Mt Arthur Coal

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Appendix G –
Noise and Blasting Assessment

ACOUSTICS AND AIR

MT ARTHUR COAL OPEN CUT MODIFICATION

NOISE & BLASTING ASSESSMENT

REPORT NO. 11246
REVISION D

JANUARY 2013

PREPARED FOR

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DOCUMENT CONTROL

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GLOSSARY OF ACOUSTIC TERMS

To describe the overall noise environment, a number of noise descriptors have been developed and these involve statistical and other analysis of the varying noise over sampling periods, typically taken as 15 minutes. These descriptors, which are demonstrated in the graph below, are here defined.

Maximum Noise Level (L_{Amax}) – The maximum noise level over a sample period is the maximum level, measured on fast response, during the sample period.

L_{A1} – The L_{A1} level is the noise level which is exceeded for 1% of the sample period. During the sample period, the noise level is below the L_{A1} level for 99% of the time.

L_{A10} – The L_{A10} level is the noise level which is exceeded for 10% of the sample period. During the sample period, the noise level is below the L_{A10} level for 90% of the time. The L_{A10} is a common noise descriptor for environmental noise and road traffic noise.

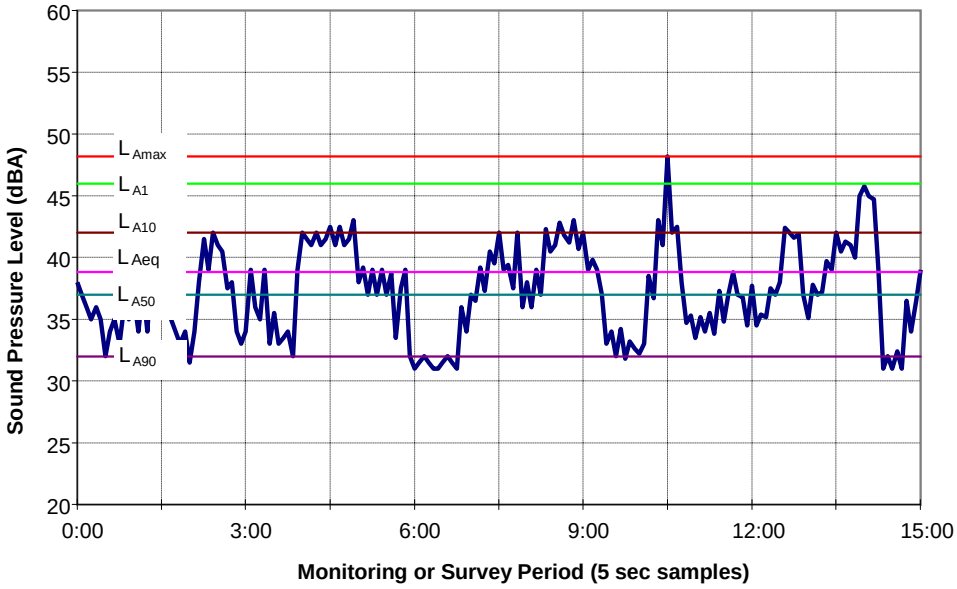
L_{A90} – The L_{A90} level is the noise level which is exceeded for 90% of the sample period. During the sample period, the noise level is below the L_{A90} level for 10% of the time. This measure is commonly referred to as the background noise level.

L_{Aeq} – The equivalent continuous sound level (L_{Aeq}) is the energy average of the varying noise over the sample period and is equivalent to the level of a constant noise which contains the same energy as the varying noise environment. This measure is also a common measure of environmental noise and road traffic noise.

ABL – The Assessment Background Level is the single figure background level representing each assessment period (daytime, evening and night-time) for each day. It is determined by calculating the 10th percentile (lowest 10th percent) background level (L_{A90}) for each period.

RBL – The Rating Background Level for each period is the median value of the ABL values for the period over all of the days measured. There is therefore an RBL value for each period – daytime, evening and night-time.

Typical Graph of Sound Pressure Level vs Time



1 INTRODUCTION

Hunter Valley Energy Coal Pty Ltd (HVEC) is a wholly-owned subsidiary of BHP Billiton and owns and operates the Mt Arthur Coal Mine. HVEC seeks to modify the existing Project Approval ([PA] 09_0062) for the extension of open cut coal mining at the Mt Arthur Coal Mine.

This document is an assessment of noise and blasting associated with the proposed Mt Arthur Coal Open Cut Modification (herein referred to as the Modification).

The assessment follows and relies on measurements, analysis, and modelling carried out for the Mt Arthur Coal Consolidation Project (HVEC, 2009a) (herein referred to as the Consolidation Project) presented in Wilkinson Murray Report No. 08172 (2009), *Mt Arthur Coal Consolidation Project Noise and Blasting Impact Assessment* (herein referred to as the Consolidation Project Noise and Blasting Assessment).

This report presents an assessment of the potential noise and blasting impacts associated with the Modification. Noise impact is assessed according to criteria set out in the existing Project Approval and the New South Wales (NSW) *Industrial Noise Policy* (INP) (Environment Protection Authority [EPA], 2000). This is consistent with the Director-General's Requirements (DGRs) provided by the NSW Department of Planning and Infrastructure (DP&I), which are presented below:

> ***Noise, Vibration & Blasting*** *- including a quantitative assessment of potential:*
>
> - *construction, operational and off-site transport noise impacts;*
> - *blasting impacts on people, livestock and property including any heritage items (Aboriginal and non-Aboriginal);*
> - *reasonable and feasible mitigation measures, including evidence that there are no such measures available other than those proposed; and*
> - *monitoring and management measures, in particular real-time, attended noise monitoring and predictive meteorological forecasting.*

The EPA provided agency comments on the draft DGRs for the Modification on 7 March 2012. Comments relating to noise and blasting have been considered in this assessment. In accordance with the DGRs and EPA comments, predicted Modification noise and blast emissions have been comprehensively evaluated and assessed in accordance with the assessment methodology and procedure guidelines outlined in the EPA's letter.

2 EXISTING MT ARTHUR COAL MINE

2.1 Overview

Open cut mining at the Mt Arthur Coal Mine is conducted using a multi-bench, multi-strip shovel and excavator operation, supported by a truck fleet to transport coal to onsite processing and transport facilities. This method provides optimal flexibility and efficiency in the staged extraction of the coal resource. Mining predominantly occurs in the north of the operation (i.e. the Northern Open Cut) and the South Pit extension mining areas. Drill and blast techniques are used to fracture competent overburden and interburden material at the Mt Arthur Coal Mine.

In 2011, 19.6 million tonnes (Mt) of run-of-mine (ROM) coal was mined from the Mt Arthur Coal Mine's open cut operations. Coal was mined from the Glen Munro seam to the Ramrod Creek seam within the Wittingham coal measures. Following processing on site, a total of 15.8 Mt of product coal was transported by rail to the Port of Newcastle for export, and by conveyor to the Bayswater Power Station.

The approved mining rate at the Mt Arthur Coal Mine is up to 36 million tonnes per annum (Mtpa) of ROM coal, of which a maximum 32 Mtpa may be sourced from open cut mining.

An underground mining operation, the Mt Arthur Underground Project, is approved (PA 06_0091), however has not yet commenced.

All coal mining operations and associated activities at the Mt Arthur Coal Mine are undertaken 24 hours per day, seven days a week.

2.2 Existing Approvals

The Mt Arthur Coal Mine was approved under PA 09_0062 by the then NSW Minister for Planning in September 2010 under Part 3A of the NSW *Environmental Planning and Assessment Act, 1979* (EP&A Act). The potential environmental impacts of the Mt Arthur Coal Mine were assessed in the Consolidation Project.

The Mt Arthur Underground Project was approved under PA 06_0091 by the then NSW Minister for Planning in December 2008 under Part 3A of the EP&A Act.

HVEC operates the Mt Arthur Coal Mine in accordance with the relevant noise and blasting conditions of PA 09_0062 and Mt Arthur Coal Environment Protection Licence (EPL 11457).

2.3 Noise and Blasting Management

A Noise Management Plan for the Mt Arthur Coal Mine was approved by the Director-General of the DP&I in June 2012 (HVEC, 2012a). The Noise Management Plan was prepared to detail the relevant noise impact assessment criteria, compliance procedures and controls relating to mining activities. The Noise Management Plan was prepared in accordance with the PA 09_0062.

A Blast Management Plan for the Mt Arthur Coal Mine was prepared by HVEC and approved by the Director-General of the DP&I November 2012 (HVEC, 2012b). The Blast Management Plan was prepared to detail the relevant blasting and vibration impact assessment criteria, compliance procedures and controls relating to open cut blasting activities. The Blast Management Plan was prepared to fulfil requirements of the PA 09_0062.

2.4 Noise and Blasting Compliance Monitoring Results

Based on Mt Arthur Coal Mine Annual Environmental Management Reports spanning 2007 to 2011 (HVEC, 2007; 2008; 2009b; 2010; 2011), the following information is provided in relation to recent noise and blasting monitoring, management and compliance.

Attended noise monitoring surveys have been conducted two nights per quarter each year at locations NP4, NP7 to NP13 (Figure 2-1) and at a temporary monitoring location in accordance with the INP and Australian Standard (AS) 1055:1989 *Acoustics – Description and Measurement of Environmental Noise*.

A review of the 2007 to 2011 noise monitoring data indicates that noise levels were consistent with the relevant Project Approval requirements and were compliant with the relevant noise limits[1] with the exception of two exceedances at site NP9 in the August 2008 survey (HVEC, 2008) and in the September 2011 survey (HVEC, 2011).

Blasting is currently monitored at Mt Arthur Coal Mine at six locations BP4 – BP9 during each blast event (Figure 2-1).

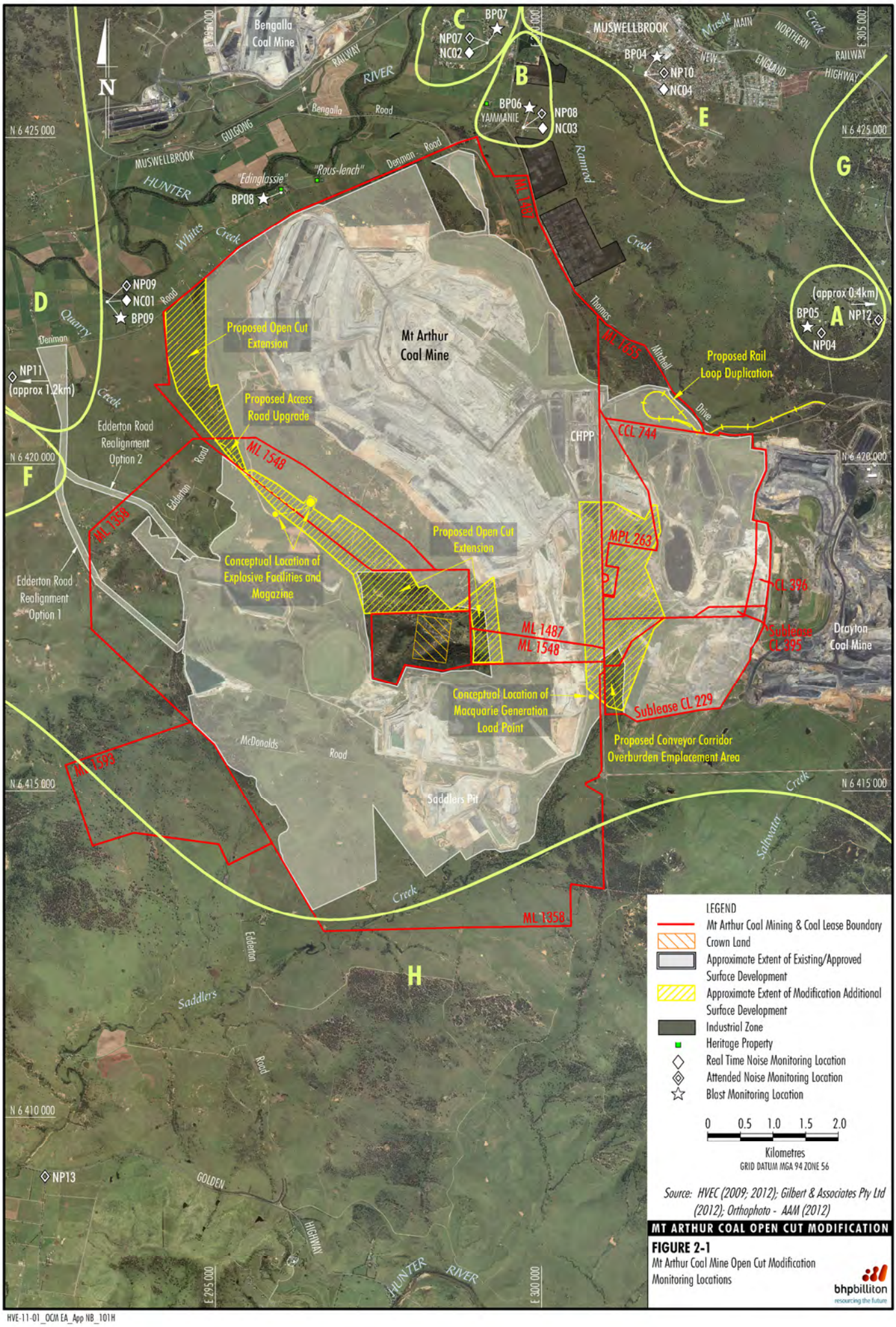
During the 2007 to 2011 period, one exceedance of the 120 linear decibels (dB(L)) airblast pressure was recorded at site BP7 on 24 February 2009 which recorded an airblast pressure of 124.6 dB(L). In the 2007 to 2011 period, the 115 dB(L) airblast pressure limit[2] was not exceeded for any 12 month period, with the exception of the BP7 exceedance above.

All vibration results were less than 10 millimetres per second (mm/s) with the exception of two blasts on 17 February and 23 March 2011, both of which were attributed to equipment malfunction. During the 2007 to 2011 period, the 5 mm/s vibration limit was not exceeded for any 12 month period, with the exception of the two equipment malfunctions above.

Accordingly, airblast and ground vibration monitoring has demonstrated that the Mt Arthur Coal Mine blasting and vibration management resulted in a high standard of compliance with the regulatory criteria at the monitored sites (HVEC, 2007; 2008; 2009b; 2010; 2011).

[1] Any recorded exceedance was within 2 A-weighted decibels (dBA) of the relevant criterion, a level which is considered in accordance with Section 11.1.3 of the INP (EPA, 2000).

[2] As per the Project Approval, this level must not be exceeded for more than 5 percent (%) of blasts in any year.



Source: HVEC (2009; 2012); Gilbert & Associates Pty Ltd (2012); Orthophoto - AAM (2012)

MT ARTHUR COAL OPEN CUT MODIFICATION

FIGURE 2-1

Mt Arthur Coal Mine Open Cut Modification Monitoring Locations

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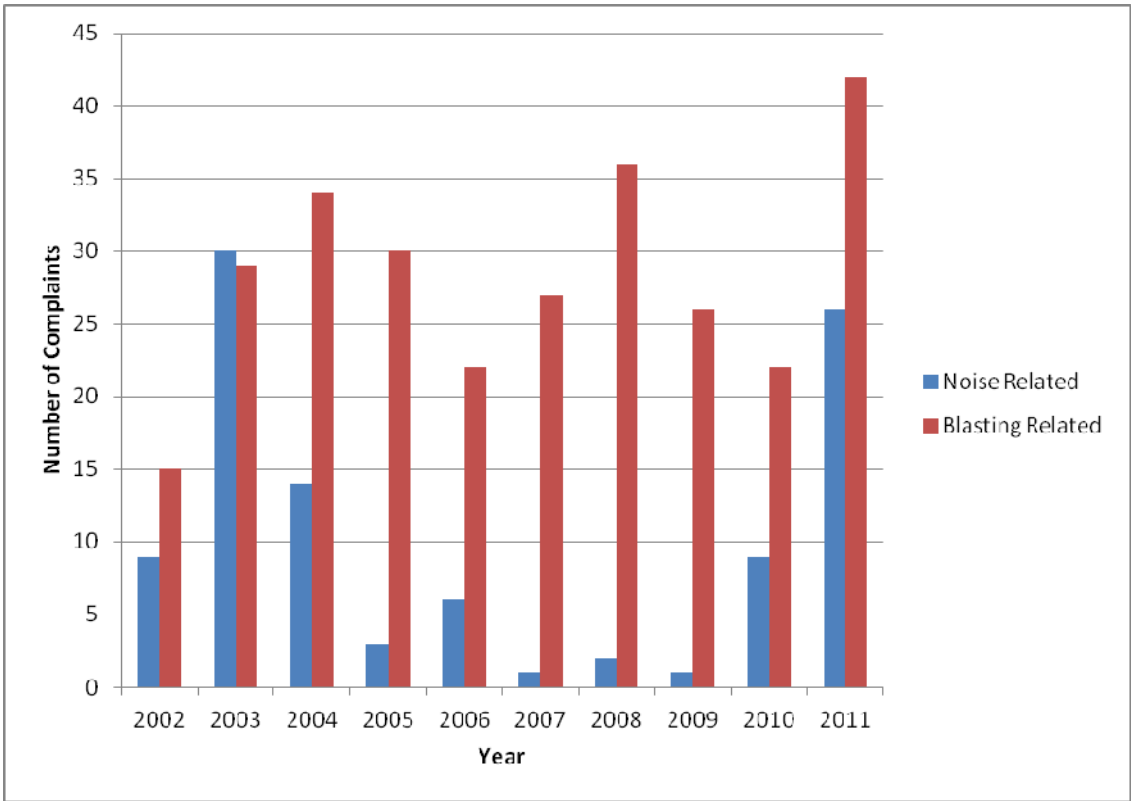
An independent environmental audit of the Mt Arthur Coal Mine operations and activities was conducted by Trevor Brown & Associates during December 2011 and January 2012 (Applied Environmental Management Consultants, 2011). Blast monitoring demonstrated compliance of the Mt Arthur Coal Mine operations with the relevant overpressure and ground vibration criteria in the PA 09_0062 and EPL 11457 Conditions L6.2 and L6.3. The independent audit of noise conditions found that Mt Arthur Coal Mine is generally in compliance with the noise criteria.

