

Rix's Creek Coal Mine

Continuation of Mining
Project

Environmental Noise
Assessment

Prepared for



Noise and Vibration Analysis and Solutions

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Continuation of Mining Project Environmental Noise Assessment

Reference: 13319_R01.docx

Report date: 8 October 2015

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EXECUTIVE SUMMARY

This environmental noise assessment considered operational noise, construction noise, low frequency noise, cumulative noise, sleep disturbance, road traffic noise and rail noise associated with the project.

Results of this assessment indicate that exceedance of PSNL is likely during adverse meteorological conditions for all Noise Assessment Groups (NAG). The greatest impact is predicted for the year 2017 stage, which is quite similar to the existing operation. Noise levels are predicted to reduce significantly during following stages as Rix's Creek Mine (RCM) acquire a higher proportion of attenuated equipment, and, develop a pit shell form that allows for haulage of waste material to topographically shielded areas deeper in the pit during adverse meteorological conditions.

In accordance with Section 10 of the NSW EPA Industrial Noise Policy (INP), where noise levels exceed Project Specific Noise Levels (PSNL) the regulator and noise source manager may need to negotiate achievable noise limits for the operation. The achievable noise limits may be greater than PSNL. Achievable noise limits will result after applying all reasonable and feasible noise controls to the current operation. It is Global Acoustics opinion that all reasonable and feasible noise controls have been considered and applied in this assessment.

RCM propose the following intrusive noise criteria be applied to the Project:

- $L_{Aeq,15minute}$ 40 dB for NAG D to O inclusive, applicable to all time periods; and
- $L_{Aeq,15minute}$ 42 dB for NAG A, B and C, applicable to all time periods.

RCM acknowledge these criteria are significantly lower than some model predictions, and are cognisant of the requirement to modify operations as required to comply with them. RCM understand the risk involved, but has undertaken analysis of the likely loss of production involved and associated cost implications. As discussed in Section 4.1.1, the weather conditions primarily responsible for night predictions for NAG located south to southeast of the site typically prevail only in winter. Outside of winter, prevailing weather conditions tend to mitigate noise toward these areas. RCM has advised there is sufficient flexibility within the production schedule to modify operations on a regular basis. RCM estimate one overburden excavator and associated fleet can be shut down for approximately 30 percent of the winter period, which RCM consider will provide sufficient latitude to avoid operating at full production during periods of adverse weather. RCM, in accordance with their noise management plan, uses predictive noise modelling and attended measurement to both proactively and reactively implement modifications to operations as required to reduce noise emission.

RCM is a long established mining operation, with legacy noise issues stemming from an outdated consent. The acoustic environment around the site is generally complex, with many areas heavily affected by road traffic and rail noise. Despite currently operating with standard (un-attenuated) equipment, RCM receive relatively few complaints regarding noise and are currently operating in compliance with consent conditions. RCM predates many of the noise affected areas around the mine.

RCM has committed to procuring attenuated equipment for future acquisitions, cladding the two critical sides of the Coal Preparation Plant (CPP), providing barriers to noise sources where reasonable

and feasible to do so, and managing noise to set limits through modification of operations as required. In overall terms, the acoustic environment will improve relative to both the historic and existing situation, albeit at significant financial cost to RCM.

In conclusion, whilst the proposed modification is predicted to exceed PSNL, RCM is committed to managing noise emission from the site to reasonable and achievable levels, resulting in significant improvement to the noise environment around the site relative to the historical situation.

Global Acoustics Pty Ltd

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1 INTRODUCTION

1.1 Rix's Creek Continuation of Mining Project

1.1.1 Project Overview

Rix's Creek Mine (RCM) is owned and operated by Bloomfield Collieries Pty Limited (Bloomfield). It is an open cut coal mine approximately 5 km north-west of Singleton in the Hunter Valley Coalfields of NSW; current output is approximately 1.5 million tonnes per annum (Mtpa) of product coal from its existing operations. Bloomfield is seeking approval for the Rix's Creek Continuation of Mining Project (the project), which relates to the continued operation of the mine. The project would allow RCM to continue to operate as an open cut mine, supported via its existing infrastructure facilities (existing mine access, Coal Handling and Preparation Plant (CHPP), coal stockpiling and rail facilities) until approximately 2037. The continuation of mining operations will extend in a north-westerly direction and require a modification to Mine Lease 1432 for an out of pit dump. A more detailed description is provided in the Environmental Impact Statement (EIS) that this assessment accompanies.

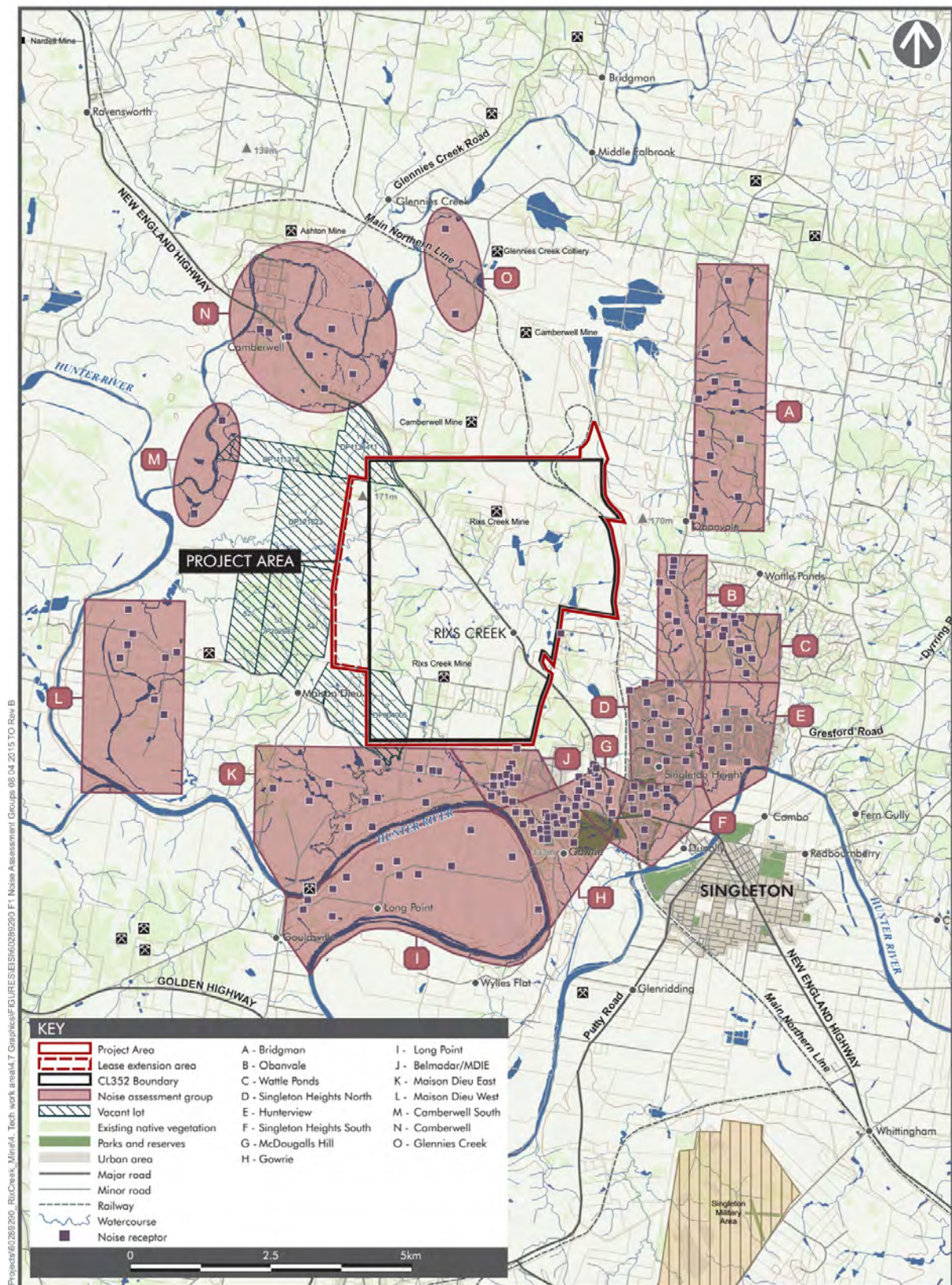
1.1.2 Proposed Development

The project seeks to continue existing operations, increasing production up to 4.5 Mtpa run of mine (ROM) coal per year. Mining methods will be the same as those currently employed, being multi-seam bench open cut techniques. ROM coal will continue to be processed onsite at the existing CHPP, which has capacity to accept the proposed increase in throughput. Product coal will then be transported by rail to the Port of Newcastle. It is estimated that the mine could yield a total of 32 million saleable tonnes of coal at an overburden ratio of approximately 10.5:1 before reserves are exhausted.

