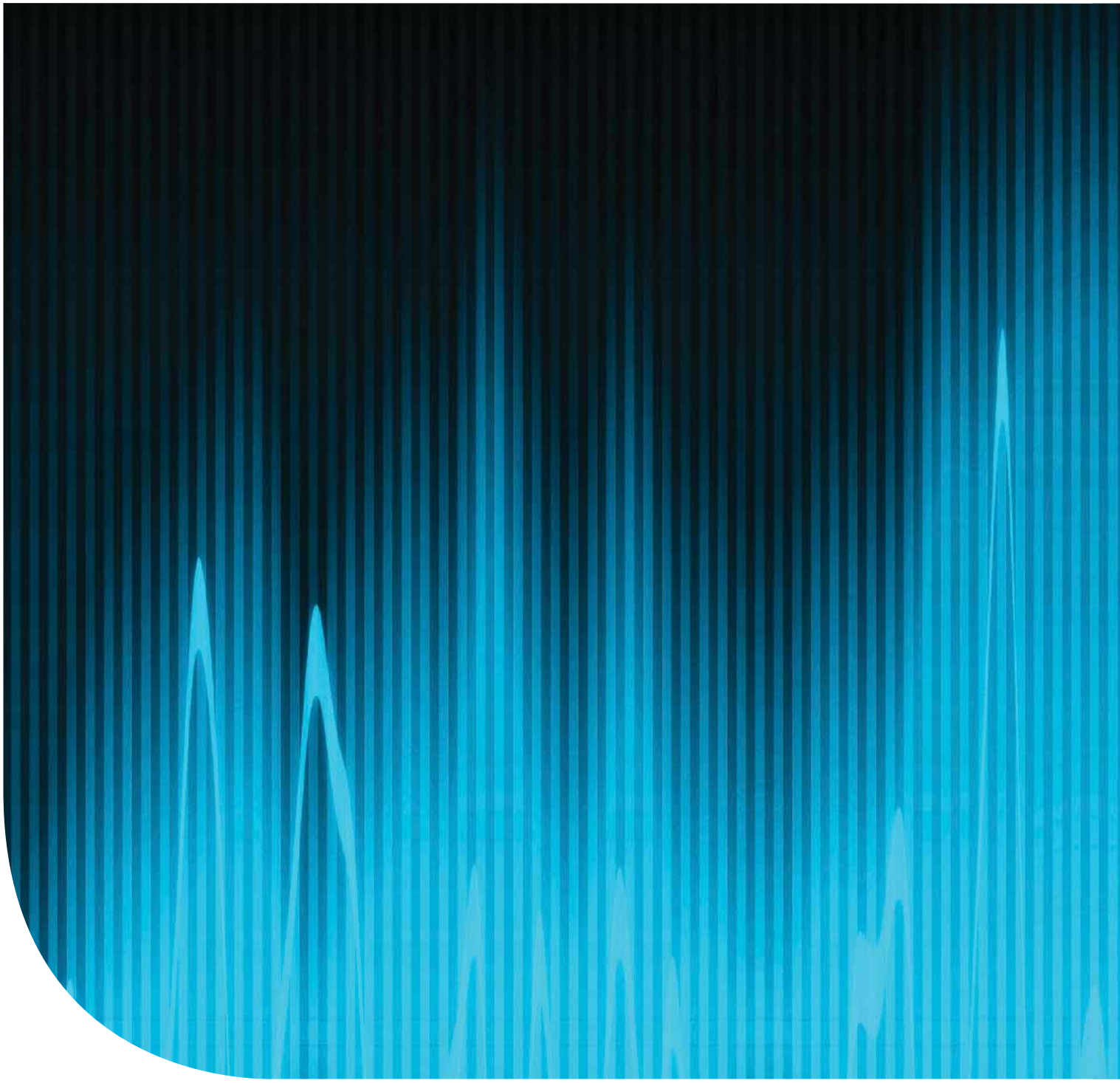

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