2.5 Noise and Blasting Complaints Summary

The numbers of complaints received during the period 2002 to 2011 relating to on site operational noise and blasting are shown on Figure 2-2.

Figure 2-2 Mt Arthur Coal Mine Complaints – 2002 to 2011



During 2011, HVEC received 26 complaints related to operational and train noise, compared to nine complaints received in 2010. Thirteen of the noise complaints received were from a single resident on Roxburgh Road concerned about low frequency mining noise. Discussions have been held with neighbouring mines, and investigations, including monitoring using the mobile directional BarnOwl monitor, were carried out in an attempt to determine the source of the noise and address the complainant's concern. Immediately following each complaint, HVEC's open cut examiners were contacted to review operations to attempt to reduce noise levels at the affected residence.

HVEC received 42 blast complaints in 2011 which accounted for 45 percent (%) of all complaints received, and was an increase on the previous year.

The HVEC Environment and Community team uses a standard list of questions to assist in determining the impacts of the blast being experienced by a complainant and to implement appropriate controls to minimise the impact of future blasts.

2.6 Consolidation Project Noise and Blasting Assessment

The Consolidation Project Noise and Blasting Assessment was prepared for the Consolidation Project in October 2009.

Operational noise levels at residences surrounding the Mt Arthur Coal Mine were calculated using the Environmental Noise Model (ENM) prediction model. The Consolidation Project Noise and Blasting Assessment concluded:

- operational noise was predicted to exceed the amenity criterion at one receiver;
- operational noise was predicted to exceed the intrusiveness criterion at 27 receivers;
- noise from rail transport was predicted to comply with relevant criteria at all receivers; and
- noise from road transport was predicted to comply with relevant criteria at all receivers.

Airblast overpressure and ground vibration levels from blasting were calculated at residences surrounding the Mt Arthur Coal Mine. Blast Control Areas were required to comply with relevant blasting criteria (e.g. HVEC reduce the Maximum Instantaneous Charge [MIC] to manage airblast overpressure and ground vibration).

Since the Consolidation Project Noise and Blasting Assessment was prepared, HVEC have purchased a number of residences that were potentially affected by noise and blasting.

3 MODIFICATION DESCRIPTION

3.1 Overview

The Modification is a proposed continuation of open cut mining operations at the Mt Arthur Coal Mine for an additional operational life of approximately four years. Aspects of the Modification which could change the noise impact presented in the Consolidation Project Noise and Blasting Assessment are discussed in this section.

In summary, the Modification includes the following key components:

- a four year continuation of the open cut mine life from 2022 to 2026 at the currently approved maximum rate of 32 Mtpa;
- an increase in open cut disturbance areas;
- use of the conveyor corridor for overburden emplacement;
- duplication of the existing rail loop;
- an increase in the daily maximum number of train movements per day from 24 to 38;
- the relocation of the load point for the overland conveyor which delivers coal to Macquarie Generation's Bayswater Power Station;
- the relocation and upgrade of the explosives storage, magazine and associated facilities; and
- the construction of additional offices, a control room and a small extension to the ROM coal stockpile footprint.

An indicative arrangement for the Modification is shown in Figure 3-1.

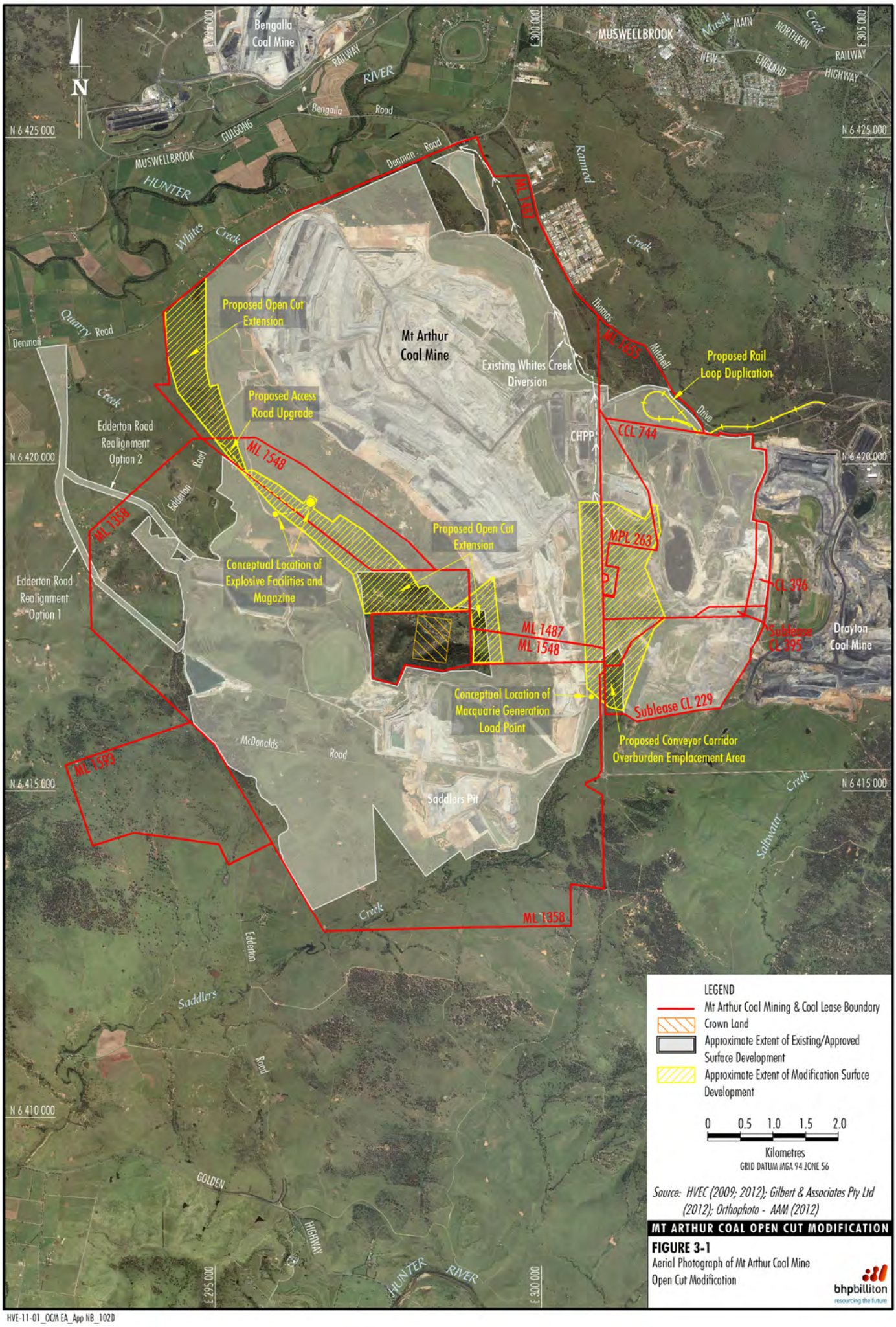
3.2 Mining Operations

The Modification would include a proposed extension of open cut mining operations to the west and south-west of approximately 400 metres (m). This brings the mining operations closer to residences located to the west.

The mine planning that was undertaken for the 2009 Consolidation Project contained assumptions on truck productivity (that is, the amount of coal or overburden that can be transported per hour of truck operation) which have been superseded. New data from the Mt Arthur Coal Mine shows that a more conservative set of truck productivity assumptions should be used. This has resulted in an increase in the indicative fleet list compared to that modelled for the Consolidation Project Noise and Blasting Assessment.

Open cut mining methods for the Modification would generally remain the same as those currently used at the Mt Arthur Coal Mine.

The indicative open cut progression of the Modification is shown on Figure 3-2.



MT ARTHUR COAL OPEN CUT MODIFICATION

FIGURE 3-1

Aerial Photograph of Mt Arthur Coal Mine Open Cut Modification

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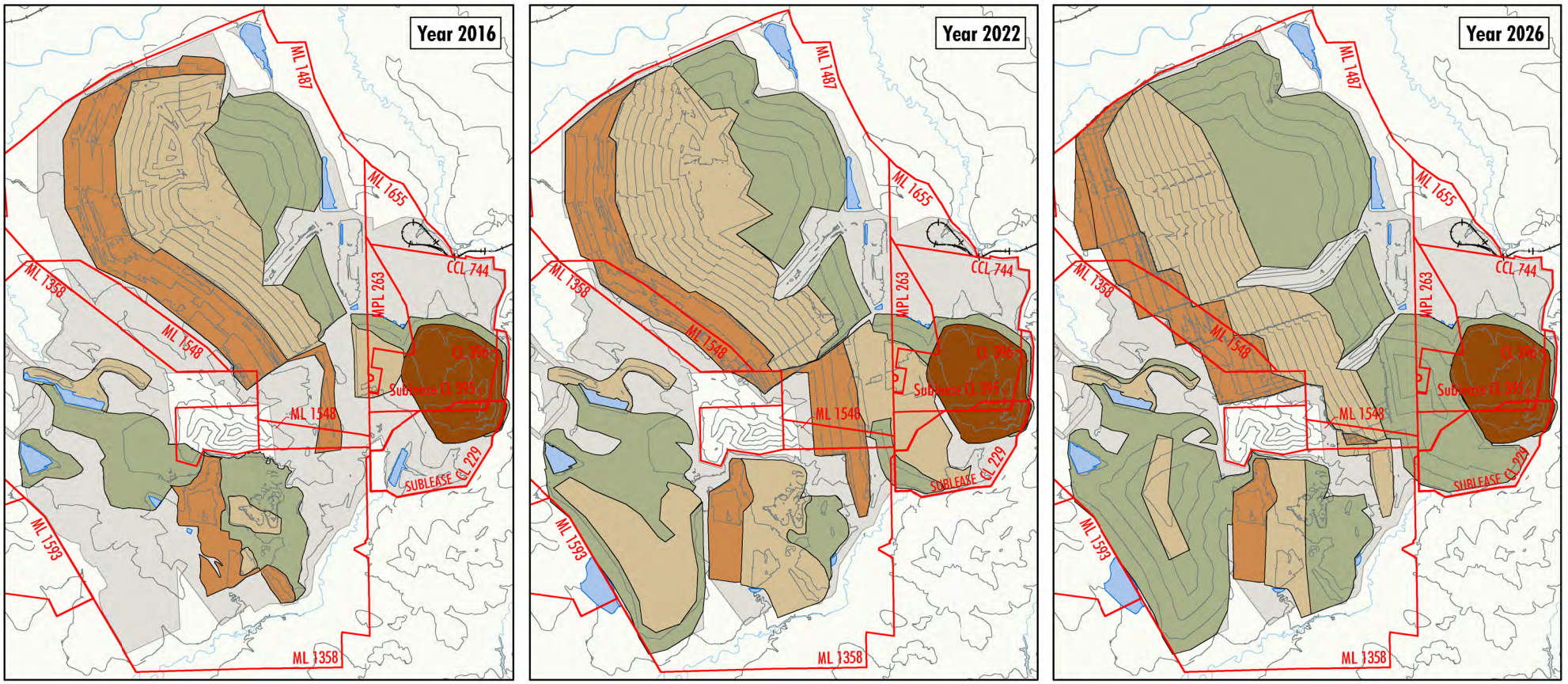

LEGEND

- Mt Arthur Coal Mining & Coal Lease Boundary
- Approximate Extent of Existing/Approved Surface Development
- Active Mining
- Overburden Emplacement
- Tailings Storage
- Rehabilitated Landform
- Water Storage

N

0 5

Kilometres

GRID DATUM MGA 94 ZONE 56

Source: HVEC (2009; 2012)

MT ARTHUR COAL OPEN CUT MODIFICATION

FIGURE 3-2

Mt Arthur Coal Mine Modification
Indicative Open Cut Progression

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3.3 Overburden Management

The existing mine landforms include a conveyor corridor which contains the existing overland conveyor from the Mt Arthur Coal Mine ROM pad to Macquarie Generation's Bayswater Power Station. As part of the Modification, the existing conveyor load point would be relocated to the south and the portion of the existing conveyor within the proposed overburden emplacement area, would be decommissioned and removed, allowing overburden material to be placed in this corridor (Figure 3-1).

Overburden material associated with the Modification would also continue to be backfilled within the open cut. Other overburden emplacement areas approved in accordance with PA 09_0062 would remain unchanged for the Modification.

The haulage routes for overburden emplacement and location of the conveyor are therefore different to those modelled for the Consolidation Project Noise and Blasting Assessment.

3.4 Rail Movements

The existing maximum total product coal transportation rate of 27 Mtpa would remain unchanged for the Modification; hence the average daily number of train movements would remain unchanged. However, due to congestion on the Main Northern Railway and reduced cargo assembly times at the Port of Newcastle, additional peak train movements are required to meet loading times and reduce delays in loading at the Port of Newcastle. As part of the Modification, HVEC seeks an increase in maximum daily train movements from 24 to 38 per day.

3.5 Rail Loading

The requirement for an increase in maximum rail movements for the Modification means that the existing rail loading infrastructure requires augmentation in order to receive and dispatch the required trains.

This would be achieved by a duplication of the existing rail loop and spur. The duplication of the rail loop would allow railway traffic waiting to be loaded to queue adjacent to mining operations, potentially reducing noise exposure at residential areas such as Antiene.

3.6 Life of Mine

The mining life would be extended to allow for an additional four years of mining (until 2026).

3.7 Other Infrastructure

The existing explosives facility and magazine would be relocated to the west of the open cut as part of the Modification.

The Modification would also include minor infrastructure upgrades including an administration building, Coal Handling and Preparation Plant (CHPP) offices and control room, and a small extension to the ROM coal stockpile footprint.

Changes to administration buildings, control rooms and offices are not considered further in the noise assessment as their contribution to noise emissions would be negligible. Changes in the ROM coal stockpile footprint are reflected in the noise scenarios.

4 NOISE CRITERIA

This section discusses noise, vibration and airblast criteria and guidelines set out by the EPA and Australian Rail Track Corporation (ARTC), which have been adopted for the assessment of the Modification.

The DGRs require assessment of operational noise against the criteria recommended in the INP. Two noise criteria are specified in the INP, the intrusiveness and the amenity criteria. Both criteria were discussed in detail in the Consolidation Project Noise and Blasting Assessment. The appropriateness of the criteria adopted for the Consolidation Project Noise and Blasting Assessment was reviewed for the Modification, as discussed below.

4.1 Assessment Locations

To set noise criteria, the residences are grouped into Zones A to H where it is considered the Rating Background Level (RBL) and existing industrial noise are consistent across the zone. The zones are shown on Figure 4-1.

Noise impacts were assessed in the Consolidation Project Noise and Blasting Assessment for residential receivers in Zones A to G.

An additional group of receivers to the south of the Mt Arthur Coal Mine which were not included in the Consolidation Project Noise and Blasting Assessment have been assessed for the Modification. These receivers are located in Zone H.

Receiver locations and identification numbers are shown in Appendix A.