The components of the proposed development comprise:

- The ongoing use of, and future additions to, the existing mine fleet;
- Use of the existing mine infrastructure facilities including the CHPP (with evaluation of the existing rail load out and an approved alternative);
- Continuation of operating hours - 24 hours a day 7 days a week;
- Use of existing and new rejects and tailings emplacements;
- Rail transport of product coal to the Port of Newcastle;
- Mine closure and rehabilitation; and
- Environmental management.

Figure 1 shows an overview of modelled noise sensitive receptors (NSR) and noise assessment groups (NAG). Figure 2 and Figure 3 provide a more detailed view of modelled NSR; these figures cover the areas south and north of RCM respectively.



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NOISE ASSESSMENT GROUPS
Rix's Creek Continuation of Mining
Environmental Impact Statement

FIGURE 1

Figure 1: Surrounding Environment, Noise Assessment Groups and Modelled Receptor Locations

1.2 Terminology & Abbreviations

Some definitions of acoustic terminology which may be used in this document are as follows:

- L_A , the A-weighted root mean squared (RMS) noise level at any instant;
- L_{A1} , the noise level which is exceeded for 1 per cent of the time;
- $L_{A1,1\text{minute}}$, corresponds to the highest noise level generated for 0.6 second during one minute. In practical terms, this represents the maximum measured level, and is often used to assess sleep disturbance;
- L_{A10} , the noise level which is exceeded for 10 per cent of the time, which is approximately the average of the maximum noise levels;
- L_{A90} , the level exceeded for 90 per cent of the time, which is approximately the average of the minimum noise levels. The L_{A90} level is often referred to as the “background” noise level and is commonly used to determine noise criteria for assessment purposes;
- L_{Aeq} , the average noise energy during a measurement period;
- dB(A), noise level measurement units are decibels (dB). The “A” weighting scale is used to describe human response to noise;
- dB(C), noise level measurement units are decibels (dB). The “C” weighting scale is used as a measure of human response to high noise levels. It includes more of the low frequency range of sounds. It is often used to assess low frequency noise impact;
- sound power level (L_W denotes linear, L_{WA} denotes A-weighted), 10 times the logarithm of energy radiated from a source (as noise) divided by a reference power, the reference power being 1 picowatt;
- sound pressure level (L_p), fluctuations in pressure measured as 10 times a logarithmic scale, the reference pressure being 20 micropascals;
- sound exposure level (SEL), the A-weighted noise energy during a measurement period normalised to one second.;
- Hertz (Hz), cycles per second, the frequency of fluctuations in pressure, sound is usually a combination of many frequencies together;
- ABL, the 10th percentile background noise level for a single period (day, evening or night) of a 24 hour monitoring period;
- RBL, the background noise level for a period (day, evening or night) determined from ABL data.

1.3 Purpose of the Report

1.3.1 Director-General's Requirements

The Rix's Creek Continuation of Mining Project Environmental Impact Statement has been prepared in accordance with Division 4.1, Part 4 of the Environmental Planning and Assessment Act 1979 (EP&A Act), which ensures that the potential environmental effects of a proposal are properly assessed and considered in the decision-making process. In preparing this Environmental Noise Assessment, the Director-General's Requirements (DGRs) issued for the Rix's Creek Continuation of Mining Project (SSD 13_6300) on 3 March 2014 have been addressed as required by Clause 75F of the EP&A Act. The key matters raised by the Director-General for consideration in the Environmental Noise Assessment (ENA, this document) are outlined in Table 1.1 along with a reference to where the requirements are addressed. Assessment of blasting impact is beyond the scope of this report.

Table 1.1: DIRECTOR-GENERAL'S REQUIREMENTS

Requirements	Section Addressed
Noise, Vibration & Blasting – including a detailed quantitative assessment of potential:	
construction, operational and off-site road/rail noise impacts (including cumulative impacts)	Section 4
Blasting impacts on nearby infrastructure and other mines	NA
Blasting impacts on people, livestock and property	NA
Mitigation measures, including evidence that demonstrates the measures are consistent with best practice, and that there are no such measures available other than those proposed	Section 5
Monitoring and management measures, in particular real-time, attended noise monitoring, and predictive meteorological forecasting	Section 5

Notes:

1. Blasting is not included within the scope of this assessment.

1.3.2 Environmental Noise Assessment Objectives

The objectives of this ENA are to:

- Assess potential noise impact associated with the proposed modification, including operational noise, construction noise, low frequency noise, sleep disturbance, road traffic noise and rail noise;
- Determine suitable criteria for each element of potential noise impact in accordance with current NSW policy and guidelines;

- Identify and assess all reasonable and feasible noise mitigation controls and management strategies; and
- Propose noise monitoring and management strategies.

1.4 Report Structure

This report is structured as follows:

Section 1.0 Introduction – outlines the project and presents the purpose of the report.

Section 2.0 Methodology – describes the methodology employed for the Environmental Noise Assessment.

Section 3.0 Criteria - describes the existing environment and derived or adopted criteria.

Section 4.0 Impact assessment – describes potential noise impacts resulting from the proposed project.

Section 5.0 Management and monitoring - provides a summary of environmental mitigation, management and monitoring responsibilities in relation to noise management for the project.

Section 6.0 Conclusion.

Appendix A Tabulates model predictions for all assessed receptors.

Appendix B Provides figures showing modelled source locations for each scenario.

Appendix C Provides figures showing calculated noise contours for each scenario.

Appendix D Lists meteorological conditions included in the modelling assessment.

Appendix E Provides background noise survey graphs.

Appendix F Lists assessed noise sensitive receptors.

2 METHODOLOGY

This ENA has been undertaken generally in accordance with the guidelines outlined in the NSW Industrial Noise Policy (INP), with the following exceptions:

- The cumulative distribution of results methodology was employed in lieu of the prevailing meteorological conditions method outlined in the INP. The cumulative distribution method provides assessment of impact for a far more comprehensive set of meteorological conditions. Further detail is contained in Section 2.3; and
- Low frequency noise has been assessed using both the INP total C-weighted minus total A-weighted result method (C minus A), and, through comparison of total predicted C-weighted levels at noise sensitive receptors (NSR) with an upper limit criterion (Broner method). The Broner method is in accordance with recommendations published in A Simple Method for Low Frequency Noise Emission Assessment (Broner, 2010), published in the Journal of Low Frequency Noise, Vibration and Active Control, Volume 29 Number 1 2010. It is understood the INP C minus A method is currently under review; the Broner method is considered an acceptable alternative for assessment purposes in the interim.