4.2 Operational Noise Criteria

4.2.1 Intrusiveness Criterion

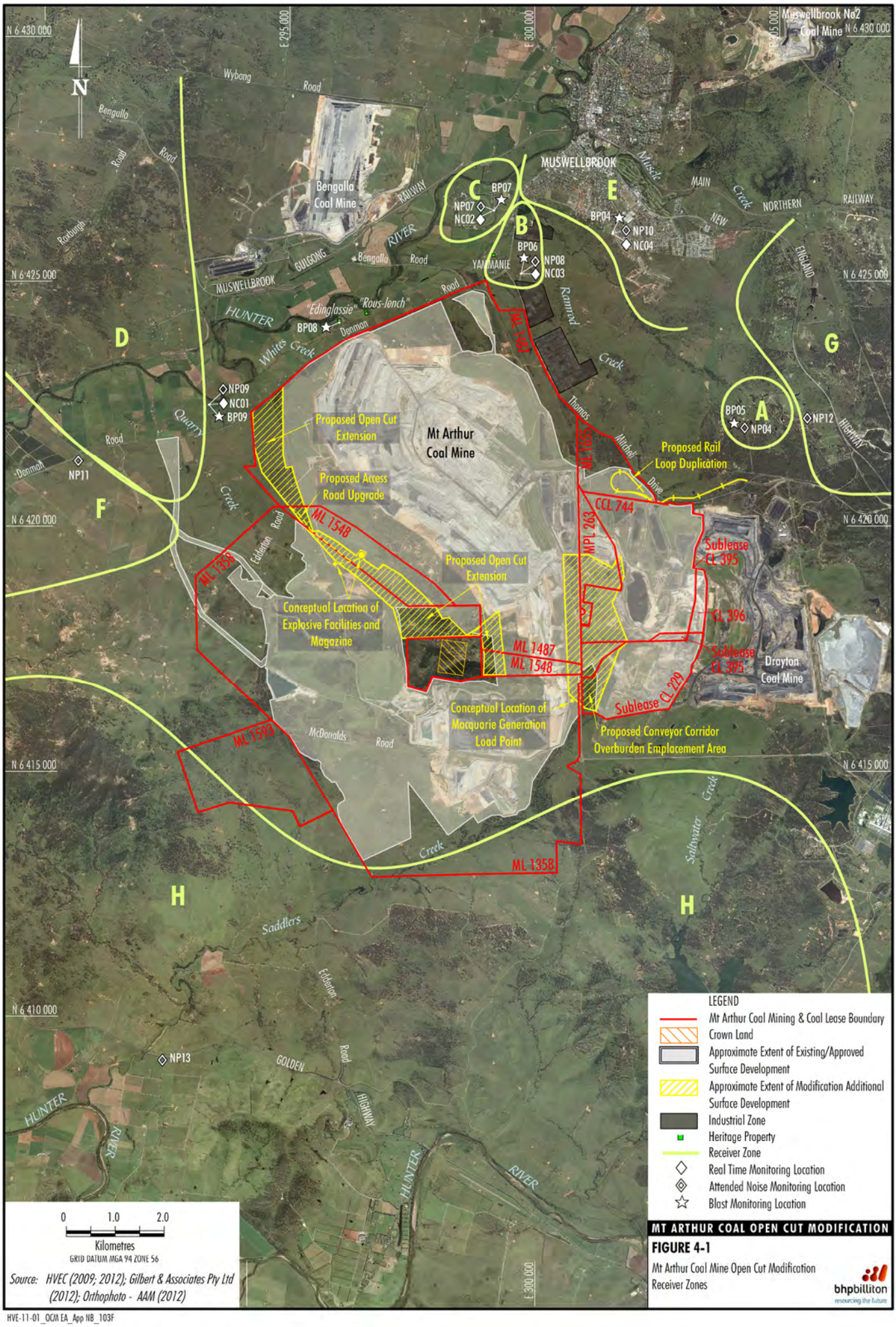
The intrusiveness criterion specifies that the equivalent continuous sound level ($L_{Aeq,15min}$) from any new source should not exceed the RBL by more than 5 dBA. The RBL is defined as the overall single-figure background level representing each measurement period (day, evening and night) over the whole monitoring period. Where the RBL is found to be less than 30 dBA, the RBL is set to 30 dBA.

This criterion should be assessed under specific meteorological conditions, which are detailed in the INP. Definition of appropriate meteorological conditions for assessment is discussed in detail in Chapter 5.

4.2.2 Amenity Criterion

The second type of criterion is an amenity criterion, and is intended to ensure that the total L_{Aeq} noise level from all industrial sources does not exceed specified levels. For rural residences, the relevant recommended “acceptable” levels are:

- Daytime (7.00 am-6.00 pm) 50 dBA $L_{Aeq\ (period)}$
- Evening (6.00 pm-10.00 pm) 45 dBA $L_{Aeq\ (period)}$
- Night-time (10.00 pm-7.00 am) 40 dBA $L_{Aeq\ (period)}$



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The recommended "maximum" amenity criteria for rural residences during daytime, evening and night-time are 5 dBA greater than the "acceptable" levels. The amenity criterion represents the cumulative impact of all existing and potential industrial noise sources affecting a receiver. The appropriate criterion for a new industrial noise source depends on the existing and future noise levels from other existing or approved industrial sources.

Noise from the Modification also has the potential to affect industrial buildings located to the north-east of the Mt Arthur Coal Mine (Figure 4-1). For industrial buildings, the INP specifies a recommended "acceptable" noise level of 70 dBA L_{Aeq} and a maximum noise level of 75 dBA L_{Aeq}.

4.3 Background Noise Surveys

4.3.1 Review of Surveys

Operational noise criteria are calculated using the RBL, which is determined from the existing background noise. Wilkinson Murray began noise surveys as part of the Northern Open Cut Environmental Impact Statement in 1999. The existing operational noise criteria for Mt Arthur Coal Mine are based largely on the results of those surveys.

Noise monitoring data for the period 1999 to 2009 was assessed as part of the Consolidation Project Noise and Blasting Assessment to confirm the RBLs for each receiver zone as discussed below.

4.3.2 Background Noise for Zones B and E

Noise criteria for Zone B are based on monitoring at Yammanie (NP08). As discussed in the Consolidation Project Noise and Blasting Assessment, analysis of directional data from the BarnOwl for the period 2006 to 2009, showed increasing noise from the direction of Muswellbrook Township. While a change in criterion at Yammanie was not proposed, it was noted that the criteria were set conservatively low.

Zone B also includes residences along Denman Road approaching Muswellbrook. The south Muswellbrook residential area including Dalwood Place and Wollombi Road, 1,800 m north of the monitoring location, was also included in this area in previous assessments.

A review of background noise in Muswellbrook residential areas indicates that Dalwood Place and Wollombi Road residences would be more accurately incorporated into Receiver Zone E than Receiver Zone B, because:

- it is a suburban residential area, whereas the Yammanie monitoring was done in a rural area;
- the area is 1,800 m north of the BarnOwl location in the direction of the township, and noise from that direction has been increasing; and
- subsequent to the Consolidation Project Noise and Blasting Assessment, a noise assessment of the Mount Pleasant Project Modification was published (EMGA Mitchell Mclennan, 2010). For assessment in the same area that report based criteria on monitored noise levels. A night-time RBL of 34 dBA was determined for the area. This corresponds to the RBL in Zone E.

As a result of the above, these receivers have been moved to Zone E as shown in Appendix A.

In addition, Ironbark Ridge Estate, which is an approved residential estate on the southern side of Muswellbrook is also considered to be within Zone E.

4.3.3 Background Noise for Zone H

Receivers in Zone H were not assessed as part of the Consolidation Project Noise and Blasting Assessment. Furthermore, no monitoring has been undertaken in this area. In the absence of data the RBL has been assumed to be 30 dBA, which is the lowest limit used in the INP. It is unlikely that the actual RBLs are as low as this.

4.3.4 Summary of Background Noise and Intrusive Noise Criteria

The results of The Consolidation Project Noise and Blasting Assessment study, supplemented by the Mount Pleasant Project Modification Data, are considered the best information available for setting intrusive noise criteria for the Modification. The RBL for the receiver zones and the resulting intrusiveness noise criteria are summarised in Table 4-1. The criteria in Table 4-1 are consistent with the Consolidation Project Noise and Blasting Assessment and Condition 2, Schedule 3 of PA 09_0062.

Table 4-1 Background Noise and Intrusive Noise Criteria

Receiver Zone	Location	Assessed RBL (Day/Evening/Night) dBA	Intrusive Criteria (Day/Evening/Night) $L_{Aeq,15min}$ dBA
A	Antiene Estate	32 / 35 / 33	37 / 40 / 38
B	Skelletar Stock Route Thomas Mitchell Drive Denman Road East	34 / 33 / 32	39 / 38 / 37
C	Racecourse Road	36 / 35 / 34	41 / 40 / 39
D	Denman Road North-west Roxburgh Vineyard (North-east) and Roxburgh Road	32 / 31 / 30	37 / 36 / 35
E	South Muswellbrook (incl. the South Muswellbrook Development Area and Ironbark Ridge Estate)	34 / 34 / 34	39 / 39 / 39
F	Denman Road West and Roxburgh Vineyard (West)	32 / 31 / 30	37 / 36 / 35
G	East Antiene	36 / 35 / 34	41 / 40 / 39
H	South of Mine	30 / 30 / 30	35 /35 / 35

4.4 The Amenity Criterion and Cumulative Noise

The amenity criterion sets an upper limit to control the total L_{Aeq} noise level from all industrial sources over day, evening and night-time periods. In this case, the surrounding residences are in an area which would be classified as "Rural" under the INP, and the relevant recommended "acceptable" amenity criteria for $L_{Aeq,period}$ are 50, 45 and 40 dBA for daytime, evening and night-time periods respectively. Where there is existing industrial noise in an area, new industrial developments need to be designed so that the cumulative noise does not significantly exceed the criteria.

Non-residential receivers are also assessed by an amenity criterion as discussed further in Section 7.3.

4.5 Vacant Land Assessment and Land Acquisition Criteria

Condition 3 of Schedule 3 of the Consolidation Project Approval states that if noise exceeds the land acquisition criteria *at any residence on privately-owned land or on more than 25 percent of any privately-owned land, the Proponent shall, upon receiving a written request for acquisition from the landowner, acquire the land* in accordance with appropriate procedures.

4.6 Blasting Overpressure and Vibration Criteria

Annoyance and structural damage criteria for blasting is discussed in the Consolidation Project Noise and Blasting Assessment. The Modification has adopted the same criteria as summarised below.

4.6.1 Annoyance

Annoyance criteria are derived from the *Technical Basis for Guidelines to Minimise Annoyance due to Blasting Overpressure and Ground Vibration* prepared by the Australian and New Zealand Environment Council (1990). The criteria specify that at any privately owned residence or other sensitive location:

- the maximum overpressure due to blasting should not exceed 115 decibels (dB) for more than 5% of blasts in any year, and should not exceed 120 dB for any blast; and
- the maximum peak particle ground velocity should not exceed 5 mm/s for more than 5% of blasts in any year, and should not exceed 10 mm/s for any blast.

4.6.2 Structural Damage

The Consolidation Project Noise and Blasting Assessment reviewed potential of vibration effects (ground vibration and airblast) on two heritage properties owned by HVEC (Edinglassie and Rous Lench) with reference to AS 2187.2-2006 *Explosives - Storage and Use. Part 2 Use of explosives (Appendix J)* and *Edinglassie Homestead & Rous Lench – Blast Vibration Vulnerability* (Bill Jordan & Associates, 2009). The following criteria were adopted for Edinglassie and Rous Lench homesteads:

- vibration limit of 10 mm/s peak component particle velocity; and
- airblast limit of 130 dB(L).

For all residential dwellings, compliance with the annoyance criteria described in Section 4.6.1 ensures that the potential to cause structural damage is negligible.

4.7 Rail Noise

Modification product coal would continue to be transported via Antiene rail spur and the Main Northern Railway to the Port of Newcastle. As part of the Modification, HVEC seeks an increase in the daily maximum number of trains from 12 to 19 trains per day (i.e. an increase from 24 to 38 train movements). Consequently, a rail noise assessment was undertaken for the Main Northern Railway.

This assessment of rail noise impacts due to train movements on the main line does not include rail movements on the Antiene rail spur which are addressed under operational noise impacts in this report.

4.7.1 Rail Noise Criteria

The ARTC operates the Main Northern Railway. Noise emissions from railways operated by ARTC are regulated via the ARTC EPL 3142. EPL section L6 does not nominate specific environmental noise limits but notes that:

> *It is an objective of this Licence to progressively reduce noise levels to the goals of 65 dB(A)Leq, (day time from 7am – 10pm), 60 dB(A)Leq, (night time from 10pm – 7am) and 85dB(A) (24 hr) max pass-by noise, at one metre from the façade of affected residential properties through the implementation of the Pollution Reduction Programs.*

Based on the information presented above and consistent with the Consolidation Project Blasting and Noise Assessment, the following noise criteria have been adopted for the Modification:

- $L_{Aeq,9\ hour}$ = 60 dBA
- $L_{Aeq,15\ hour}$ = 65 dBA
- Maximum noise level (L_{Amax}) = 85 dBA

In addition, the NSW EPA's rail noise requirements *Environment Assessment Requirements for Rail Traffic – Generating Developments* (EPA, 2012) provides alternative rail noise assessment criteria. Rail noise assessment trigger levels are presented in Table 4-2.

Table 4-2 EPA Rail Noise Assessment Trigger Levels

Descriptor	***Rail Traffic Noise Goal***
$L_{Aeq,24\ hour}$	*60 dBA*
Maximum Passby L_{Amax} (95^{th} percentile)	*85 dBA*

Note: 95^{th} percentile equates to the 5% exceedance value.

The EPA's rail noise assessment trigger levels are similar to the ARTC's EPL noise goals; however the EPA trigger levels have an averaging period of 24 hours, rather than daytime (15 hours) and night-time (9 hours) for the ARTC's goals. The EPA rail noise assessment document also indicates:

> *Where the cumulative noise level exceeds the noise assessment trigger levels, and project-related noise increases are predicted, all feasible and reasonable noise mitigation measures should be implemented. As a general principle, where the reduction of existing noise levels can be achieved through feasible and reasonable measures, a reduction in noise levels to meet the noise assessment trigger levels is the primary objective. In all cases where the L_{Aeq} noise level increases are more than 2dB(A), strong justification should be provided as to why it is not feasible or reasonable to reduce the increase.*

In addition, the EPA's rail noise assessment requirements also provides guidance in relation to the geographical extent of rail noise assessment which should be undertaken for a rail traffic generating development (such as the Modification):

> *Ideally, the geographical extent of the rail noise assessment should be to where project-related rail noise increases are less than 0.5dB. This roughly equates to where project-related rail traffic represents less than 10% of total line/corridor rail traffic.*

5 OPERATIONAL NOISE PREDICTION

5.1 Noise Modelling Methodology

Operational noise levels at residences have been calculated using the ENM prediction model (a proprietary computer program from RTA Technology Pty Ltd). This model has been endorsed by the EPA for environmental noise assessment and, using appropriate meteorological conditions, its results have been directly validated for noise surrounding the Mt Arthur Coal Mine. Consistent with the Consolidation Project Blasting and Noise Assessment the modification to the open cut development is modelled and combined with other operations from the Mt Arthur Coal Mine to predict the noise generated from the entire complex, including CHPP, rail noise and other auxiliary activities. Total predicted operational noise levels are then compared with the Project-specific intrusive noise criteria described in Table 4-1.

Calculations were undertaken for three progressive operational scenarios, namely worst-case winter nights in Years 2016, 2022 and 2026. Due to the prevalence of night-time temperature inversions in winter, it has been demonstrated that if predicted operational noise levels comply with criteria during winter nights, they would be expected to comply at all other times.

All calculations were performed for adverse meteorological conditions using the methodology outlined in Section 5.2.

5.2 Meteorological Conditions

During the preparation of the *Mt Arthur Coal South Pit Extension Noise and Blasting Assessment* (Wilkinson Murray, 2007a), a calibration exercise determined that the best correlation between measured noise levels and the ENM model predictions was under a single meteorological condition of high temperature inversion strength at night (4 degrees Celsius per 100 m). Under this meteorological condition, the ENM model's predicted noise levels have generally been within 2 dBA of measured noise levels which is considered best-practice. The South Pit Extension EA, Mt Arthur Coal Underground EA (Wilkinson Murray, 2007b) and the Consolidation Project used this methodology. Calibrations undertaken during the preliminary constraints analysis for the Consolidation Project Noise and Blasting Assessment showed that under night-time inversion conditions, there was an excellent correlation between predicted and measured noise levels over the winter period. This methodology has therefore been used for this Modification.

5.3 Noise Mitigation

The modelled scenarios presented in this report are the result of several ongoing constraints analyses of mining operations, as described below.

Where feasible and reasonable, mitigation measures have been introduced into the proposal to reduce potential noise emissions from the Modification. The iterative steps undertaken are described below:

1. Preliminary noise modelling of scenarios representative of the maximum noise emissions from the Modification to identify the potential for noise exceedances.

2. Evaluation of various combinations of noise management and mitigation measures to assess their relative effectiveness.

3. Review of the effectiveness of these measures and assessment of their feasibility by HVEC.
4. Adoption by HVEC of management and mitigation measures to appreciably reduce noise emissions associated with the Modification, including:
   - procurement of noise-attenuated vehicles for critical haul routes; modified alignment of haul routes for day and night scenarios dumping of overburden in less noise-sensitive locations during night-time, then using daytime dumping to increase barrier heights in the vicinity of the night-time dumping locations; and
   - use of bulldozers on overburden in less noise-sensitive locations during night-time.

5.4 Equipment Sound Power Levels

Table 5-1 presents the assumed sound power levels for the noise modelling. As a noise control measure it is anticipated that all Type T282 haul trucks would be noise–attenuated (113 dBA) and made available for deployment on noise-sensitive routes.

5.5 Equipment Locations

5.5.1 Mobile Plant

Mine plan drawings were supplied for mine Years 2016, 2022 and 2026. This included indicative locations of all mobile plant and haul routes.

5.5.2 Infrastructure

The infrastructure model for the Modification includes additional noise emission sources to those modelled in the Consolidation Project Noise and Blasting Assessment, including:

- new conveyor to rail loading area;
- change in location of second coal loader at duplicated rail loop;
- relocation of Macquarie Generation conveyor to the south (2022 and 2026);
- duplicated rail loading facility; and
- duplicated rail loop and spur.

5.5.3 Rail

Rail noise is considered as a line source in the ENM prediction model. Two trains were modelled on the rail loop and spur for the Consolidation Project Noise and Blasting Assessment (Wilkinson Murray, 2009). However, the duplication of the existing rail loop and spur will allow an additional train to fit on the rail loop and spur. Therefore conservatively, the model for the Modification assumes that three trains are on the rail loop and spur. Model predictions were based on a train with three 90 Class locomotives and 91 wagons.

Table 5-1 Indicative Equipment Sound Power Levels

Equipment	Indicative Sound Power Level, dBA	Source
Haul Truck 793DXQ	115	HVEC Measurements (2008)*
Haul Truck T282	113	Best Practice Mitigated
Haul Truck 789C	111	HVEC Measurements (2008)*
Drill	112	HVEC Measurements (2008)*
Excavator 996	115	HVEC Measurements (2008)*
Excavator 994	113	HVEC Measurements (2008)*
Wheeled Dozer 854	115	HVEC Measurements (2008)*
Shovel 4100	121	HVEC Measurements (2008)*
D11 Dozer	113 (Attenuated)	HVEC Measurements (2008)*
D10 Dozer	110 (Attenuated)	HVEC Measurements (2008)*
Water cart	116	HVEC Measurements (2008)*
Grader	108	HVEC Measurements (2008)*
Conveyors (Shielded)	82/m 79/m	WM Measurements
Conveyor Drive	102	Global Acoustics (2008)
Coal Prep Plant Module	117 (Southern façade excluded)	Global Acoustics (2008)
Crushers	115	Global Acoustics (2008)
Transfer Station and Conveyor Drive	112	Global Acoustics (2008)
Stacker and Conveyor Drive	103	Global Acoustics (2008)
Reclaimer and Conveyor Drive	115	Global Acoustics (2008)
Reject Bin	96	Global Acoustics (2008)
2 x QR Locomotives (20 kph)	79.1/m	Measurements: WM (2007)
1280 m Freight Wagons (20 kph)	76.6/m	Measurements: WM (2007)
Rail Load out Bin	106	Measurements: WM (2005)
Stockpile Tracked Dozer	113 (D11 Attenuated)	HVEC Measurements (2008)*
PC 2000	117	WM Measurements
PC 1800	116	WM Measurements
PC 1600	115	WM Measurements
CAT 785	117	WM Measurements
CAT 777	115	WM Measurements

Note: * Independent specialist monitoring commissioned by HVEC.
WM = Wilkinson Murray.
QR = Queensland Rail.
kph = kilometres per hour.

5.5.4 Equipment Utilisation

The following assumptions have been made for noise sources in the ENM prediction model:

- 85% utilisation of haul trucks;
- 100% utilisation of other mobile mining plant;
- three rail movements (one arriving, one leaving, one being loaded on loop); and
- infrastructure operating at full capacity.

The indicative operational fleet is summarised in Table 5-2.

Table 5-2 Indicative Operational Fleet

Equipment	2016	2022	2026
Electric Face Shovels	3	3	5
Excavators	19	19	20
Graders	13	13	15
Bulldozers	28	29	30
Rubber tyre Bulldozers	5	5	7
Water Carts	13	13	16
Drills	7	8	9
Trucks – total fleet	152	155	189
Trucks – 85% operational	130	132	160

Source: HVEC (2011).

6 NOISE IMPACT ASSESSMENT

The predicted daytime and night-time $L_{Aeq,15min}$ operational noise levels at receivers in Zones A to G are presented in Appendices B and C respectively. The predicted $L_{Aeq,15min}$ operational noise levels for the receivers in Zone H are well below the intrusiveness criterion of 35 dBA (i.e. predicted $L_{Aeq,15min}$ of 14 to 24 dBA) and have not been included in Appendices B or C.

Night-time noise contours for 2016, 2022 and 2026 are presented in Appendix D for receivers surrounding the Mt Arthur Coal Mine.

Noise is predicted to exceed the daytime criterion at one receiver, 102 Robertson (Appendix B). This exceedance is predominately due to noise from rail passby.

Table 6-1 shows the number of predicted exceedances of the night-time intrusiveness criteria. Table 6-1 also shows the exceedances predicted in the Consolidation Project Noise and Blasting Assessment for Years 2016 and 2022. The location of receivers is shown in Appendix A.

Table 6-1 Summary of Predicted Exceedances under Night-time Inversion Conditions

Year	Noise Management Zone		Noise Affectation Zone	Total Exceedances for Modification	Total Exceedances for Consolidation Project* (2009)
	1 to 2 dBA Exceedance	3 to 5 dBA Exceedance	> 5 dBA Exceedance		
2016	6, 8, 11, 40, 41, 43, 87, 93, 95, 97, 98, 99(1), 99(2), 187, 200, 203, 204	94, 100, 101, 206, 209, 211, 226	102, 210	26	28
2022	93, 97, 98, 99(1), 99(2), 187, 200, 204, 226	94, 100, 101, 206, 209	102, 210, 211	17	26
2026	6, 8, 93, 95, 97, 98, 99(1), 99(2), 187, 200, 203	94, 100, 101, 204, 206, 209, 226,	102, 210, 211	21	Not applicable

* Source: Wilkinson Murray (2009).

Note: Consolidation Project exceedances include some receivers now owned by HVEC which have been removed from total exceedances for the Modification and one receiver where criterion was revised (Receiver 37).

Note: There are two receivers on property 99 which exceed the relevant noise criterion.

Table 6-2 shows the predicted noise levels at receivers where an exceedance of the intrusiveness criteria is predicted. It also compares the noise levels predicted for the Modification with the noise level predictions in the Consolidation Project Noise and Blasting Assessment.

Table 6-2 Predicted Exceedances of Night-time Intrusiveness Noise Criterion, $L_{Aeq,15min}$ dBA

Rec. Num.	Receiver	Receiver Zone	Intrusiveness Criterion	Acquisition Criterion	Night-time Level (2016)	Night-time Level (2022)	Night-time Level (2026)	Exceedance 2016	Exceedance 2022	Exceedance 2026	Consolidation Report Prediction (2016)	Consolidation Report Prediction (2022)
87	Halloran[+]	A	38	43	39	38	38	1	0	0	39	39
93	Osborn[+]	A	38	43	39	39	39	1	1	1	40	40
94	Skinner[^b]	A	38	43	41	41	41	3	3	3	42	41
6	Scriven[a]	B	37	42	39	37	38	2	0	1	36	36
8	Drake[a]	B	37	42	38	37	38	1	0	1	36	36
11	JP Drake[^]	B	37	42	38	37	37	1	0	0	36	36
40	JR & JA Buckley[^#]	B	37	42	38	36	37	1	0	0	36	35
41	Ray[^#]	B	37	42	38	36	37	1	0	0	36	35
43	Hallett & Campbell[#]	B	37	42	38	36	37	1	0	0	36	35
200	Walsh[b]	D	35	40	36	36	36	1	1	1	35	35
203	Latham[a]	D	35	40	37	35	36	2	0	1	34	35
204	Latham[a]	D	35	40	37	37	38	2	2	3	36	37
206	Wild[a]	D	35	40	38	39	38	3	4	3	37	37
209	Rankin[a]	D	35	40	38	39	38	3	4	3	36	36
210	Rankin[a]	D	35	40	42	41	41	7	6	6	40	40
211	Rankin[a]	D	35	40	40	42	41	5	7	6	39	39
226	T Roots[a]	D	35	40	38	37	38	3	2	3	38	37
187	Duncan[b]	F	35	40	37	36	37	2	1	2	36	36
95	De Boer[+]	G	39	44	40	39	40	1	0	1	40	40
97	Clifton[^]	G	39	44	41	41	41	2	2	2	42	41
98	Jones[^]	G	39	44	41	41	41	2	2	2	42	41

Rec. Num.	Receiver	Receiver Zone	Intrusiveness Criterion	Acquisition Criterion	Night-time Level (2016)	Night-time Level (2022)	Night-time Level (2026)	Exceedance 2016	Exceedance 2022	Exceedance 2026	Consolidation Report Prediction (2016)	Consolidation Report Prediction (2022)
99(1)	Hunter^	G	39	44	41	41	41	2	2	2	41	41
99(2)	Hunter^	G	39	44	41	41	41	2	2	2	41	41
100	Sharman^	G	39	44	42	42	42	3	3	3	42	42
101	Horder*	G	39	44	44	44	44	5	5	5	45	45
102	Robertson*	G	39	44	48	48	48	9	9	9	48	48

Notes: * Existing Noise Acquisition Upon Request as per PA 09_0062.
^ Existing Noise Management Zone as per PA 09_0062.
# Receivers within Industrial Zone as per the *Muswellbrook Local Environmental Plan, 2002*.
[a] Existing Air Quality Acquisition Upon Request as per PA 09_0062.
[b] Existing Air Quality Management Zone as per PA 09_0062.
+ Noise exceedance by 1 to 2 dBA in the Consolidation Project, however, not included in the Noise Management Zone of PA 09_0062.

6.1 Meteorological Forecasting System

A predictive meteorological forecasting system would be implemented in accordance with Condition 8(b) of Schedule 3 of PA 09_0062. This system would work in conjunction with the real-time monitoring and management system, providing an alert for the appropriate personnel to review the real-time data. This would allow for proactive management measures to be invoked, including increasing controls or limiting activity in various areas of the site to reduce noise emissions.

6.2 Potential for Sleep Disturbance

The potential for sleep disturbance as a result of mining and rail operations was assessed in the Consolidation Project Noise and Blasting Assessment. Sleep disturbance predictions as a result of mining and CHPP operations (i.e. excluding rail noise) were well below the L_{Amax} criterion of RBL plus 15 dBA recommended in the NSW Department of Environment and Climate Change's (DECC) *Environmental Noise Control Manual* (DECC, 1985).

Sleep disturbance from rail noise (i.e. from a single locomotive) was predicted at residences closest to the rail line in Zones A and G. Sleep disturbance noise was predicted to exceed the RBL plus 15 dBA criterion at two receivers, 101 Horder and 102 Robertson, located in close proximity to the rail spur (Wilkinson Murray, 2009). The train model and emitting sound power level for the Modification will be the same as those assessed for the Consolidation Project Noise and Blasting Assessment. As the L_{Amax} noise levels are determined by a single train (i.e. it is unlikely that L_{Amax} levels of two trains would coincide), the L_{Amax} noise level at receivers surrounding the Modification is therefore expected to remain unchanged and has not been considered further in this report.

6.3 Vacant Land Assessment

Intrusive noise impacts on vacant land have been assessed on a "case by case" basis for the Modification. No exceedances of the intrusive $L_{Aeq,15min}$ noise level are predicted for more than 25% of any privately owned property.

6.4 Construction Noise

6.4.1 Description of Construction

As part of the Modification, a duplication of the Mt Arthur Coal Mine rail loop, and rail spur from the loop to the underbridge at Thomas Mitchell Drive is proposed (Figure 3-1). Receivers in Zones A and G would be potentially impacted by construction noise associated with these works.

Construction would be carried out during daytime hours (7.00 am to 6.00 pm) Monday to Friday and 8.00 am to 1.00 pm on Saturdays.

6.4.2 Construction Noise Criteria

The *Interim Construction Noise Guideline* (DECC, 2009) provides recommended noise management levels as described in Table 6-3.

Table 6-3 Construction Noise Guidelines within Recommended Standard Hours

Time of Day	Management Level $L_{Aeq,15\ min}$	How to Apply
Recommended Standard Hours: Monday to Friday 7.00 am to 6.00 pm Saturday 8.00 am to 1.00 pm	Noise affected RBL + 10 dBA	The noise affected level represents the point above which there may be some community reaction to noise: • Where the predicted or measured $L_{Aeq,15\ min}$ is greater than the noise affected level, the proponent should apply all feasible and reasonable work practices to meet the noise affected level. • The proponent should also inform all potentially impacted residents of the nature of works to be carried out, the expected noise levels and duration, as well as contact details.
No work on Sundays or public holidays	Highly noise affected 75 dBA	The highly noise affected level represents the point above which there may be strong community reaction to noise: • Where noise is above this level, the relevant authority (consent, determining or regulatory) may require respite periods by restricting the hours that the very noisy activities can occur, taking into account: 1. Times identified by the community when they are less sensitive to noise (such as before and after school for works near schools, or mid-morning or mid-afternoon for works near residences. 2. If the community is prepared to accept a longer period of construction in exchange for restrictions on construction times.

Source: DECC (2009)

Two representative dwellings, closest to the proposed construction in Zones A and G respectively, have been assessed against the construction noise criteria as shown in Table 6-4.

Table 6-4 Construction Noise Criteria

Receiver Zone	Location	Assessed RBL (Day) dBA	Construction Noise Criteria (Day) $L_{Aeq,15min}$ dBA
A	Antiene Estate	32	42
G	East Antiene	36	46

6.4.3 Construction Plant Source Noise Levels

Sound power levels of typical plant used in construction of rail lines are shown in Table 6-5.

Table 6-5 Typical Construction Plant Sound Power Levels

Plant	Indicative Sound Power Level (dBA)
20 tonne (t) Excavator with Piling Auger Attachment	115
25 t Excavator with Vibrating Attachment	112
Jackhammer	113
Hydraulic Hammer (Silenced)	122
Cat 426 Backhoe	107
Bobcat	107
Smooth Wheel Vibratory Roller	107
Compaction Plate	101
Front End Loader	111
Dump Truck	109
Table Top Delivery Truck	105
10 t Bogie Truck	105
Hand-held Pneumatic Fence Post Driver	100
30 t Crane	105
15 t Excavator	107
Grader	107
Air Track Drill	117
Agitator Truck	109
Concrete Pump	105
Dewatering Pump	105
Concrete Vibrator	103
Shotcrete Pump	106
Air Compressor	98
Concrete Saw	109
Bobcat with Claw Attachment	107
Generator	90
Cherry Picker/with alarm disabled	105/75
Mulching Machine	108
Super Sucker	110
Tamping Machine	114

Not all equipment listed in Table 6-5 would be used simultaneously in close proximity.

Table 6-6 shows the three noisiest activities that would be undertaken at all locations along the rail spur and loop duplication. Table 6-6 also shows typical equipment that would be used for each task, and the typical sound power level for the construction site. Construction sound level varies constantly through the work day, and the level shown is intended to represent the typical maximum noise levels that would be produced.

Table 6-6 Calculation of Total Sound Power Level

Activity	Typical Equipment Used	Total L_{Aeq} Sound Power Level used for calculations (dBA)
Site Establishment	Excavators, Chainsaws, Mulching Plant and Chipper, Cranes, Generators	112
Earthworks	4 x Road Trucks, Compactor, Grader, Vibratory Rollers, Concrete Pour, including Trucks and Concrete Vibrator, Excavator	115
Rail Construction	Tamper, 3 x Road Trucks, Crane	117

6.4.4 Impact of Construction

The construction would take place in daytime hours; that is 7.00 am to 6.00 pm Monday to Friday, and 8.00 am to 1.00 pm Saturdays.

The worst-case noise levels from construction of the rail spur are shown in Table 6-7 for the nearest receiver in Zone A (Receiver 94) and Zone G (Receiver 102). The locations of these dwellings are shown in Appendix A.

Noise was predicted using ENM, based on the rail alignment and topography used for the operational noise analysis.

Table 6-7 shows that the construction noise at Zones A and G is predicted to comply at all times.

Table 6-7 Predicted Construction Noise Levels, $L_{Aeq,15min}$ dBA

Receiver	Construction Works	Rail Spur		Criterion
		Worst-Case Distance (m)	Noise Level $L_{Aeq,15min}$ (dBA)	
94 – Antiene E Zone A	Site establishment	1100	23	42
	Earthworks	1100	26	
	Rail Construction	1100	28	
102 – East Antiene Zone G	Site establishment	1650	24	46
	Earthworks	1650	27	
	Rail Construction	1650	29	

As shown in Table 6-7, no exceedances of the construction criterion are predicted at Receivers 94 or 102. Given these two receivers are closest to the proposed construction; it can be assumed that all other receivers in Zones A and G will comply with the construction noise criteria.

6.4.5 Noise Mitigation Measures

The following mitigation measures would be implemented to manage construction noise for the Modification:

- *Noise Management Plan* – would be revised to include the Modification construction activities.
- *Operator Instruction* – Operators would be trained in order to raise their awareness of potential noise problems and to increase their use of techniques to minimise noise emission.
- *Equipment Selection* – All fixed plant at the work sites would be appropriately selected, and where necessary, fitted with silencers, acoustic enclosures and other noise–attenuation.
- *Site Noise Planning* – Where practical, the layout and positioning of noise-producing plant and activities on each work site would be optimised to minimise noise emission levels.
- An effective community relations programme would be put in place to keep the community, that has been identified as being potentially affected, appraised of progress of the works, updated and to notify potentially affected groups (e.g. by letterbox drop and meetings with surrounding tenants) of any anticipated changes in noise and vibration emissions prior to critical stages of the works, and to explain complaint procedures and response mechanisms.

7 CUMULATIVE NOISE ASSESSMENT

7.1 Industrial Noise Sources

The INP recognises that for multiple developments, a strategic approach can be implemented to ensure the amenity objectives are not compromised and an equitable share of the remaining available allocation of amenity-related noise for each industrial development is achieved. The INP's amenity criterion has been applied to all industrial noise sources by setting a cumulative $L_{Aeq,period}$ noise amenity level for all industrial noise sources. The following coal mines and industrial facilities located in the vicinity of the Mt Arthur Coal Mine were considered:

- Bengalla Mine;
- Drayton Mine;
- Mangoola Mine;
- Mount Pleasant Coal Mine; and
- South Muswellbrook Industrial Estate (the Industrial Estate).