Four staged operational noise scenarios were modelled representing the progression of mining operations over the proposed life of mine, with emphasis on targeting the highest noise impact periods. Each stage modelled represents reasonable and feasible worst case operating conditions for that period of operations. The stages nominally relate to years 2017, 2020, 2023 and 2026. The four stages represent:

- 2017: the early stages of the project at a production rate of 1.5 Mtpa product coal. The modelled mine plan for this stage is quite similar to current operations. Upgrading to an attenuated fleet has commenced, although the majority of plant is un-attenuated (mostly existing fleet);
- 2020: a production rate of 1.5 Mtpa product coal. More than half of the attenuated fleet upgrade is complete;
- 2023: the maximum production rate of 2.5 Mtpa product coal, and involves operation of the most equipment. All proposed attenuated equipment is operational; and
- 2026: a production rate of 1.3 Mtpa product coal, after the maximum production rate period has passed. It is expected noise emissions after this point in time would gradually reduce until closure of the mine.

RCM obtained approval to construct and operate a rail loading facility under the Modification 5 approval. Rail loading is currently undertaken at the Integra Coal rail loading facility. At the time of this assessment, it is not known whether the Integra rail facility will continue to be used in the future, or if the Rix's facility option will be progressed. Therefore, both rail loading facilities have been included in the assessment.

Operational A-weighted noise, low frequency noise and potential sleep disturbance impact associated with each of these stages is assessed. Further detail regarding the operating scenarios is provided in

Section 4.1.2.

No significant construction tasks are proposed. Minor works are proposed to clad two sides of the Coal Processing Plant (CPP, refers to the coal washing building within the larger CHPP) and create an earth bund on the southern side of the coal haul route. Construction noise associated with the second cut and cover tunnel, CHPP works and bund construction would occur in close proximity to mining operations. As such, it is considered highly unlikely that construction noise from onsite construction activities would be audible over and above the noise generated by the open cut mining operation; therefore construction noise has not been quantitatively assessed. Noise associated with minor construction activities will be managed to comply with project approval criteria and will therefore be treated as an operational noise source for compliance purposes. Construction noise is not discussed further in this report.

Road traffic and rail noise impact arising as a result of the proposed production rate increase are assessed.

2.1 Policy and Guidelines

Technical policy and guidelines relevant to the Environmental Noise Assessment include:

- NSW Industrial Noise Policy (INP) (EPA 2000);
- Voluntary Land Acquisition and Mitigation Policy for State Significant Mining, Petroleum and Extractive Industry Developments (VLAMP) (NSW Government, 2014);
- NSW Road Noise Policy (EPA 2011); and
- Rail Infrastructure Noise Guideline (RING) (EPA 2013).

2.2 Study Area

The study area for this assessment includes the following suburbs and localities surrounding the project:

- Bridgman;
- Obanvale;
- Wattle Ponds;
- Singleton Heights;
- Hunterview;
- McDougalls Hill;

- Gowrie;
- Maison Dieu.
- Long Point;
- Camberwell; and
- Glennies Creek.

For the purposes of this assessment, the assessment area has been divided into Noise Assessment Groups (NAG). Refer to Section 3.1.1 for further detail. The study area is illustrated in Figure 1.

2.3 Noise Modelling Methodology

Noise levels were predicted using RTA Technology's Environmental Noise Model (ENM), a computer based environmental noise model, to determine the acoustic impact of mining and construction activities. The model takes into account geometric spreading, atmospheric absorption, and, barrier and ground attenuation. ENM Terrain Category 2, representing a rural land environment, was adopted for model input.

Results were determined using the cumulative distribution of results methodology; this methodology has previously been considered appropriate by the EPA. In a Submission in Reply by the Environment Protection Authority to the Commission of Inquiry into a proposal to establish the Mount Pleasant Open Cut Coal Mine, February 1999, the EPA stated that 'The EPA accepts that this ten [sic] percentile of noise levels under all weather conditions is a reasonable representation of what would normally occur under adverse meteorological conditions ... but clearly does not and should not include all extreme or unusual conditions'. The cumulative distribution methodology has been accepted as appropriate on many occasions since that time. It is understood this methodology will be listed as an acceptable assessment method in the forthcoming revision of the INP.

The cumulative distribution method determines a noise level that is likely to be exceeded 10 percent of the time in the worst-case season. A range of results is calculated for a comprehensive set of meteorological conditions, and frequency of occurrence of each of these meteorological conditions is calculated from historical meteorological data. The cumulative distribution of these results is analysed to establish a single value for comparison with the limiting criterion. It is considered appropriate to use the 90th percentile result (10 percent of results are higher than this number) to represent intrusive noise impact. Results provided are 90th percentile L_{Aeq} values; that is, a range of L_{Aeq} results (260 meteorological conditions) have been calculated for each receptor, and the 90th percentile L_{Aeq} has been determined based on the percentage distribution of meteorological conditions. From the cumulative distribution, it is possible to determine the percentage of time criteria may be exceeded. Appendix D lists the 260 meteorological conditions included in the assessment.

Shorter duration weather conditions that increase noise may be an insignificant percentage of time if the assessment is based on annual distribution of meteorological conditions. Therefore results are determined for each season and the worst-case season result is adopted as the predicted level; the

worst-case season may not be the same for each receptor.

This methodology requires more calculation than would a procedure involving a smaller set of prevailing meteorological parameters (i.e. INP conditions) but represents best available technology and is, in our opinion, one of the most comprehensive methods available to estimate the range of likely noise levels for a receptor. The INP procedures only require assessment of potentially enhancing meteorological conditions if they occur more than 30 percent of a time period (day, evening and night) in any season. This could mean conditions that enhance noise and result in unacceptably high levels, and which may occur for significant periods of time (right up to 30 percent), are not assessed.

On the other hand, the cumulative distribution method results in a level being calculated for all possible meteorological conditions. The range of wind speed, wind direction and stability class combinations is actually infinite in the real world. For the purpose of modelling we've broken this down into 260 conditions, which can be considered to be quite a comprehensive analysis. Using historical meteorological data, the percentage of time each condition may occur per period and season is known. For any mining scenario modelled it is then possible to determine the likely percentage occurrence of any noise level. Further, the likely percentage of time a criterion might be exceeded can also be estimated.

2.4 Mine Plan Development

The EPA requested RCM enter into a pollution reduction program (PRP) in 2012. An ENA undertaken for the PRP by Global Acoustics predicted that noise emissions from the existing RCM operation would significantly exceed project specific noise levels (PSNL). A number of mitigation options were recommended, including

- Attenuation of mobile equipment;
- Cladding of the CPP;
- Mitigation of haul truck noise through realignment of haul routes, adding acoustic bunds, and lowering an exposed section into a 'slot'; and
- Development of a predictive noise model to proactively manage noise.

Since the PRP assessment, RCM has commenced a fleet attenuation program, realigned and lowered the critical haul route into a slot, constructed an acoustic bund at the ROM pad and developed a predictive noise model. RCM propose to clad the two critical sides of the CPP (south and east); the expected completion date is 2015/2016.

Modelling for this ENA commenced in August 2013. Since that time, numerous model iterations have been undertaken to achieve the outcomes presented in this report. Early iterations of the maximum production rate scenario indicated a number of noise issues, which were progressively addressed through the subsequent modelling process. Of note, the following noise controls and management strategies were developed:

- Three levels were provided for overburden emplacement at varying elevations to allow shielded emplacement to occur deeper in the pit during adverse meteorological conditions;
- Haul route alignments within the pit were refined to maximise the available topographical shielding provided by the pit shell;
- The general progression of West pit was refined to ensure the major emplacement area to the south could be utilised to provide topographical shielding to sensitive receptor areas located south of West pit, in particular Belmadar Way and the Maison Dieu Road area;
- Two high elevation emplacement areas were developed, to the north and south of the pit, separated by approximately 1300 metres. This arrangement allows emplacement to occur in the northern end of the site during north to northwest airflow, and in the south of the site during south to southeast airflow, significantly reducing noise emission in the direction of wind enhanced noise propagation;
- The need for attenuated blast hole drills was identified to allow operation at or near natural surface level. RCM now operates two fully attenuated drills, and are in the process of attenuating a third drill;
- Haul trucks, and to a lesser extent water carts were identified as being the primary noise emitters on site. Various iterations were undertaken to determine the extent of attenuation required. Model predictions indicated that operating standard un-attenuated equipment deep in the pit does not have a significant influence on whole of site predictions. However, it was apparent that haul trucks required to operate at the upper elevations would need to be attenuated. To this end, all new haul trucks and watercarts acquired by RCM will be attenuated, whilst the existing fleet will be retained (although phased out over time) in its current state, and operated in the most shielded locations available;
- Modelling indicated operation of dozers in second gear in exposed areas, such as overburden emplacement areas, generated high noise levels. Attended monitoring off site has also identified dozer track noise as an emergent noise source from the general mining continuum. RCM has recognised this issue, and currently restricts dozer operation to 1st gear during noise enhancing meteorological conditions. As predictions in this assessment are 90th percentile levels, and as such represent likely noise levels under enhancing conditions, dozers were modelled with a sound power representing 1st gear operation; this is the mode RCM would employ during adverse meteorological conditions;
- A 4.5 metre high earth bund was included on the southern side of the coal haul route to reduce noise emission to the south;
- A 6 metre high acoustic barrier was modelled adjacent the ROM bin to reduce noise emission to the south and east when dumping at the ROM bin;

- The current front end loader used for coal rehandle at the ROM pad was identified as a primary contributor to off site noise levels during adverse meteorological conditions. RCM has committed to acquiring a modern loader for this application with lower sound power;
- A decision was made to clad the south and east facades of the CPP to reduce noise levels at the nearest receptors. It should be noted that the CHPP has operated in its current form, since 1993. As no modifications are proposed for the CHPP to account for the production rate increase, this action, combined with a new ROM loader, ROM bin barrier, and attenuated coal haul trucks, should improve the noise environment in the Obanvale, Bridgman Road and Wattle Ponds areas relative to historical and current levels. Reductions of 3 to 5 dB are predicted; and
- A series of operational management controls were developed to manage noise emission during adverse meteorological conditions. These controls are discussed in Section 4.1.3. A number of iterations were undertaken to assess various combinations of haul routes and equipment operating configurations. At full production, RCM generally operates two overburden excavators and one coal front end loader (FEL), with associated fleet. At the maximum production rate of 4.5 Mtpa, a third overburden excavator would operate. The assessment found that shutting down one of the overburden excavators and associated fleet at night during adverse meteorological conditions provided substantial reductions to predicted levels. RCM has advised there is sufficient flexibility within the production schedule to modify operations on a regular basis. RCM estimate one overburden excavator and associated fleet can be shut down for approximately 30 percent of the winter period. Based on the historic frequency occurrence of adverse meteorological conditions, this is considered sufficient to allow shutdown of equipment to occur as required. Analysis also indicates further reductions can be achieved if both an additional overburden excavator and the coal FEL are shut down. This has been demonstrated to be an effective noise control during particularly adverse conditions when required.

It is Global Acoustics opinion that all reasonable and feasible noise controls have been investigated and, where applicable, included in the assessment.

2.5 Noise Contours

Noise contours were produced for assessment areas containing private residences to provide a visual representation of the model results. It should be noted that noise contours are based on interpolation of results determined for individual points, and as such are indicative, and are presented for illustrative purposes only.

2.6 INP Modifying Factors

Section 4 of the INP requires consideration of modifying factors. These are characteristics of noise received at receptor locations that could result in more annoyance than would normally occur from that level. The modifying factors are tonal noise, low frequency noise (LFN), impulsive noise, intermittent noise and duration (if single event).

Extensive environmental noise monitoring undertaken around open cut mines by Global Acoustics has shown that these factors are rarely if ever applicable, with the exception of LFN. Evaluation of LFN in this assessment is through comparison of total predicted C-weighted levels at receptor locations with an upper limit criterion as described above. Assessment of C-weighted minus A-weighted totals has also been undertaken as per current INP guidelines.

3 CRITERIA

3.1 Existing Environment

The area surrounding RCM contains a range of acoustic environments including rural land containing scattered farm residences (rural residential), suburban areas, and rural residential areas affected by road traffic and rail noise. For the purpose of this ENA, the various areas surrounding the mine have been divided into noise assessment groups. These NAG, and a description of the acoustic environment in each area, are detailed in Section 3.1.1.

3.1.1 Noise Assessment Groups

Table 3.3 lists NSR included in the assessment, and the NAG each NSR has been allocated to. It should be noted that not all NSR surrounding the mine have been assessed directly. Where clusters of residences exist, NSR representative of the potentially most affected residences have been assessed. Details of modelled NSR are included in Appendix F.

Receptor 1, located off Rix's Lane, is not included in any NAG. The owners of this property have a negotiated private agreement with RCM; as such criteria are not applicable at this location. Receptor 11 in NAG A, and receptors 175, 176, 178 and 179 in NAG N are designated acquisition upon request in the Integra Open Cut Consolidated Approval (DA 08_0101 and 08_0102) Modification 2 dated February 2013.

Figure 1 shows an overview of modelled NSR and NAG. Figure 2 and Figure 3 provide a more detailed view of modelled NSR; these figures cover the areas south and north of RCM respectively.

Table 3.1: NOISE SENSITIVE RECEPTORS

NAG ID	NAG Name	NSR within each NAG
A	Bridgman	2,3,4,5,6,7,8,9,10,11,12,13,14,24
B	Obanvale	15,16,17,18,19,20,21,22,23
C	Wattle Ponds	25,26,27,28,29,30,31,32,33,34,35,36,37,38,39
D	Singleton Heights North	57,58,59,60,61,62,64,65,71,72,74,75,76,77,78,79,80
E	Huntermview	85,86,87,88,89,90,91,92,93,94,95
F	Singleton Heights South	56,63,66,67,68,69,70,73,81,82,83,84
G	McDougalls Hill	40,41,42,43,44,45,46,47,48,49,50,51,52,53,54,55
H	Gowrie	96,97,98,99,100,101,102,103,104,105,106,107,108,109,110,111,112,113,114,115,116,117,118,119,120,121
I	Long Point	123,124,125,126,127,128,129,130,131,132,133,134,135
J	Belmadar	136,137,138,139,140,152,153,154,155,156,157,158,159,166
K	Maison Dieu East	141,142,143,144,145,146,147,148,160,161,162,163
L	Maison Dieu West	149,150,151,164,165,167,168,169
M	Camberwell South	171,174
N	Camberwell	170,172,173,175,176,177,178,179
O	Glennies Creek	180,181

NAG A includes NSR located on Bridgman Road, which is generally east to northeast of the mine. Background noise levels in this area would generally be typical of a rural environment; however, road traffic noise on Bridgman Road, rail noise from the Great Northern Railway, mining noise from Integra Open Cut mine and to a lesser extent mining noise from RCM would often be audible. Rail loading activities at the Integra rail loading facility would affect this area during adverse meteorological conditions. It is acknowledged that Integra Open Cut is in care and maintenance at the time of preparing this document, however, that noise source would have been a feature of this acoustic environment (and other NAG) for some time, and may be again in the future.

NAG B includes NSR located in Obanvale, and includes NSR located on Bridgman Road, generally east to southeast of the CHPP. This area has a complex acoustic environment, characterised by road traffic noise, rail movements on the Great Northern Railway, mining noise from Integra Open Cut Mine, and Rix's Creek CHPP. Of particular note is the Great Northern Railway, which passes through the assessment area between the Project and all NSR in this NAG. Noise from trains will be, often, considerably higher than criteria for the project. Further, the trains themselves, besides being frequent, are very long and powered by multiple locomotives. The RCM CHPP is located in relatively close proximity to this NAG and would typically be audible during both neutral and adverse meteorological conditions.