The Industrial Estate comprises many individual businesses. They include many buildings for storage and light industry. Observations on site visits have indicated that noise from the site as a whole is not predicted to be significant during daytime and evening, and there are no major noise sources at night. For these reasons noise from the Industrial Estate has not been included in previous assessments. The Industrial Estate is still predicted to be an insignificant noise source; however, it is recommended that HVEC include the Industrial Estate as part of the monitoring program to confirm this prediction.

The potential for the simultaneous operation of adjoining mine developments to exceed the acceptable and maximum noise amenity criteria can be assessed on a worst-case scenario basis by adding the predicted (worst-case) intrusive noise levels of the surrounding mining operations and the Modification. The combined intrusive noise levels are then adjusted by subtracting 3 dB to provide an estimate of the cumulative $L_{Aeq,period}$.

The following documents have been reviewed to identify the worst-case intrusive noise levels:

Approved Projects

- *Mount Pleasant Project Modification, Noise and Vibration Assessment* (EMGA Mitchell Mclennan, 2010).
- *Drayton Extension Project – Noise and Vibration Impact Assessment* (Bridges Acoustics, 2007a).
- *Bengalla Mining Company, Wantana Extension – Acoustic Impact Statement* (Bridges Acoustics, 2007b).
- *Mangoola Mine Modifications – Noise & Vibration Assessment* (Wilkinson Murray, 2010).

Proposed Projects or Modifications:

- *Drayton South Coal Project – Acoustic Impact Assessment* (Bridges Acoustics, 2012). Currently on public exhibition.
- *Bengalla Continuation Project* – Open cut coal mining at up to 15 Mtpa ROM coal for 24 years continuing to utilise a dragline and truck/excavator fleet. DGRs have been provided.

The cumulative period noise levels have been calculated using all the best available information presented above. Bengalla Continuation Project is not considered as no available noise information exists.

The cumulative noise level was estimated for approximately 2016 as it is the year with the potential for the highest noise impact as a result of the Modification. For the other coal mines the year presented in the noise assessment closest to 2016 was used for the cumulative assessment. It should be noted that this is a conservative worst-case assessment as it assumes that all mines simultaneously emit their maximum noise levels to a common receiver locality.

The cumulative industrial noise levels are presented in Table 7-1. No privately owned residences are predicted to exceed the cumulative criterion.

7.2 Directional Noise Monitoring

HVEC operates a system of directional noise monitors (BarnOwl) as discussed in relation to background noise monitoring. The purpose of the monitors is to allow determination of which noise source, industrial or otherwise, is the predominant source at any location. If a noise exceedance is from the direction of Mt Arthur Coal Mine, operations can be assessed to determine the cause.

7.3 Amenity Assessment to Non-Residential Receivers

For non-residential noise-sensitive receivers, the INP gives recommended levels for assessment under the amenity criteria. The criteria apply at the time the receiver is “in use”.

Noise levels at non-residential receivers surrounding the Mt Arthur Coal Mine are shown in Table 7-2. Although these facilities are generally used during the daytime, conservatively noise levels have been predicted at night-time.

No noise exceedances of the amenity criteria are predicted during daytime, evening or night-time.

Table 7-1 Estimated Industrial $L_{Aeq,period}$ Noise Levels Considering Approved and Proposed Projects

Area	Period	Bengalla $L_{Aeq,15min}$	Drayton^ $L_{Aeq,15min}$	Mangoola $L_{Aeq,15min}$	Mount Pleasant $L_{Aeq,15min}$	Mt Arthur $L_{Aeq,15min}$	Total $L_{Aeq,period}$	Criterion
A	Day	<20	37	<15	<20	35	36	50
	Evening	<20	40	<15	<20	35	39	45
	Night	<20	40	<15	<20	40	40	40
B	Day	28	<25	<15	35	32	35	50
	Evening	31	<25	<15	35	32	35	45
	Night	36	<30	<15	35	37	38	40
C	Day	33	<20	<15	36	29	35	50
	Evening	33	<20	<15	36	29	36	45
	Night	38	<20	<15	37	38	40	40
D	Day	<30	<20	28	29	32	34	50
	Evening	<30	<20	29	29	32	34	45
	Night	<35	<20	30	30	38	38	40
E	Day	<25	<25	<15	32	29	32	50
	Evening	<25	<25	<15	32	29	32	45
	Night	<30	<30	<15	32	38	37	40
F	Day	<25	<20	31	26	27	31	50
	Evening	<25	<20	32	26	27	32	45
	Night	<30	<20	33	28	37	37	40
G*	Day	<20	30	<15	<20	36	34	50
	Evening	<20	32	<15	<20	36	34	45
	Night	<20	36	<15	<20	42	40	40

Area	Period	Bengalla $L_{Aeq,15min}$	Drayton $L_{Aeq,15min}$	Mangoola $L_{Aeq,15min}$	Mount Pleasant $L_{Aeq,15min}$	Mt Arthur $L_{Aeq,15min}$	Total $L_{Aeq,period}$	Criteria
H	Day	<15	30	<25	<20	22	<31	50
	Evening	<15	30	<25	<20	22	<31	45
	Night	<15	30	<25	<20	<30	<31	40

Notes: All noise levels have been estimated from other environmental assessments.
The noise levels are an average level for the area, as such higher and lower noise levels exist in the area.
Noise level based on adverse noise predictions.
* Based on receiver 100, outside of Affectation zone.
^ Includes the proposed Drayton South Coal Project.

Table 7-2 Amenity Assessment at Non-Residential Receivers

Receiver	Land Use	Criterion (when in use)		Predicted Noise Level $L_{Aeq,period}$ (Night-time – worst-case period) (dBA)
		Acceptable	Maximum	
Industrial Estate	Industrial premises	70	75	30-35
Receiver 10. Muswellbrook Race Club Ltd (Receiver Zone C)	Active recreation	55	60	38
Highbrook Park Muswellbrook	Active recreation	55	60	37
Receiver 268. Lake Liddell Recreational Park	Active recreation	55	60	44

8 RAIL NOISE

8.1 Rail Noise Impacts

From the Mt Arthur Coal rail loop the HVEC trains use the Antiene rail spur to join the Main Northern Railway to travel south-east to Newcastle.

The annual coal production rate, and therefore the average number of rail movements, would remain the same for the Modification. However, the Modification proposes to increase the maximum number of train movements per day (note that one train entering and exiting the site is classified as two train movements). An additional seven train movements per day in each direction has been assessed, in addition to existing HVEC trains (i.e. an increase in maximum daily trains from 12 to 19 trains per day).

Table 8-1 shows the existing/approved and Modification train movements on the Main Northern Railway east of the Antiene rail spur. Existing HVEC rail movements are 16% of the total current/approved 24 hour peak rail traffic on the Main North Railway. The proposed Modification contribution would be approximately 9% of existing/approved rail movements.

The EPA requirements for geographic extent of rail noise assessments for rail traffic generating development extends to where Modification rail traffic represents less than 10% of total line/corridor rail traffic. The Modification contribution is only 9% of the total traffic, so the discussion of impacts relates only to the Antiene rail spur up to the junction with the Main Northern Railway. The relative contribution of HVEC trains diminishes along the route to Newcastle.

Table 8-1 Main Northern Railway – Rail Movements

Status	Train Type	Peak Train Movements			Train Length (m)	Train Speed (kph)
		Daytime	Night-time	24 Hours		
Existing/ Approved	Passenger	8	2	10	-	-
	Freight	2	0	2	850	60
	Cotton, Grain, General Freight[4]	5.6	3.4	9	1543	60[5]
	Ulan Continued Operations	14	6	20	1543	60
	Moolarben	6	2	8	1543	60
	Wilpinjong	8	4	12	1543	60
	Mangoola	4	4	8	1543	60
	Bengalla	4	2	6	1543	60
	Mount Pleasant	4	2	6	1543	60
	Boggabri Coal Mine[4]	1.6	1	2.6	1543	60[5]
	Narrabri Coal Mine Stage 1[4]	4	0	4	1543	60[5]
	Narrabri Coal Mine Stage 2[4]	6	4	10	1543	60[5]
	Werris Creek	8	3	11	1543	60
	Muswellbrook No 2[6]	2	1	3	1543	60
	Mt Arthur[1]	15[3]	9[3]	24	1543	60
	Drayton[2]	8[3]	4[3]	12	1543	60

Status	Train Type	Peak Train Movements			Train Length (m)	Train Speed (kph)
		Daytime	Night-time	24 Hours		
	Total trains	100.2	47.4	147.6		
Proposed Mod	Mt Arthur	9[3]	5[3]	14	1543	60
	Total	109.2	52.4	161.6		

Source: SLR Consulting (2011), except where indicated below.

Notes: One movement equals one arrival or departure of a single train.

1 *Mt Arthur Coal Consolidation Project Environmental Assessment* (Hansen Bailey, 2009).

2 *Drayton Mine Extension Traffic and Transport Impact Assessment* (Hansen Bailey, 2007).

3 Assumed on a Pro-rata basis.

4 *Tarrawonga Coal Project Environmental Assessment Noise and Blasting Assessment* (Wilkinson Murray, 2011).

5 Assumed.

6 Pro-rata basis upon information from Website: http://www.idemitsu.com.au/content/cms/Overview+Ownership/434/.

Using the data from Table 8-2, it is possible to calculate the distance from the rail line at which ARTC criteria are exceeded. Calculations use measured energy average L_{Aeq} and Sound Exposure Levels from RailCorp the NSW standard rail noise database for passenger trains, locomotives and freight wagons. As an example, the following calculation includes the following assumptions:

- all trains comprising 3 x Class 90 locomotives, with a length of 1,543 m;
- speed of 60 kph;
- low audible wheel defects;
- no shielding between the rail and receivers;
- a full view of the train along its length (that is no cuttings, buildings, etc.); and
- façade correction of 2 dBA.

The speed of trains varies, and the selection of 60 kph as a typical assessment speed is based on the following observations (from *Report on ARTC Minimbah Third Track Environmental Assessment, Noise and Vibration Impact Assessment* [GHD, 2008]):

- Laden trains' speed varies from 20 kph to 80 kph.
- Unladen trains generally travel at 80 kph on the downside line, but were generally quieter than laden trains.

As the following assessment relies on relative difference between current and proposed rail flows, changes in speed do not change the conclusions.

The increase in noise levels due to the extra trains associated with the proposal is 0.4 dBA (daytime and night-time), which is below the relevant threshold described in the EPA requirements for Project-related rail noise increases.

Distances at which the ARTC and EPA criteria are exceeded for on the Main Northern Railway east of the rail spur to Mt Arthur Coal Mine and Drayton Mine are illustrated in Table 8-2.

Table 8-2 Criteria Offset Distances: Train Movements along the Antiene Rail Spur

Period	Criterion (dBA)	Existing/Approved Movements	Existing/Approved, plus Proposed Modification
		Distance from Track (m)	Distance from Track (m)
$L_{Aeq,Day}$ (7.00 am-10.00 pm)	65	<54	<56
$L_{Aeq,Night}$ (10.00 pm-7.00 am)	60	<65	<68
$L_{Aeq,24\ hour}$ (24 hour)	60	<90	<93
$L_{Amax,Passby\ Noise}$ (24 hours)	85	<30	<30

Table 8-2 shows that for the Main Northern Railway east of Mt Arthur Coal Mine:

- The maximum increase in distance from the track to meet the ARTC criteria as a result of the Modification rail movements, compared with the existing/approved plus proposed movements, is 2 m for daytime operations and 3 m for operations at night.
- The maximum increase in distance from the track to meet the EPA criteria as a result of the Modification rail movements, compared with the existing/approved plus proposed movements, is 3 m for 24 hour operations.
- Maximum passby noise would continue to comply at less than 30 m for the Modification.

8.2 Conclusion

It is concluded from the rail noise assessment presented above that the Modification rail movements would result in a negligible increase in noise along the Main Northern Railway, with any increase in rail noise being less than 0.5 dBA (which is the relevant threshold in the EPA's *Environmental assessment requirements for rail traffic-generating developments* (EPA, 2012).

The buffer distance from the rail line at which the relevant ARTC and EPA criteria would be met would extend away from the rail line by a maximum of a negligible 3 m due to the Modification. In addition, L_{Amax} passby noise levels would continue to comply at less than 30 m for the Modification.

9 ROAD NOISE

Traffic movements, including employee and heavy vehicles, associated with the Mt Arthur Coal Mine would not change for the Modification. However, as part of the Modification, HVEC proposes to access the relocated explosives facility from Edderton Road. This would lead to a change in the distribution of traffic on the local roads, as some traffic which currently accesses the site from Thomas Mitchell Drive would access the explosives facility from Edderton Road.

This change in traffic distribution would lead to an increase in traffic movements along Denman Road, between Thomas Mitchell Drive and Edderton Road, and Edderton Road itself, which may lead to an increase in road traffic noise along these roads. However, it is noted that there are no private receivers along these roads, with the majority of land in the vicinity owned by HVEC and the southern end of Edderton Road owned by Anglo Coal (owners of the Drayton Mine). Therefore, it follows that impacts on private receivers would be negligible.

10 BLASTING

10.1 Background to the Study

The assessment of blasting follows from the analysis of the Consolidation Project Noise and Blasting Assessment. Blast Control Areas (e.g. areas where the MIC of a blast is reduced) were proposed at the north and west of the site as shown on Figure 10-1.

10.2 Prediction of Overpressure and Vibration Levels

The methodology used to predict airblast overpressure and ground vibration levels from blasting is the same used for the Consolidation Project Noise and Blasting Assessment.

10.3 Blast Designs

Blast designs in the proposed mining area would depend on numerous factors including the depth of coal seams and design of benches. Consistent with the Consolidation Project Noise and Blasting Assessment, three typical blast designs have been provided, with differing values of MIC as follows:

- Deep Interburden/Overburden: MIC 1681 kilogram (kg);
- Intermediate Interburden: MIC 812 kg; and
- Shallow Interburden: MIC 182 kg.

It is assumed that any of these three general blast types may be required at any location, and hence potential impacts should be assessed using the Deep Interburden/Overburden blast, representing the maximum impact. However, both Deep and Intermediate Interburden blasts are considered in order to indicate the range of impacts that may occur.

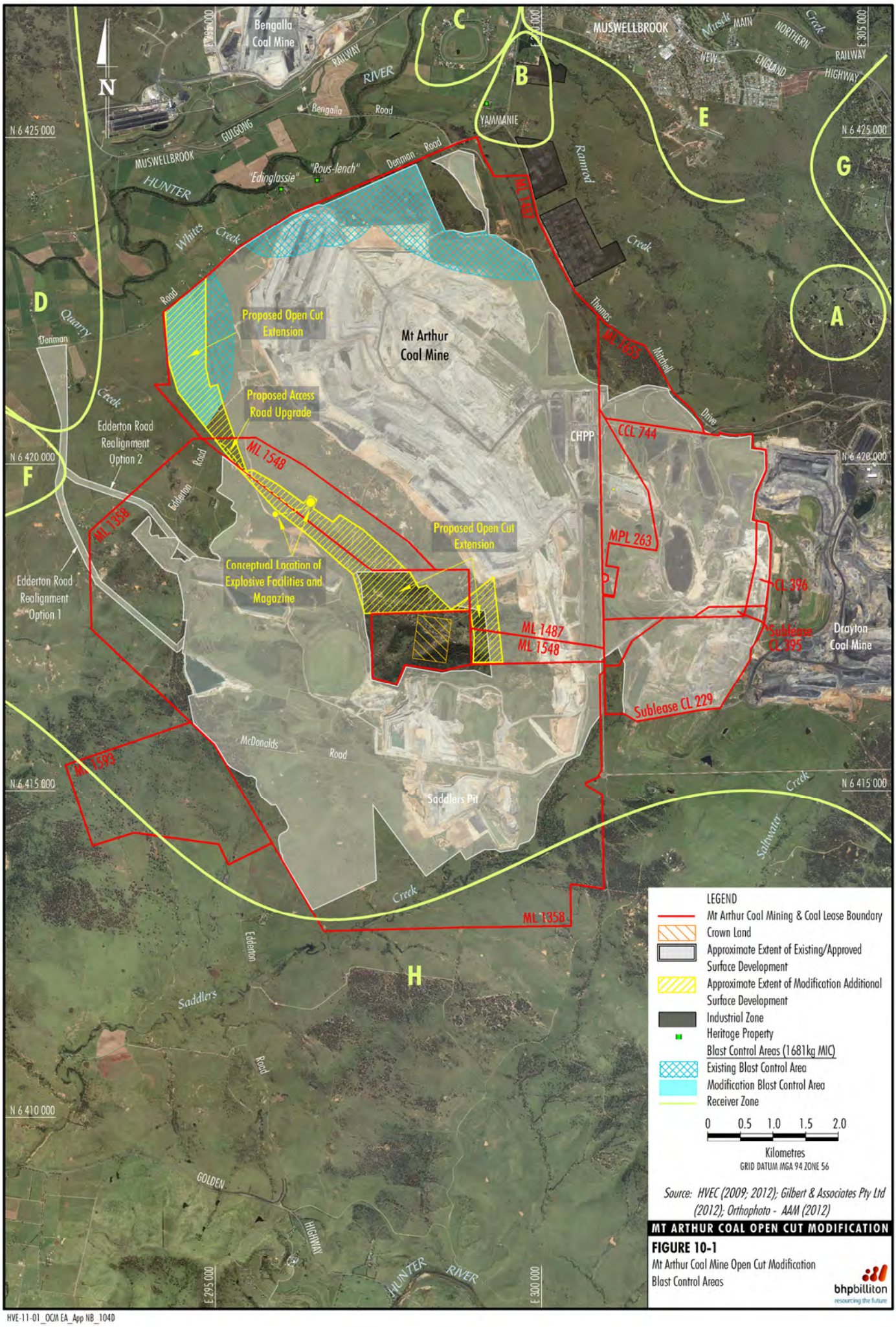
10.4 Predicted Residential Overpressure and Vibration Levels

Two Blast Control Areas were defined in the Consolidation Project Noise and Blasting Assessment where HVEC is required to manage blasts (Figure 10-1). For the Modification an assessment of blasting in the additional open cut pit areas has been undertaken. The predictions of blast overpressure and vibration indicate that the western Blast Control Area must be extended to satisfy the relevant criteria as shown on Figure 10-1.

10.5 Potential Flyrock Impacts

Consistent with the advice of both the NSW Division of Resources and Energy (within the NSW Department of Trade and Investment, Regional Infrastructure and Services) and the *Road Closure Management Plan* (HVEC, 2012c), the section of Denman Road within 500 m of blasting activities would be closed and public access restricted during blasting events by use of road closure signs and sentries at either end of the roadway.

All land within 500 m of proposed open cut areas is owned by HVEC (other than Denman Road). HVEC would employ measures to minimise livestock grazing on HVEC-owned land within 500 m of a blast event. No heritage items of high significance are within 500 m of a proposed open cut (Appendix A).



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10.6 Blast Management

Electronic detonators were introduced on site for vibration management in August 2010. Electronic detonators improve blast initiation sequence by accurately controlling timing delays of blasts, increase rock fragmentation, lower vibration levels and decrease the potential of flyrock.

The initial electronic shot reduced the vibration at the Edinglassie Homestead by 50% on standard initiating explosives. Continued refinement of the electronic techniques in this area resulted in five blasts where vibration at the homestead was managed without the need to reduce the size of the area blasted (shot size).

HVEC would continue to implement management and mitigation measures for the Blast Control Areas described in Section 10.4.

11 CONCLUSION

The conclusions from this assessment of noise and blasting impacts resulting from the proposed Modification are summarised below.

11.1 Intrusive Noise Impact

HVEC proposes to implement management and mitigation measures to appreciably reduce noise emissions associated with the Modification, including:

- procurement of noise-attenuated vehicles for critical haul routes;
- dumping of overburden in less noise-sensitive locations during night-time, then using daytime dumping to increase barrier heights in the vicinity of the night-time dumping locations; and
- use of bulldozers on overburden in less noise-sensitive locations in conjunction with the revised dumping locations during night-time.

Operational noise impacts were assessed for three years (Years 2016, 2022 and 2026), under night-time inversion conditions. Noise impacts of the Modification were compared to the Consolidation Project and Project-specific criteria. Changes in predicted noise exceedances relative to the Consolidation Project are detailed below:

- One new noise management zone exceedance (Receiver 43).
- Two existing noise management zone exceedances (Receivers 210 and 211) have moved into the noise affectation zone.
- One existing noise affectation exceedance (Receiver 101) has moved into the noise management zone.

11.2 Meteorological Forecasting System

A predictive meteorological forecasting system would be implemented in accordance with Condition 8(b) of Schedule 3 of PA 06_0092. This system would work in conjunction with the real-time monitoring and management system, providing an alert for the appropriate personnel to review the real-time data. This would allow for proactive management measures to be invoked, including increasing controls or limiting activity in various areas of the site to reduce noise emissions.

11.3 Vacant Land Impact

Intrusive noise impacts on vacant land areas have been assessed on a “case by case” basis for the Modification. No exceedances of the intrusive $L_{Aeq,15\ min}$ noise level are predicted for more than 25% of any privately owned property.

11.4 Construction Noise Impact

Assessment of the potential for noise impacts from construction associated with the duplication of the rail loop and rail spur for receivers in Zones A and G indicates that no receiver would exceed the construction noise criteria.

Notwithstanding the above, HVEC would implement the following mitigation measures to manage construction noise for the Modification:

- *Noise Management Plan* – This plan would be revised to include the Modification.
- *Operator Instruction* – Operators would be trained in order to raise their awareness of potential noise problems and to increase their use of techniques to minimise noise emission.
- *Equipment Selection* – All fixed plant at the work sites would be appropriately selected, and where necessary, fitted with silencers, acoustic enclosures and other noise-attenuation.
- *Site Noise Planning* – Where practical, the layout and positioning of noise-producing plant and activities on each work site would be optimised to minimise noise emission levels.
- An effective community relations programme would be put in place to keep the community, that has been identified as being potentially affected, appraised of progress of the works, updated and to notify potentially affected groups (e.g. by letterbox drop and meetings with surrounding tenants) of any anticipated changes in noise and vibration emissions prior to critical stages of the works, and to explain complaint procedures and response mechanisms.

11.5 Cumulative Noise Impact

Cumulative noise impacts resulting from the concurrent operation of the Modification, Bengalla Mine, Drayton Mine, Mangoola Mine and Mount Pleasant Coal Mine were assessed against the INP recommended acceptable and recommended maximum amenity criteria.

The assessment indicates that cumulative noise levels resulting from the concurrent operation of the Modification and surrounding mines would comply with the night-time recommended maximum amenity criterion (RBL plus 15 dBA) and recommended acceptable amenity criterion (RBL plus 10 dBA) at all privately owned receivers.

Notwithstanding the above, it is recommended that the BarnOwl at the corner of Denman Road and Thomas Mitchell Drive include the Industrial Estate as a noise source to confirm that monitored noise levels are consistent with predictions.

Continued monitoring is recommended to assess the ongoing contribution of HVEC operations to the overall noise environment.

11.6 Rail Noise Impact

The maximum coal production rate, and therefore the average number of rail movements, will remain the same for the Modification. However, an increase in maximum daily trains from 12 to 19 trains per day in each direction is required for the Modification.

There will be a negligible increase in noise along the Main Northern Railway, with an increase in L_{Aeq} rail noise predicted to be 0.4 dBA (which is lower than the relevant threshold in the OEH rail noise assessment requirements for Project-related rail noise increases). The predicted $L_{Aeq,max}$ would remain unchanged for the Modification. The buffer distance from the rail line at which the relevant ARTC and OEH criteria would be met would extend away from the rail line by 2 m during the day and 3 m during the night due to the Modification. In addition, predicted L_{Amax} passby noise levels would not change due to the Modification.

Rail noise impacts along the Northern Railway are considered negligible.

11.7 Blasting Vibration and Overpressure

The western Blast Control Area identified in the Consolidation Project Noise and Blasting Assessment would need to be extended as open cut operations advance to the west as shown on Figure 10-1. Consistent with current practices at the Mt Arthur Coal Mine, blasts vibration and overpressure would be managed by a reduction in the MIC.

Sections of Denman Road that are within 500 m of a proposed open cut area would be closed during blasts. HVEC would employ measures to manage livestock grazing on HVEC-owned land within 500 m of a blast event. No heritage items of high significance are within 500 m of a proposed open cut.

12 REFERENCES

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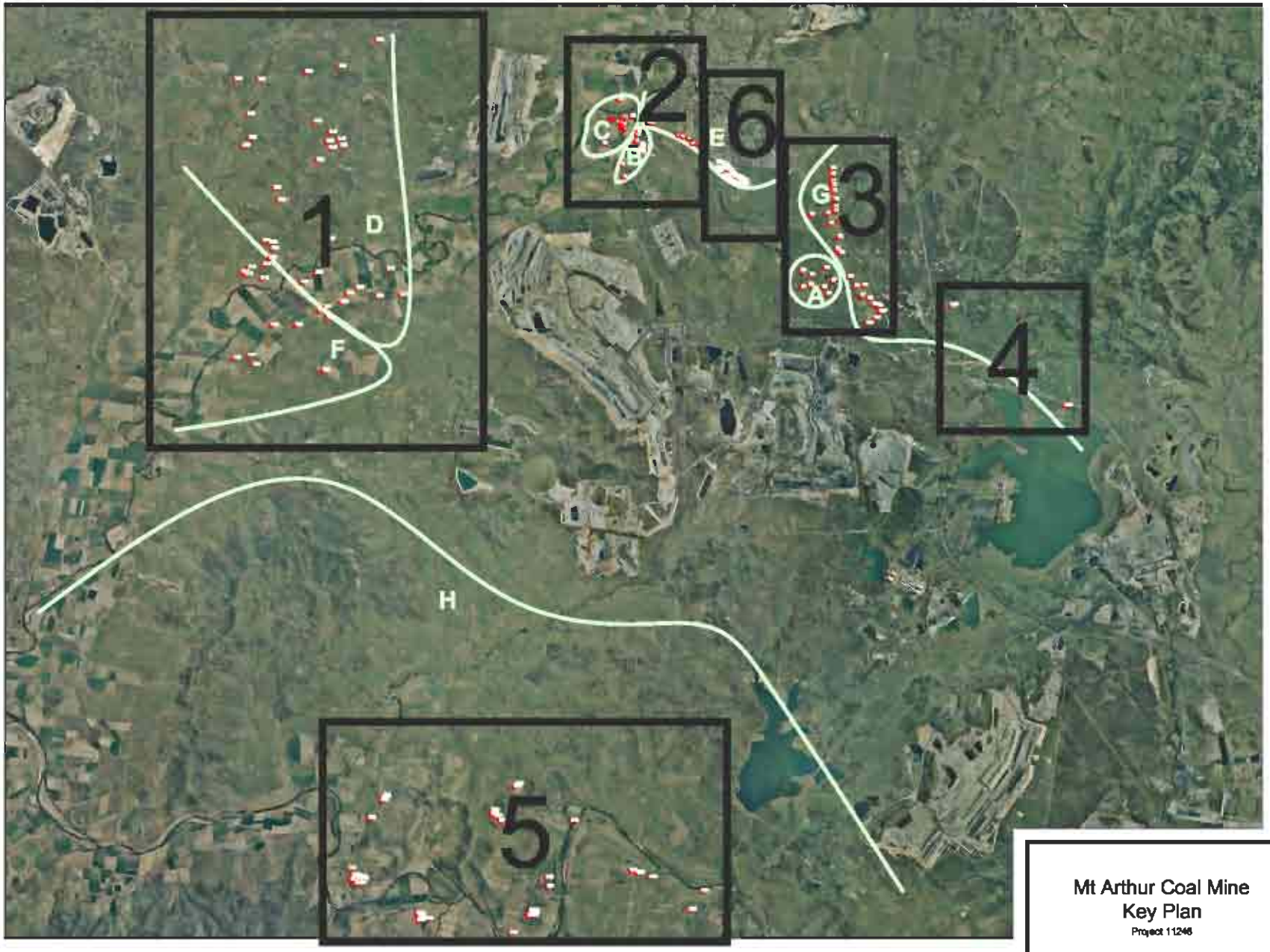
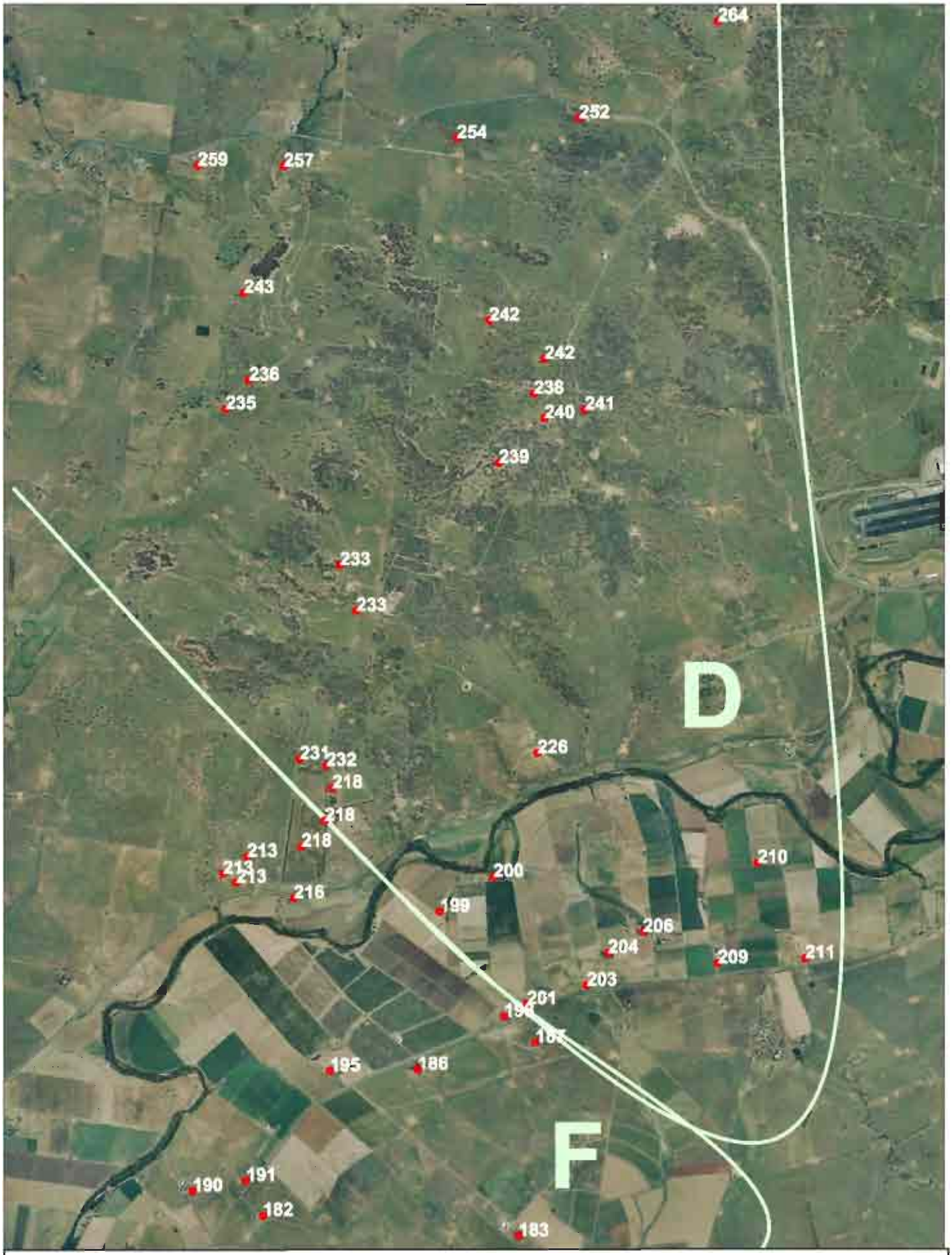
APPENDIX A