NAG C includes NSR located in Wattle Ponds. This area contains scattered residences in a low density suburban, bordering on rural environment. The acoustic environment in this area is often typical of a rural environment, although traffic noise from Bridgman Road and rail noise from the Great Northern Railway are often audible.

NAG D includes NSR located in the suburb of Singleton Heights North, which is southeast of the mine. The acoustic environment in this area is typical of a suburban environment. The Great Northern Railway passes within 50 metres of some residences in this NAG. As such, this area would be highly affected by rail noise.

NAG E includes NSR located in Hunterview. The acoustic environment in this area is typical of a suburban environment.

NAG F includes NSR located in the suburb of Singleton Heights South. The acoustic environment in this area is typical of a suburban environment.

NAG G includes NSR located in McDougalls Hill. This area contains residences in a low density suburban environment. This area is located between the New England Highway and the Maison Dieu Industrial Estate. The Great Northern Railway passes within 250 metres of some residences in this NAG. The acoustic environment would be far from rural.

NAG H includes NSR located in Gowrie. This area contains residences in a low density suburban, bordering on rural environment. The Maison Dieu Industrial Estate is located immediately north of this NAG. Background noise levels in this area would often be typical of a rural environment; however, rail noise from the Great Northern Railway and road traffic noise from the New England Highway would also be audible during certain meteorological conditions.

NAG I includes NSR located in Long Point, which includes residences located within the loop formed by the Hunter River south of the Mine, on Long Point Road. Background noise levels in this area would generally be typical of a rural environment; however, mining noise from Mount Thorley Warkworth mine and RCM would also be audible during certain meteorological conditions.

NAG J includes NSR located on Belmadar Way and Maison Dieu Road in the vicinity of the Maison Dieu Industrial Estate, which is south of the mine. The acoustic environment in this area includes road traffic noise from the New England Highway, industrial noise from the industrial estate located immediately east of Belmadar Way, and rail noise from the Great Northern Railway. During periods when these noise sources are less significant, noise levels in this area would generally be typical of a rural environment.

NAG K includes NSR located in Maison Dieu East, and includes residences located on Maison Dieu Road and Dights Crossing Road. The acoustic environment in this area is typical of a rural environment, with road traffic noise contributing during higher traffic flow periods on Maison Dieu Road.

NAG L includes NSR located in Maison Dieu West. This NAG includes residences located in Maison Dieu, on Shearers Lane and Knodlers Lane. Background noise levels in this area would generally be typical of a rural environment; however, mining noise from Hunter Valley Operations and RCM would also be audible during certain meteorological conditions.

NAG M includes two NSR located in Camberwell South, located generally west of RCM. Background noise levels in this area would generally be typical of a rural environment; however, mining noise from Hunter Valley Operations, Ravensworth Operations, Integra Coal operations and RCM are audible during certain meteorological conditions

NAG N includes NSR located in Camberwell, and includes residences located between RCM and Camberwell Village, close to the New England Highway. This a complex acoustic environment which is at times heavily affected by road traffic on the New England Highway. Mining noise is typically audible, the source of which is dependent on the direction of propagation (the village has nearby mines in most directions).

NAG O includes NSR located in the Glennies Creek area. In the absence of mining background noise levels in this area would generally be typical of a rural environment; however, mining noise from Integra Coal Operations would also be audible during certain meteorological conditions.



AECOM

NOISE RECEPTORS - SOUTH
Rix's Creek Continuation of Mining
Environmental Impact Statement

FIGURE 2

Figure 2: Modelled Noise Sensitive Receptors - South

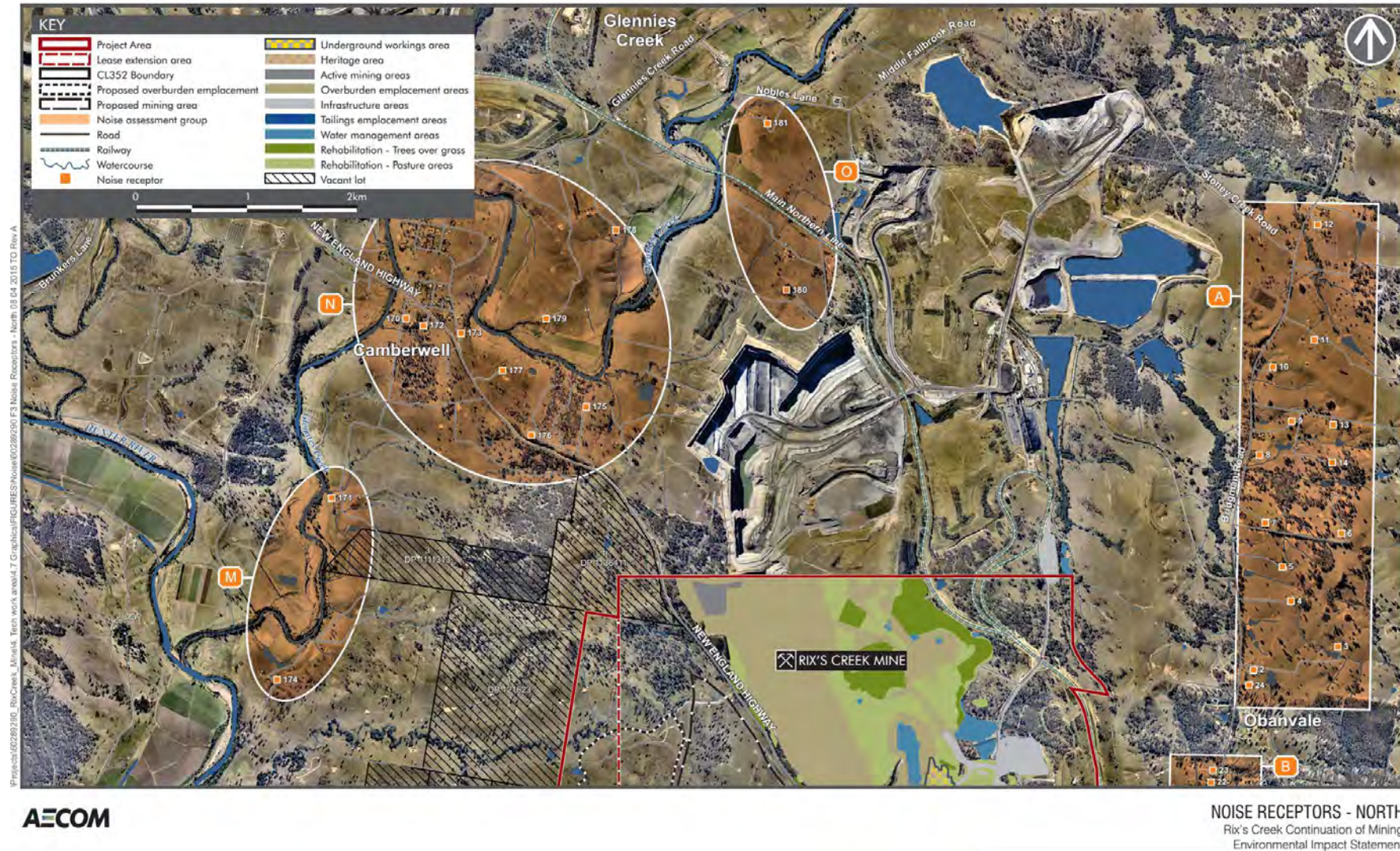


FIGURE 3

Figure 3: Modelled Noise Sensitive Receptors - North

3.1.2 Measured Background Levels

SLR Consulting Australia Pty Ltd (SLR Consulting) was commissioned by RCM to undertake background noise logging in the Retreat Road and Singleton Heights areas. Unattended noise logging was conducted at 5 Partridge Close, Singleton Heights, and, the intersection of Bridgman and Retreat Roads during May and June 2011. Data recorded at Retreat Road was affected by nearby dust monitoring equipment and was deemed invalid.