RECEIVER NUMBERS



Mt Arthur Coal Mine
Key Plan
Project 11246



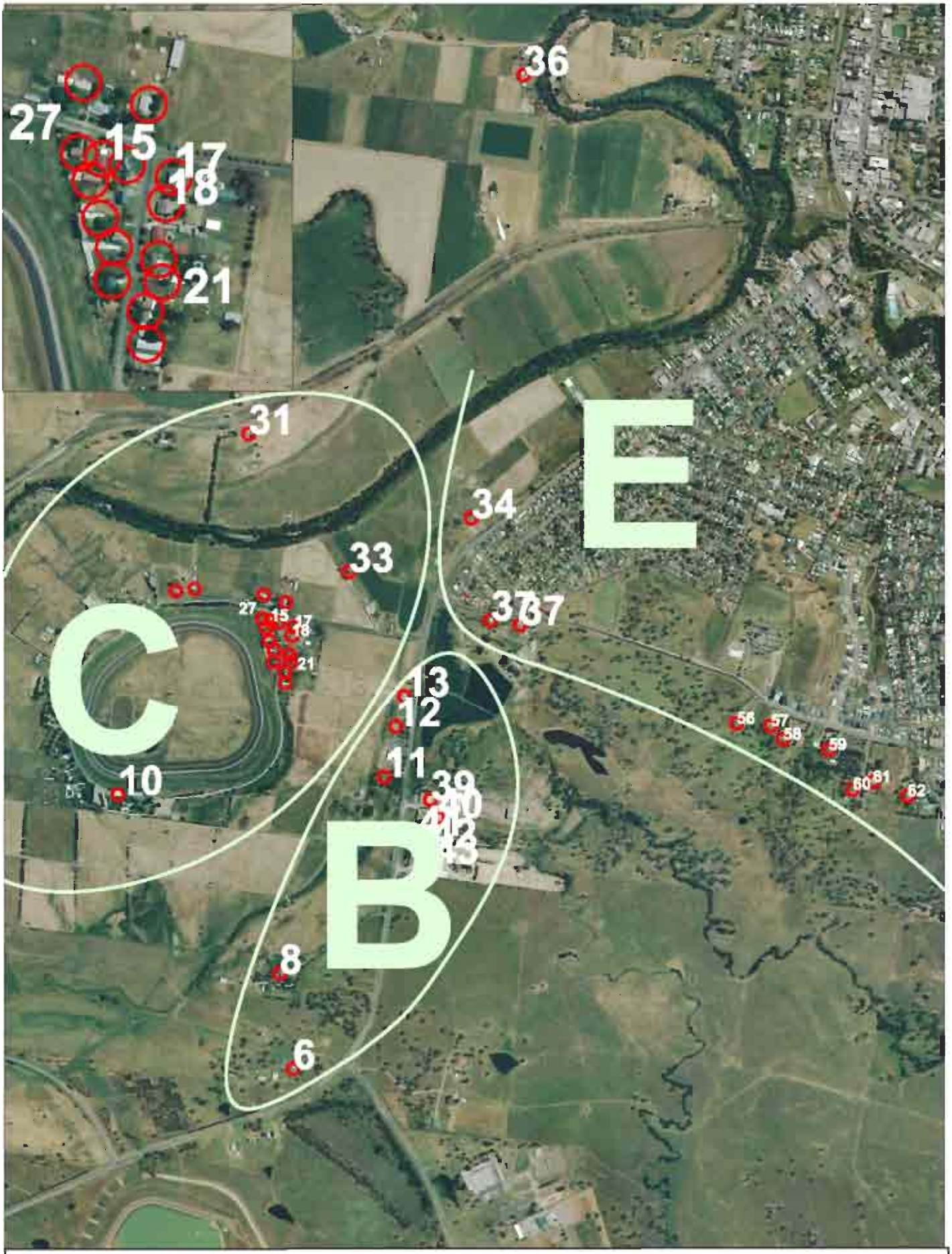
Mt Arthur Coal Mine

○ Receiver

Receiver Locations

N

Project 11246



Mt Arthur Coal Mine

Receiver Locations

○ Receiver

N

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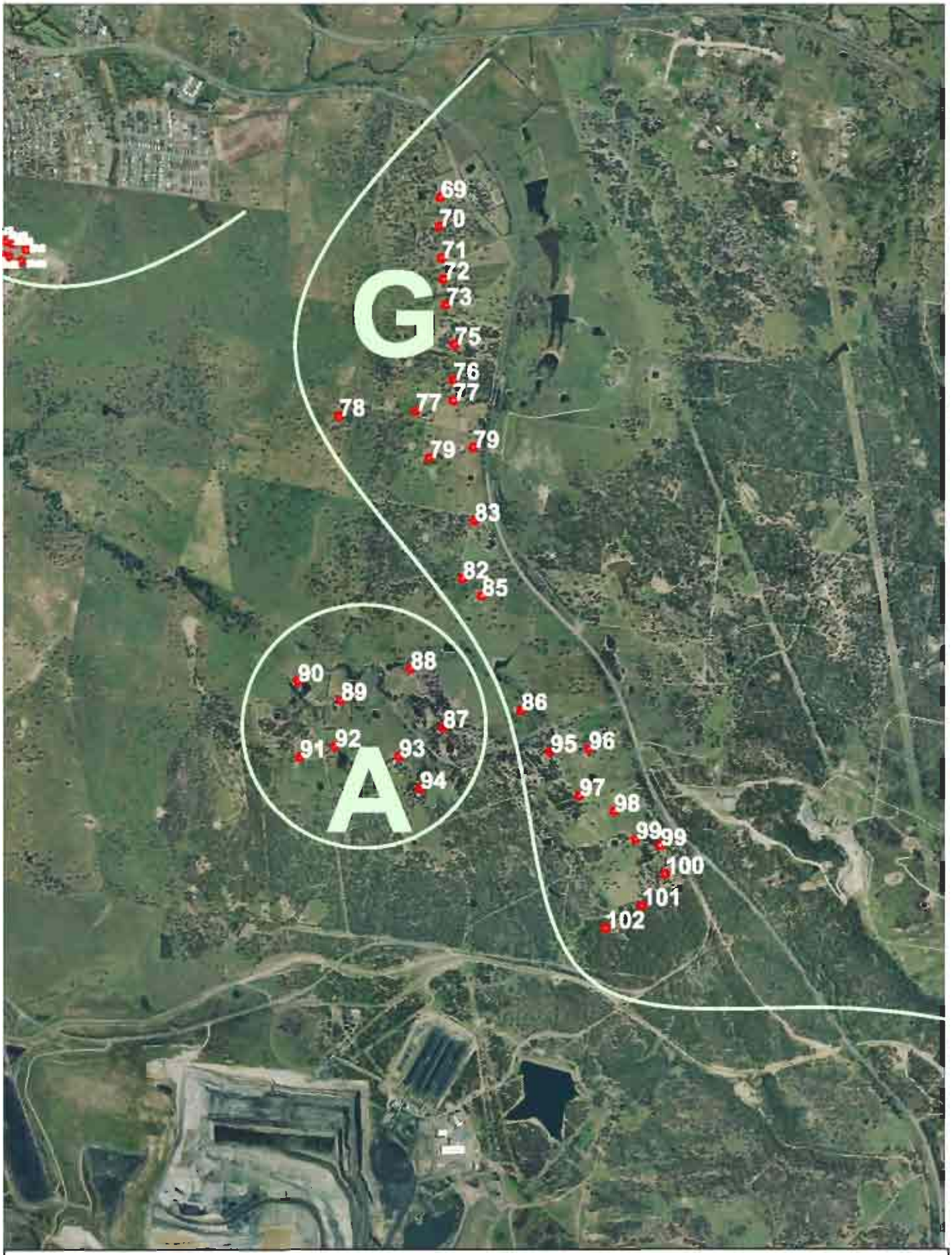

Mt Arthur Coal Mine

○ Receiver

Receiver Locations

N

Project 11246

Mt Arthur North

Receiver Locations

○ Receiver

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Project 11246

Mt Arthur Coal Mine

Receiver Locations

○ Receiver

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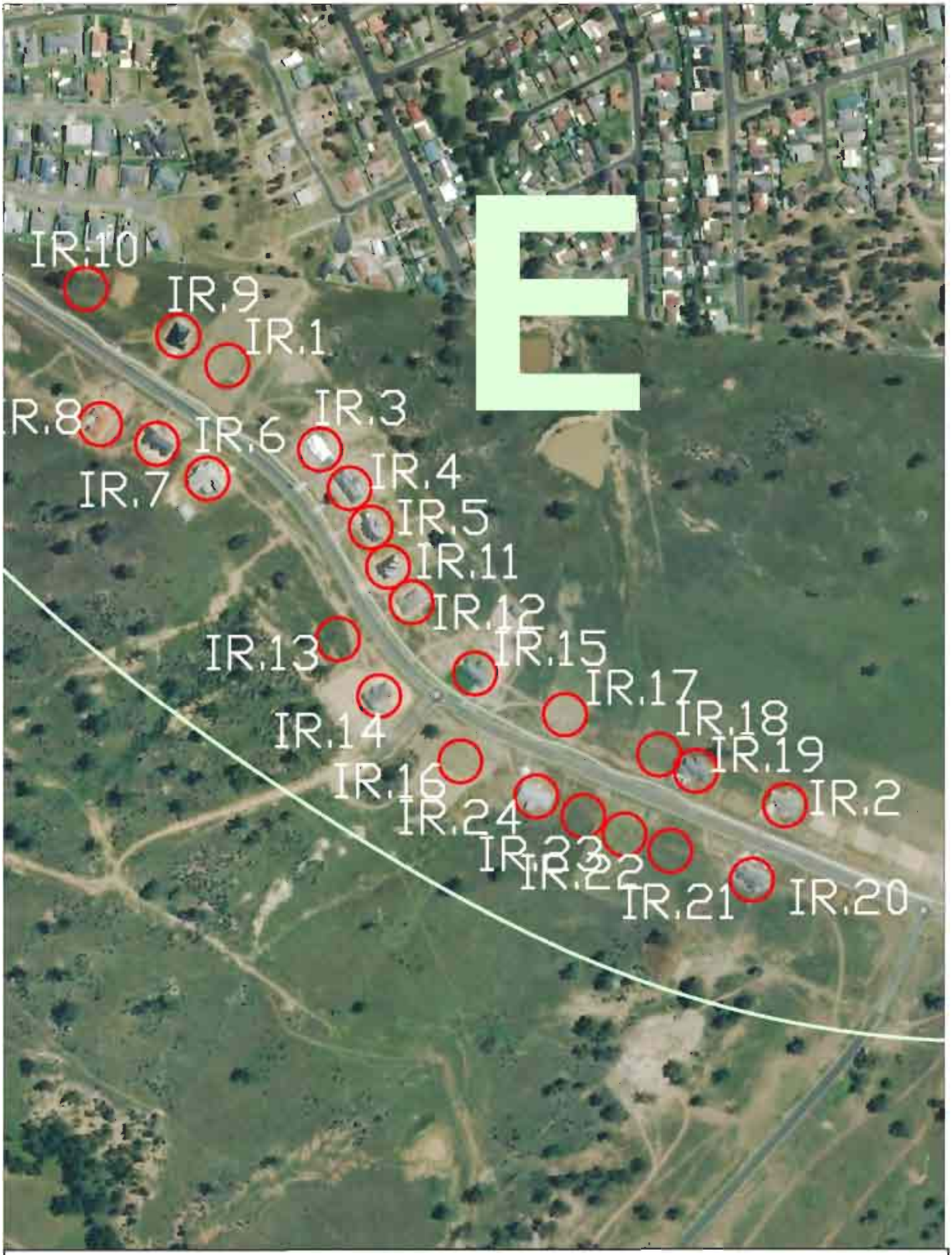
Project 11246



Mt Arthur Coal Mine
Receiver Locations

○ Receiver

N

Project 11246

APPENDIX B

PREDICTED NOISE LEVELS – DAYTIME

EA Receiver Number	Label	Receiver Zone	Criterion (Day)	Predicted Noise Level 2016	Predicted Noise Level 2022	Predicted Noise Level 2026	Exceedance 2016	Exceedance 2022	Exceedance 2026
6	Scriven	B	39	32	27	28	0	0	0
8	Drake	B	39	31	27	27	0	0	0
11	JP Drake	B	39	29	25	25	0	0	0
12	DR & CJ Tubb	B	39	29	25	25	0	0	0
13	Upper Hunter Developers Pty Ltd & Turner	B	39	29	25	24	0	0	0
14	Robinson	C	41	29	26	24	0	0	0
15	Dobie	C	41	29	26	24	0	0	0
16	Sweeney	C	41	28	26	24	0	0	0
17	Gleeson & Cranfield	C	41	28	26	24	0	0	0
18	SM Bredden	C	41	29	26	24	0	0	0
20	Good	C	41	29	26	24	0	0	0
21	Cridland	C	41	29	26	24	0	0	0
22	Englebrecht Racing Stables Pty Ltd	C	41	29	26	24	0	0	0
23	Englebrecht	C	41	29	26	24	0	0	0
24	RJ & TT Reid	C	41	29	26	24	0	0	0
25	Andrews	C	41	29	26	24	0	0	0
26	Byrnes & Moller	C	41	29	26	24	0	0	0
27	TD Barron	C	41	29	26	24	0	0	0
28	McGoldrick	C	41	29	27	24	0	0	0
29	Berrnett	C	41	29	26	24	0	0	0
30	Englebrech	C	41	28	26	24	0	0	0
31	Jabetin PT	C	41	28	25	23	0	0	0
32	Almond & Hume	C	41	28	26	24	0	0	0
33	Barkley	C	41	28	25	23	0	0	0
34	Hardes	E	39	28	25	23	0	0	0
36	Horne	B	39	25	22	20	0	0	0
37	The Council of the Municipality of Muswe	E	39	29	25	23	0	0	0
37	The Council of the Municipailty of Muswe	E	39	29	25	23	0	0	0
39	JR & JA Buckley	B	39	29	25	24	0	0	0
40	JR & JA Buckley	B	39	29	25	25	0	0	0
41	Ray	B	39	30	25	25	0	0	0
42	Hallett & Campbell	B	39	30	25	25	0	0	0
43	Hallett & Campbell	B	39	30	26	25	0	0	0
56	Bancroft	E	39	29	24	23	0	0	0
57	Mayer	E	39	29	24	23	0	0	0
58	Masters	E	39	29	24	23	0	0	0
59	Osborn	E	39	29	24	23	0	0	0
60	Osborn	E	39	29	24	23	0	0	0
61	Burton	E	39	29	24	23	0	0	0
62	Burke & Talbot	E	39	29	24	23	0	0	0
69	Wells	G	41	24	21	18	0	0	0
70	Folpp	G	41	25	21	19	0	0	0
71	Hunt	G	41	24	21	19	0	0	0
72	Budden	G	41	23	21	19	0	0	0
73	Hogan	G	41	23	21	19	0	0	0
75	Harris	G	41	23	22	20	0	0	0
76	Merlaust Pty Ltd	G	41	23	22	20	0	0	0
77	Perram	G	41	22	21	20	0	0	0
77	Perram	G	41	22	21	20	0	0	0
78	Yarramolong Stud Pty Ltd	G	41	27	25	22	0	0	0
79	Jackson	G	41	22	22	21	0	0	0
79	Jackson	G	41	22	22	21	0	0	0
82	Newton	G	41	27	26	25	0	0	0
83	K Newton	G	41	24	23	23	0	0	0
85	Collins	G	41	28	26	25	0	0	0
86	Baxter	G	41	31	30	30	0	0	0
87	Halloran	A	37	31	31	31	0	0	0
88	Reynolds	A	37	29	28	28	0	0	0
89	Page	A	37	29	28	28	0	0	0
90	Page	A	37	27	26	25	0	0	0
91	Doherty	A	37	30	30	30	0	0	0
92	Duck	A	37	31	30	30	0	0	0
93	Osborn	A	37	32	32	32	0	0	0
94	Skinner	A	37	35	34	34	0	0	0
95	De Boer	G	41	33	32	32	0	0	0
96	Bird	G	41	32	32	31	0	0	0
97	Clifton	G	41	35	34	34	0	0	0
98	Jones	G	41	35	35	35	0	0	0
99	Hunter	G	41	35	35	35	0	0	0

EA Receiver Number	Label	Receiver Zone	Criterion (Day)	Predicted Noise Level 2016	Predicted Noise Level 2022	Predicted Noise Level 2026	Exceedance 2016	Exceedance 2022	Exceedance 2026
99	Hunter	G	41	33	33	33	0	0	0
100	Sharman	G	41	36	36	36	0	0	0
101	Horder	G	41	40	40	40	0	0	0
102	Robertson	G	41	44	44	44	3	3	3
182	Paulsen	F	37	23	23	16	0	0	0
186	Turner	F	37	25	24	17	0	0	0
187	Duncan	F	37	27	27	20	0	0	0
190	Phillips	F	37	23	23	16	0	0	0
191	Wilks	F	37	22	22	14	0	0	0
195	MacPherson	F	37	24	24	16	0	0	0
198	Duncan	F	37	25	25	19	0	0	0
200	Walsh	D	37	27	27	21	0	0	0
201	Denton	D	37	26	27	20	0	0	0
203	Latham	D	37	27	28	22	0	0	0
204	Latham	D	37	28	29	22	0	0	0
206	Wild	D	37	29	30	23	0	0	0
209	Rankin	D	37	29	30	24	0	0	0
210	Rankin	D	37	32	33	27	0	0	0
211	Rankin	D	37	31	31	26	0	0	0
213	Lawson	F	37	24	19	17	0	0	0
213	Lawson	F	37	24	15	18	0	0	0
213	Lawson	F	37	23	15	15	0	0	0
216	Meyer	F	37	25	17	18	0	0	0
218	Markham	F	37	26	34	20	0	0	0
218	Markham	D	37	27	23	20	0	0	0
218	Markham	F	37	26	24	19	0	0	0
226	T Roots	D	37	29	23	23	0	0	0
231	Brown	D	37	26	24	19	0	0	0
232	Brown	D	37	27	26	20	0	0	0
233	Merrick	D	37	22	27	17	0	0	0
233	Merrick	D	37	23	26	17	0	0	0
235	Thompson	D	37	16	29	11	0	0	0
236	Thompson	D	37	17	26	11	0	0	0
238	M Peel	D	37	26	27	20	0	0	0
239	P Ellis	D	37	27	21	21	0	0	0
240	Murray	D	37	25	23	19	0	0	0
241	P & C Lane	D	37	26	15	20	0	0	0
242	Ellis	D	37	26	16	19	0	0	0
242	Ellis	D	37	21	26	15	0	0	0
243	McNeill	D	37	17	24	11	0	0	0
252	B & T Strachan	D	37	21	25	16	0	0	0
254	Hughes	D	37	16	20	12	0	0	0
257	Parkinson	D	37	16	26	11	0	0	0
259	Googe	D	37	18	16	12	0	0	0
264	J Moore	D	37	16	20	12	0	0	0
265	Ray	G	41	19	19	19	0	0	0
IR.1	Ironbark Ridge	E	39	28	25	23	0	0	0
IR.2	Ironbark Ridge	E	39	28	25	23	0	0	0
IR.3	Ironbark Ridge	E	39	25	24	22	0	0	0
IR.4	Ironbark Ridge	E	39	28	25	23	0	0	0
IR.5	Ironbark Ridge	E	39	28	25	23	0	0	0
IR.6	Ironbark Ridge	E	39	28	25	23	0	0	0
IR.7	Ironbark Ridge	E	39	29	26	24	0	0	0
IR.8	Ironbark Ridge	E	39	29	26	23	0	0	0
IR.9	Ironbark Ridge	E	39	29	26	23	0	0	0
IR.10	Ironbark Ridge	E	39	28	25	23	0	0	0
IR.11	Ironbark Ridge	E	39	28	25	23	0	0	0
IR.12	Ironbark Ridge	E	39	28	25	23	0	0	0
IR.13	Ironbark Ridge	E	39	28	25	23	0	0	0
IR.14	Ironbark Ridge	E	39	28	25	23	0	0	0
IR.15	Ironbark Ridge	E	39	28	25	23	0	0	0
IR.16	Ironbark Ridge	E	39	28	26	23	0	0	0
IR.17	Ironbark Ridge	E	39	28	25	22	0	0	0
IR.18	Ironbark Ridge	E	39	28	25	23	0	0	0
IR.19	Ironbark Ridge	E	39	28	25	23	0	0	0
IR.20	Ironbark Ridge	E	39	28	25	23	0	0	0
IR.21	Ironbark Ridge	E	39	28	25	23	0	0	0
IR.22	Ironbark Ridge	E	39	28	25	23	0	0	0
IR.23	Ironbark Ridge	E	39	28	25	23	0	0	0
IR.24	Ironbark Ridge	E	39	28	25	22	0	0	0
10	Muswellbrook Race Club Ltd^	C	55	30	29	26	0	0	0
268	Lake Liddell Recreational Park^	G	55	39	39	39	0	0	0
9	Englebrecht*	C	41	30	29	27	*0*	*0*	*0*