Global Acoustics undertook further background noise surveys at four locations during July 2013 and February 2014 as follows:

1. Corner of Retreat and Bridgman Roads. This location is representative of NAG B and NAG C;
2. 25 Belmadar Way. This location is representative of NAG J;
3. 213 Maison Dieu Road. This location is representative of NAG H; and
4. 434 Maison Dieu Road. This location is representative of NAG K.

Data measured at these four locations were used to calculate Rating Background Levels (RBL) for the relevant NAG. Data measured by SLR Consulting were used for calculation of RBL for NAG D and NAG F (Singleton Heights).

The background noise surveys undertaken by Global Acoustics were conducted over two separate logging periods. During the first survey in July 2013, the presence of meteorological conditions that enhanced noise from RCM influenced measured background levels during some measurement periods. Once these periods were removed, that data set was deemed insufficient in quantity for calculation of reliable RBL. Therefore, a second survey was conducted during February 2014 to improve the integrity of the measured data set. Data recorded during both surveys were analysed to remove any data measured during periods of meteorological enhancement from RCM in order to ensure that background levels used in the determination of RBL was in the absence of any contributions from the mine.

RBL determined from measured data are summarised in Table 3.5. Graphs illustrating the variation in logged noise levels during the background noise surveys are included in Appendix E.

Table 3.2: BACKGROUND NOISE LEVELS RBL SUMMARY - L_{A90} dB

NAG	Day	Evening	Night
B and C	38	37	32
D and F	31	32	30
H	33	36	32
J	34	38	32
K	29	32	30

Background noise logging was not undertaken for NAG A, E, G, I, L, M, N or O. RBL for these NAG have been established using one of the following methods:

- Adopting measured background levels for the nearest representative NAG where it is considered a similar noise environment exists;
- Adopting the INP default minimum background of L_{Aeq} 30 dB;
- Adopting consent criteria contained in approvals for neighbouring mines. This approach is only adopted for NAG where cumulative impact with the neighbouring mine is considered unlikely, and, consent criteria are set approximately 5 dB above likely background noise levels in that area; and
- Adopting RBL presented in ENA for neighbouring mines. A comprehensive background noise survey was undertaken for the Integra Open Cut Operational Noise and Blasting Assessment (Heggies, 2009) (Integra ENA). RBL derived for assessment purposes in the Integra ENA, presented in Table 17 of that report, have been adopted where measured RBL are considered representative of NAG in this assessment.

Discussion regarding adopted RBL is discussed in the following points:

- NAG A - RBL presented in Table 17 of the Integra ENA for NAG 11 have been adopted. These are L_{A90} 33/38/35 dB for the day, evening and night periods;
- NAG E - RBL determined for NAG D have been adopted as representative of the background noise environment in this area;
- NAG G - RBL determined for NAG J have been adopted as representative of the background noise environment in this area. NAG G is significantly closer to the New England Highway than NAG J, and it possible that background noise levels would be higher than those adopted;
- NAG I - Warkworth Mine was approved in May 2003 (Development Consent DA-300-9-2002-i) with a modification approved on 29 January 2014. Conditions 18 to 21 of the Warkworth consent relate to mine noise emissions. A criterion of $L_{Aeq,15minute}$ 37 dB is applicable for all time periods in Long Point Road area. Accordingly, this criterion has been adopted as the Project Specific Noise Level (PSNL) for NAG I in this assessment. It is noted that cumulative noise from RCM and Warkworth Mine would not result, as these mines are located in geographically opposite directions. When noise is atmospherically enhanced from one mine, it would be attenuated from the other and vice versa;
- NAG L - Hunter Valley Operations South Coal Project consent 06_0261 contains noise impact assessment criteria for this area. Any residence located within one kilometre of Shearers Lane is allocated a criterion of $L_{Aeq,15minute}$ 37 dB for all time periods. Accordingly, this criterion has been adopted as PSNL for NAG L in this assessment. It is noted that cumulative noise from RCM and Hunter Valley Operations would not result, as these mines are located in

geographically opposite directions. When noise is atmospherically enhanced from one mine, it would be attenuated from the other and vice versa;

- NAG M - RBL presented in Table 17 of the Integra ENA for NAG 6 have been adopted. These are L_{A90} 34/36/33 dB for the day, evening and night periods;
- NAG N - Background noise levels in this NAG vary with proximity to the New England Highway. RBL presented in Table 17 of the Integra ENA for the night period range from L_{A90} 32 dB for locations away from the highway (NAG 4), to L_{A90} 37 dB for locations close to the highway (NAG 5). RBL for NSR located adjacent the highway and southeast of Camberwell Village (NAG 7) are L_{A90} 40/37/34 for the day, evening and night periods. NSR in this latter group are predicted to receive the greatest noise impact from RCM; therefore, RBL for Integra ENA NAG 7 have been adopted as representative of NAG N in this assessment; and
- NAG O - The INP default minimum background of L_{Aeq} 30 dB was adopted.

3.2 Existing Consent

The most recent project approval for RCM is DA N90/00356 approved by the Minister for Urban Affairs and Planning in October 1995. The following extract presents noise criteria from the DA.

10. The Applicant shall

(i) comply with the L_{A10} daytime noise level design goals set out below:

<i>The Retreat</i>	<i>42 dB(A)</i>
<i>Singleton Heights</i>	<i>42 dB(A)</i>
<i>Maison Dieu Road</i>	<i>38dB(A)</i>

(ii) comply with the L_{A10} night-time noise level design goals set out below:

<i>The Retreat</i>	<i>40 dB(A)</i>
<i>Singleton Heights</i>	<i>40 dB(A)</i>
<i>Maison Dieu Road</i>	<i>38 dB(A)</i>

The goals relate to average conditions (neutral atmosphere) and not to inversion conditions.

Criteria in the approval use the L_{A10} statistical noise descriptor; L_{A10} criteria are one of the former ways of assessing noise impacts. It is noted these criteria only apply under neutral atmospheric conditions. Model predictions for open cut mines are often in the range 8 to 10 dB higher for enhancing meteorological conditions than for neutral atmospheric conditions.

3.3 Operational Noise Criteria

3.3.1 Project Specific Noise Levels

Rix's Creek is an existing facility, which has been producing coal since 1990. The INP provides a method for assessing existing premises which is essentially the same as for a new development, where PSNL are determined, and proposed (or current) operations are assessed against these criteria, with the exception that, should the predicted levels exceed any criterion, an assessment should be made of

feasible and reasonable noise mitigation strategies, and negotiated achievable noise levels may be agreed upon between the noise source manager and the regulator.

The INP states that objectives for environmental noise are 'to account for intrusive noise and ... to protect the amenity of particular land uses'. To achieve these objectives, limits are specified where the 'intrusiveness criterion essentially means that the equivalent continuous (energy-average) noise level of the source should not be more than 5 decibels (dB) above the measured background level'. Amenity is protected by 'noise criteria specific to land use and associated activities'. Amenity criteria 'relate only to industrial-type noise and do not include road, rail or community noise'.

The INP recommends acceptable amenity criteria for various land uses. Where the existing noise level from industrial sources approaches the acceptable noise level, noise from new sources must be limited to protect the amenity of the area. Table 2.2 of the INP provides modification levels to be applied to the recommended acceptable amenity limits depending upon the relationship between existing industrial L_{Aeq} noise levels and acceptable noise levels (ANL).

Existing L_{Aeq} from industrial sources in the areas around RCM range widely due to variances in meteorological conditions. In the case of Camberwell Village, industrial noise levels can be relatively low during calm atmospheric conditions, and close to acceptable amenity criteria during periods with meteorological enhancement. Typically, industrial mining noise received in Camberwell Village occurs from only one or two mines on any given occasion depending on the direction of enhancement. Similarly, industrial noise in Maison Dieu, Long Point Road, and along Maison Dieu Road would, at any moment, be from sources along the direction of meteorological enhancement (e.g. upwind), and cumulative noise from mines located in geographically different directions would rarely occur. On this basis, no adjustment has been made to ANL to account for existing levels of industrial noise.

As the purpose of amenity criteria is to prevent cumulative increases in industrial noise from exceeding acceptable amenity limits, a cumulative noise assessment has been undertaken where the cumulative noise from existing industrial sources, combined with predicted noise from the project is assessed. Amenity criteria shown in Table 3.7 have been adopted as suitable criteria for the cumulative noise assessment.

Applicable intrusiveness and amenity limits are derived independently. Typically, these are then compared to determine PSNL. However, as amenity is being addressed in the cumulative noise assessment, intrusive noise criteria will become PSNL. This is usually the case in rural and many suburban environments where road traffic noise levels are low, as the intrusiveness criterion is typically the most stringent.

The intrusiveness criterion is expressed as:

$$L_{Aeq,15\text{minute}} = RBL + 5$$

where $L_{Aeq,15\text{minute}}$ is the L_{Aeq} noise level from the source, measured over 15 minutes and RBL is the rating background level. INP application notes provide guidance on situations where the RBL for evening or night is higher than the RBL for daytime. Accordingly, where measured RBL for evening or night are higher than the preceding time period, the lower RBL has been adopted for derivation of

PSNL. Derived PSNL are presented in Table 3.3.

Table 3.3: PROJECT SPECIFIC NOISE LEVELS

NAG	Period	RBL ¹	Acceptable Amenity Criterion L _{Aeq,period} dB	Maximum Amenity Criterion L _{Aeq,period} dB	Intrusiveness Criterion/PSNL L _{Aeq,15minute} dB
A	Day	33	50	55	38
	Evening	33 ²	45	50	38
	Night	33 ²	40	45	38
B	Day	38	50	55	43
	Evening	37	45	50	42
	Night	32	40	45	37
C	Day	38	50	55	43
	Evening	37	45	50	42
	Night	32	40	45	37
D	Day	31	55	60	36
	Evening	31 ²	45	50	36
	Night	30	40	45	35
E	Day	31	55	60	36
	Evening	31 ²	45	50	36
	Night	30	40	45	35
F	Day	31	55	60	36
	Evening	31 ²	55	50	36
	Night	30	40	45	35
G	Day	34	50	55	39
	Evening	34 ²	45	50	39
	Night	32	40	45	37
H	Day	33	50	55	38
	Evening	33 ²	45	50	38
	Night	32	40	45	37
I	Day	NA ⁴	50	55	37
	Evening	NA ⁴	45	50	37
	Night	NA ⁴	40	45	37
J	Day	34	50	55	39
	Evening	34	45	50	39
	Night	32	40	45	37
K	Day	30 ³	50	55	35
	Evening	30 ²	45	50	35
	Night	30	40	45	35

L	Day	NA ⁴	50	55	37
	Evening	NA ⁴	45	50	37
	Night	NA ⁴	40	45	37
M	Day	34	50	55	39
	Evening	34 ²	45	50	39
	Night	33	40	45	38
N	Day	40	55	60	45
	Evening	37	45	50	42
	Night	34	40	45	39
O	Day	30 ³	50	55	35
	Evening	30 ³	45	50	35
	Night	30 ³	40	45	35

Notes:

1. Rating Background Level L_{A90} dB;
2. Preceding time period RBL adopted in accordance with INP application notes;
3. INP default minimum RBL of 30 dB applied; and
4. NA indicates PSNL set at consent criterion for neighbouring mine, RBL not used.

3.3.2 Voluntary Land Acquisition and Mitigation Policy

The NSW government has recently published the Voluntary Land Acquisition and Mitigation Policy (VLAMP) for State Significant Mining, Petroleum and Extractive Industry Developments (NSW Government, 2014). This document describes the NSW Government's policy for voluntary mitigation and land acquisition to address noise impacts from State significant mining, petroleum and extractive industry developments.

Mitigation and acquisition criteria

The VLAMP provides the following guidance on the applicability of noise mitigation and acquisition criteria:

A consent authority can grant voluntary mitigation and acquisition rights to reduce:

- Operational noise impacts of a development on privately-owned land; and
- Rail noise impacts of a development on privately-owned land near non-network rail lines (private rail lines) on or exclusively servicing industrial sites (see Appendix 3 of the RING).

But not:

- Construction noise impacts, as these impacts are shorter term and can be controlled;
- Noise impacts on the public road or rail network; or
- Modifications of existing developments with legacy noise issues, where the modification would have

beneficial or negligible noise impacts. In such cases, these legacy noise issues should be addressed through site-specific pollution reduction programs under the Protection of the Environment Operations Act 1997.

Voluntary mitigation rights

The VLAMP states:

A consent authority should only grant voluntary mitigation rights:

- If the noise generated by the development would be equal to or greater than 3dB(A) above the INP project-specific noise level at any residence on privately owned land; or*
- If the development would increase the total industrial noise level at any residence on privately-owned land by more than 1dB(A), and noise levels at the residence are already above the recommended amenity criteria in Table 2.1 of the INP; or*
- If the development includes a private rail line and the use of that private rail line would cause exceedances of the recommended acceptable levels in Table 6 of Appendix 3 of the RING (see Appendix B) by greater than or equal to 3dB(A) at any residence on privately-owned land.*

All noise levels must be calculated in accordance with the INP or RING (as applicable).

Voluntary land acquisition rights

The VLAMP states:

A consent authority should only grant voluntary land acquisition rights where:

- The noise generated by the development would be more than 5dB(A) above the project specific noise level at any residence on privately-owned land; or*
- The noise generated by the development would contribute to exceedances of the recommended maximum noise levels in Table 2.1 of the INP on more than 25% of any privately owned land, and a dwelling could be built on that land under existing planning controls (voluntary land acquisition rights should not be applied to address noise levels on vacant land other than to vacant land specifically meeting these criteria); or*
- If the development includes a private rail line and the use of that private rail line would cause exceedances of the recommended maximum criteria in Table 6 of Appendix 3 of the RING at any residence on privately owned land.*

All noise levels must be calculated in accordance with the INP or RING (as applicable).

Existing developments with legacy noise issues

The policy recognises that in some circumstances it may not be possible to comply with assessment criteria even with the implementation of all reasonable and feasible mitigation measures. The policy

outlines the approach to decision making in these situations, including how to set levels at which mitigation and acquisition criteria apply. The policy also states that a consent authority cannot grant voluntary mitigation and acquisition rights for:

Modifications of existing developments with legacy noise issues, where the modification would have beneficial or negligible noise impacts. In such cases, these legacy noise issues should be addressed through site-specific pollution reduction programs under the Protection of the Environment Operations Act 1997.

It is Global Acoustics opinion the Project fulfils the criteria for 'modification of an existing development with legacy noise issues', and as demonstrated by model predictions, a reduction in noise impact relative to the existing situation is predicted despite the proposed production rate increase. The reduction would be achieved through implementation of noise mitigation measures in keeping with industry best practice. Furthermore, RCM predates the majority of NSR for which significant exceedance of PSNL is predicted. On this basis, noise mitigation and acquisition criteria outlined in the policy are not deemed applicable to this Project.

Vacant Land Assessment

Notwithstanding the above comments regarding the applicability of VLAMP criteria to the Project, an assessment of operational noise impact over vacant lots has been completed. The goal of the assessment is to determine if the recommended maximum noise levels in Table 2.1 of the INP are exceeded on more than 25% of any privately owned vacant land, on which a dwelling could be built under existing planning controls. As previously stated, VLAMP criteria are not deemed applicable to this Project.

Seven vacant lots, that retain planning approval for dwelling construction, were identified within the Project area. These are shown in Figure 2 and Figure 3. Each of these lots is considered 'rural' in accordance with the INP. Recommended maximum noise levels in Table 2.1 of the INP for rural land are L_{Aeq} 55/50/45 dB for the day/evening/night periods respectively. Results of the assessment are included in Section 4.2.3.