EA Receiver Number	Label	Receiver Zone	Criterion (Day)	Predicted Noise Level 2016	Predicted Noise Level 2022	Predicted Noise Level 2026	Exceedance 2016	Exceedance 2022	Exceedance 2026
49	Webber*	B	39	32	27	25	*0*	*0*	*0*
49	Webber*	B	39	32	27	25	*0*	*0*	*0*
183	Beringer Blass Wine*	F	37	26	26	18	*0*	*0*	*0*
184	Fosters Wine*	F	37	29	29	23	*0*	*0*	*0*
184	Fosters Wine*	F	37	28	29	22	*0*	*0*	*0*
184	Fosters Wine*	F	37	28	29	22	*0*	*0*	*0*
196	Eglington, Fuller & Goodchild*	F	37	24	24	17	*0*	*0*	*0*
197	Eglington, Fuller & Goodchild*	F	37	25	25	18	*0*	*0*	*0*
199	Boyle*	D	37	26	27	20	*0*	*0*	*0*
202	Fosters Wine*	D	37	28	28	21	*0*	*0*	*0*
205	Lambkin*	D	37	28	29	22	*0*	*0*	*0*
207	Zahra*	D	37	29	30	23	*0*	*0*	*0*
208	Zahra*	D	37	30	30	24	*0*	*0*	*0*
212	Chudyk*	D	37	32	25	28	*0*	*0*	*0*
250	Hamilton*	D	37	26	25	20	*0*	*0*	*0*

^ Non-residential receivers

* These receivers acquired by Mine-Owned Company since 2009 EA

APPENDIX C

PREDICTED NOISE LEVELS – NIGHT-TIME

EA Receiver Number	Label	Receiver Zone	Criterion (Night)	Predicted Noise Level 2016	Predicted Noise Level 2022	Predicted Noise Level 2026	Exceedance 2016	Exceedance 2022	Exceedance 2026
6	Scriven	B	37	39	37	38	2	0	1
8	Drake	B	37	38	37	38	1	0	1
11	JP Drake	B	37	38	37	37	1	0	0
12	DR & CJ Tubb	B	37	37	37	37	0	0	0
13	Upper Hunter Developers Pty Ltd & Turner	B	37	37	37	37	0	0	0
14	Robinson	C	39	38	38	37	0	0	0
15	Dobie	C	39	38	38	37	0	0	0
16	Sweeney	C	39	38	38	37	0	0	0
17	Gleeson & Cranfield	C	39	38	38	37	0	0	0
18	SM Bredden	C	39	38	38	37	0	0	0
20	Good	C	39	38	38	37	0	0	0
21	Cridland	C	39	38	38	37	0	0	0
22	Englebrecht Racing Stables Pty Ltd	C	39	38	38	37	0	0	0
23	Englebrecht	C	39	38	38	37	0	0	0
24	RJ & TT Reid	C	39	38	38	37	0	0	0
25	Andrews	C	39	38	38	37	0	0	0
26	Byrnes & Moller	C	39	38	38	37	0	0	0
27	TD Barron	C	39	38	38	37	0	0	0
28	McGoldrick	C	39	39	38	38	0	0	0
29	Berrnett	C	39	39	38	37	0	0	0
30	Englebrech	C	39	38	38	37	0	0	0
31	Jabetin PT	C	39	38	37	37	0	0	0
32	Almond & Hume	C	39	38	38	37	0	0	0
33	Barkley	C	39	38	38	37	0	0	0
34	Hardes	E	39	37	36	36	0	0	0
36	Horne	B	37	36	35	35	0	0	0
37	The Council of the Municipality of Muswe	E	39	38	37	37	0	0	0
37	The Council of the Municipailty of Muswe	E	39	37	37	36	0	0	0
39	JR & JA Buckley	B	37	37	36	36	0	0	0
40	JR & JA Buckley	B	37	38	36	37	1	0	0
41	Ray	B	37	38	36	37	1	0	0
42	Hallett & Campbell	B	37	37	36	36	0	0	0
43	Hallett & Campbell	B	37	38	36	37	1	0	0
56	Bancroft	E	39	38	36	37	0	0	0
57	Mayer	E	39	38	36	36	0	0	0
58	Masters	E	39	38	36	37	0	0	0
59	Osborn	E	39	38	36	36	0	0	0
60	Osborn	E	39	38	36	36	0	0	0
61	Burton	E	39	38	36	36	0	0	0
62	Burke & Talbot	E	39	38	36	36	0	0	0
69	Wells	G	39	33	31	33	0	0	0
70	Folpp	G	39	33	32	32	0	0	0
71	Hunt	G	39	32	31	32	0	0	0
72	Budden	G	39	31	32	31	0	0	0
73	Hogan	G	39	30	28	30	0	0	0
75	Harris	G	39	30	29	30	0	0	0
76	Merlaust Pty Ltd	G	39	30	28	29	0	0	0
77	Perram	G	39	29	28	28	0	0	0
77	Perram	G	39	30	29	29	0	0	0
78	Yarramolong Stud Pty Ltd	G	39	38	37	37	0	0	0
79	Jackson	G	39	30	29	29	0	0	0
79	Jackson	G	39	30	29	29	0	0	0
82	Newton	G	39	36	36	37	0	0	0
83	K Newton	G	39	32	32	32	0	0	0
85	Collins	G	39	37	36	37	0	0	0
86	Baxter	G	39	38	38	39	0	0	0
87	Halloran	A	38	39	38	38	1	0	0
88	Reynolds	A	38	38	37	38	0	0	0
89	Page	A	38	36	36	36	0	0	0
90	Page	A	38	34	33	34	0	0	0
91	Doherty	A	38	38	37	37	0	0	0
92	Duck	A	38	38	38	38	0	0	0
93	Osborn	A	38	39	39	39	1	1	1
94	Skinner	A	38	41	41	41	3	3	3
95	De Boer	G	39	40	39	40	1	0	1
96	Bird	G	39	39	39	39	0	0	0
97	Clifton	G	39	41	41	41	2	2	2
98	Jones	G	39	41	41	41	2	2	2
99	Hunter	G	39	41	41	41	2	2	2

EA Receiver Number	Label	Receiver Zone	Criterion (Night)	Predicted Noise Level 2016	Predicted Noise Level 2022	Predicted Noise Level 2026	Exceedance 2016	Exceedance 2022	Exceedance 2026
99	Hunter	G	39	41	41	41	2	2	2
100	Sharman	G	39	42	42	42	3	3	3
101	Horder	G	39	44	44	44	5	5	5
102	Robertson	G	39	48	48	48	9	9	9
182	Paulsen	F	35	31	33	32	0	0	0
186	Turner	F	35	34	34	34	0	0	0
187	Duncan	F	35	37	36	37	2	1	2
190	Phillips	F	35	32	32	33	0	0	0
191	Wilks	F	35	30	31	31	0	0	0
195	MacPherson	F	35	33	33	33	0	0	0
198	Duncan	F	35	34	33	34	0	0	0
200	Walsh	D	35	36	36	36	1	1	1
201	Denton	D	35	34	34	34	0	0	0
203	Latham	D	35	37	35	36	2	0	1
204	Latham	D	35	37	37	38	2	2	3
206	Wild	D	35	38	39	38	3	4	3
209	Rankin	D	35	38	39	38	3	4	3
210	Rankin	D	35	42	41	41	7	6	6
211	Rankin	D	35	40	42	41	5	7	6
213	Lawson	F	35	34	33	34	0	0	0
213	Lawson	F	35	34	33	34	0	0	0
213	Lawson	F	35	31	30	31	0	0	0
216	Meyer	F	35	34	33	34	0	0	0
218	Markham	F	35	35	35	35	0	0	0
218	Markham	D	35	35	35	35	0	0	0
218	Markham	F	35	35	34	35	0	0	0
226	T Roots	D	35	38	37	38	3	2	3
231	Brown	D	35	35	34	35	0	0	0
232	Brown	D	35	35	35	35	0	0	0
233	Merrick	D	35	30	30	30	0	0	0
233	Merrick	D	35	30	31	31	0	0	0
235	Thompson	D	35	27	28	28	0	0	0
236	Thompson	D	35	28	28	28	0	0	0
238	M Peel	D	35	33	33	34	0	0	0
239	P Ellis	D	35	33	35	34	0	0	0
240	Murray	D	35	32	33	33	0	0	0
241	P & C Lane	D	35	33	32	33	0	0	0
242	Ellis	D	35	33	32	32	0	0	0
242	Ellis	D	35	29	30	30	0	0	0
243	McNeill	D	35	26	27	27	0	0	0
252	B & T Strachan	D	35	29	29	29	0	0	0
254	Hughes	D	35	27	27	28	0	0	0
257	Parkinson	D	35	28	27	27	0	0	0
259	Googe	D	35	27	27	27	0	0	0
264	J Moore	D	35	27	27	28	0	0	0
265	Ray	G	39	30	30	30	0	0	0
IR.1	Ironbark Ridge	E	39	38	37	37	0	0	0
IR.2	Ironbark Ridge	E	39	38	37	37	0	0	0
IR.3	Ironbark Ridge	E	39	30	29	29	0	0	0
IR.4	Ironbark Ridge	E	39	37	36	36	0	0	0
IR.5	Ironbark Ridge	E	39	39	37	37	0	0	0
IR.6	Ironbark Ridge	E	39	38	37	37	0	0	0
IR.7	Ironbark Ridge	E	39	39	37	37	0	0	0
IR.8	Ironbark Ridge	E	39	38	37	37	0	0	0
IR.9	Ironbark Ridge	E	39	38	37	37	0	0	0
IR.10	Ironbark Ridge	E	39	38	37	36	0	0	0
IR.11	Ironbark Ridge	E	39	39	37	37	0	0	0
IR.12	Ironbark Ridge	E	39	39	37	37	0	0	0
IR.13	Ironbark Ridge	E	39	39	37	37	0	0	0
IR.14	Ironbark Ridge	E	39	39	37	37	0	0	0
IR.15	Ironbark Ridge	E	39	38	36	36	0	0	0
IR.16	Ironbark Ridge	E	39	39	37	37	0	0	0
IR.17	Ironbark Ridge	E	39	38	36	36	0	0	0
IR.18	Ironbark Ridge	E	39	38	37	37	0	0	0
IR.19	Ironbark Ridge	E	39	38	37	37	0	0	0
IR.20	Ironbark Ridge	E	39	38	37	37	0	0	0
IR.21	Ironbark Ridge	E	39	38	37	37	0	0	0
IR.22	Ironbark Ridge	E	39	38	37	37	0	0	0
IR.23	Ironbark Ridge	E	39	38	36	36	0	0	0
IR.24	Ironbark Ridge	E	39	38	36	36	0	0	0
10	Muswellbrook Race Club Ltd^	C	55	40	39	38	0	0	0
268	Lake Liddell Recreational Park^	G	55	44	44	44	5	5	5
9	Englebrecht*	C	39	40	40	39	*1*	*1*	*0*

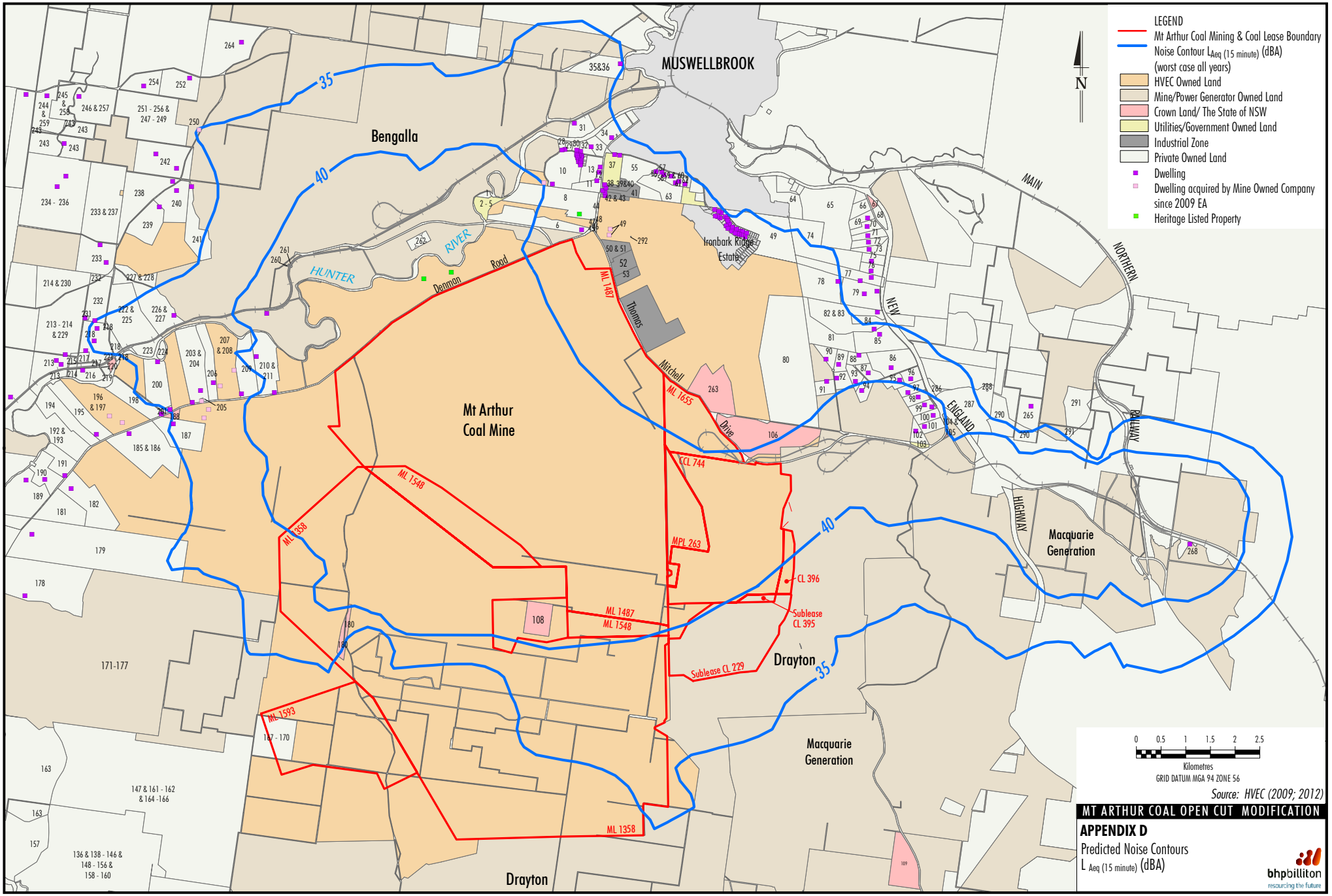
EA Receiver Number	Label	Receiver Zone	Criterion (Night)	Predicted Noise Level 2016	Predicted Noise Level 2022	Predicted Noise Level 2026	Exceedance 2016	Exceedance 2022	Exceedance 2026
49	Webber*	B	37	39	37	37	*2*	*0*	*0*
49	Webber*	B	37	39	37	37	*2*	*0*	*0*
183	Beringer Blass Wine*	F	35	34	35	35	*0*	*0*	*0*
184	Fosters Wine*	F	35	39	38	39	*4*	*3*	*4*
184	Fosters Wine*	F	35	38	38	38	*3*	*3*	*3*
184	Fosters Wine*	F	35	38	38	38	*3*	*3*	*3*
196	Eglington, Fuller & Goodchild*	F	35	34	33	34	*0*	*0*	*0*
197	Eglington, Fuller & Goodchild*	F	35	34	34	34	*0*	*0*	*0*
199	Boyle*	D	35	35	35	36	*0*	*0*	*1*
202	Fosters Wine*	D	35	37	36	37	*2*	*1*	*2*
205	Lambkin*	D	35	37	36	36	*2*	*1*	*1*
207	Zahra*	D	35	38	39	39	*3*	*4*	*4*
208	Zahra*	D	35	38	40	39	*3*	*5*	*4*
212	Chudyk*	D	35	42	42	42	*7*	*7*	*7*
250	Hamilton*	D	35	36	35	35	*1*	*0*	*0*

^ Non-residential receivers

* These receivers acquired by Mine-Owned Company since 2009 EA

APPENDIX D

NIGHT-TIME $L_{Aeq,15min}$ NOISE CONTOURS



HVE-11-01_OCM EA_App Noise_203F