3.3.3 Proposed Criteria

RCM has entered into preliminary discussion regarding noise criteria with the NSW Department of Infrastructure and Environment (DPE) and the Environment Protection Agency (EPA). These authorities have agreed that RCM has legacy noise issues, and compliance with PSNL may not be possible during adverse meteorological conditions. As outlined in Section 10 of the INP, negotiation of achievable noise levels for existing operations may occur once reasonable and feasible noise mitigation options have been investigated.

RCM propose the following intrusive noise criteria be applied to the Project:

- $L_{Aeq,15minute}$ 40 dB for NAG D to O inclusive, applicable to all time periods; and
- $L_{Aeq,15minute}$ 42 dB for NAG A, B and C, applicable to all time periods.

Justification for these proposed criteria is provided in Section 6.

3.4 Sleep Disturbance Criteria

EPA INP application notes provide guidance on setting sleep disturbance criteria. The application notes state that a review of sleep disturbance research included in the 'NSW Road Noise Policy' (RNP) (DECCW¹ 2011) concludes, "the range of results is sufficiently diverse that it was not reasonable to issue new noise criteria for sleep disturbance".

The EPA recognises that a sleep disturbance criterion based on the $L_{A1,1\text{minute}}$ not exceeding background noise levels by more than 15 dB is not ideal. However, as there is insufficient evidence to determine an alternate criterion, the EPA continues to use it as a guide to identify the likelihood of sleep disturbance. This means that where this criterion is met, sleep disturbance is not likely, but where it is not met, a more detailed analysis is required. The detailed analysis should cover the maximum noise level, and, the number of occurrences during the night period.

As an initial assessment of sleep disturbance, a criterion of background (RBL) plus 15 dB has been adopted. The derived criterion for each NAG is presented in Table 3.4.

Table 3.4: SLEEP DISTURBANCE CRITERIA, $L_{A1,1\text{minute}}$ dB

NAG	RBL ¹	Criterion
A	33 ²	48
B	32	47
C	32	47
D	30	45
E	30	45
F	30	45
G	32	48
H	32	47
I	NA ⁴	47
J	32	47
K	30	45
L	NA ⁴	47
M	33	48
N	34	49
O	30 ³	45

Notes:

1. Rating Background Level L_{A90} dB;
2. Preceding time period RBL adopted in accordance with INP application notes;
3. INP default minimum RBL of 30 dB applied; and
4. Criterion is set 10 dB above adopted PSNL on the basis that the PSNL adopted from the consent for a neighbouring mine would be 5 dB above RBL.

¹ Now the Environment Protection Authority.

3.5 Cumulative Noise Criteria

As discussed in Section 3.3.1, the INP provides both intrusive and amenity noise criteria. Amenity criteria are intended to protect residents from the cumulative impact of industrial noise from all sources (excluding road, rail and community noise), whereas intrusive noise criteria are intended to be applied the project alone.

Recommended acceptable and maximum amenity criteria for each NAG are presented in Table 3.7.

3.6 Low Frequency Noise Criteria

Two methodologies have been adopted for assessment of low frequency noise (LFN):

- Evaluation of LFN through comparison of C-weighted and A-weighted predicted total noise levels at receptors, as per INP guidelines. In this method, the difference between C-weighted and A-weighted levels at receptor locations is calculated, and if the difference is greater than or equal to 15 dB, a 5 dB penalty (modifying factor) is added to predicted levels; and
- Evaluation of LFN through comparison of total predicted C-weighted levels at receptor locations with an upper limit criterion. This method is in accordance with recommendations published in A Simple Method for Low Frequency Noise Emission Assessment (Broner, 2010), published in the Journal of Low Frequency Noise, Vibration and Active Control, Volume 29 Number 1 2010. The author of the document recommends outdoor criteria for LFN assessment; Table 3.5 presents criteria recommended in the document. If the total predicted C-weighted noise level at a receptor exceeds the relevant criterion a 5 dB penalty (modifying factor) is added to predicted levels. In this assessment, the desirable limit for residential receptors of L_{Ceq} 60 dB has been adopted for the night period, and L_{Ceq} 65 dB for the day and evening periods.

Table 3.5: LOW FREQUENCY NOISE CRITERIA - BRONER METHOD

Land Use	Sensitive Receiver	Range	Criteria L_{Ceq} (dB)
Residential	Night time of plant operation 24/7	Desirable	60
		Maximum	65
	Daytime or Intermittent (1-2 hours)	Desirable	65
		Maximum	70
Commercial/Office	Night time or plant operation 24/7	Desirable	70
		Maximum	75
Industrial	Daytime or Intermittent (1-2 hours)	Desirable	75
		Maximum	80

Source: A Simple Method for Low Frequency Noise Emission Assessment by N. Broner.

3.7 Road Traffic Noise Criteria

The NSW Road Noise Policy (RNP) (DECCW² 2011) is applicable to road traffic noise generated by the

² Now the Environment Protection Authority.

project, and applies different noise limits dependent upon the development category and receptor type. Access to Rix's Creek Mine is via Rix's Lane and the New England Highway, which are designated local and arterial respectively in accordance with Section 2.2 of the RNP.

Table 3.6 shows the applicable residential noise level criteria for local and arterial roads affected by additional traffic generated by land use developments. These are external criteria for assessment against façade corrected noise levels.

Table 3.6: ROAD TRAFFIC NOISE CRITERIA

Development Type/Land Use	Day Criterion	Night Criterion
Local Roads		
Existing residences affected by additional traffic on existing local roads generated by land use developments	$L_{Aeq,1hour}$ 55 dB	$L_{Aeq,1hour}$ 50 dB
Arterial Roads		
Existing residences affected by additional traffic on existing freeways/arterials/ sub-arterial roads generated by land use developments	$L_{Aeq,15hour}$ 60 dB	$L_{Aeq,9hour}$ 55 dB

Notes:

1. Day $L_{Aeq,15hour}$ from 7am to 10pm ~ Night $L_{Aeq,9hour}$ from 10pm to 7am.

Section 2.4 of the RNP states that in addition to the assessment criteria outlined above, any increase in the traffic noise level at a location due to a proposed project or traffic generating development must be considered. Residences experiencing increases in total traffic noise level above a relative increase criterion should also be considered for mitigation. Table 3.7 shows relative increase criteria for residential land uses.

Table 3.7: RELATIVE INCREASE CRITERIA FOR RESIDENTIAL LAND USES

Development Type/Land Use	Total traffic noise level increase - dB(A)	
	Day 7am to 10pm	Night 10pm to 7am
New road corridor/redevelopment of existing road/land use development with the potential to generate additional traffic on existing road	Existing traffic $L_{Aeq,15hour}$ + 12 dB (external)	Existing traffic $L_{Aeq,9hour}$ +12 dB (external)

The 'existing' traffic noise level refers to the level from all road categories that would occur for the relevant 'no build' option. Where the existing road traffic $L_{Aeq,period}$ is found to be less than 30 dB, it is deemed to be 30 dB.

Section 3.4 of the RNP outlines procedures for applying the assessment and relative increase criteria. Essentially, once the study area is identified, assessment is undertaken to identify if any criterion, either assessment or relative increase, is exceeded. Where any exceedance is determined, feasible and reasonable mitigation measures should be identified and applied.

Where the controlling criteria are not achievable, and justification can be provided that reasonable and feasible mitigation measures have been applied, the RNP states: “for existing residences and other sensitive land uses affected by additional traffic on existing roads generated by land use developments, any increase in the total traffic noise level should be limited to 2 dB above that of the corresponding ‘no build option’.

3.8 Rail Noise Criteria

Appendix 3 of the NSW Rail Infrastructure Noise Guideline (RING) (EPA, 2013) outlines noise criteria for non-network rail lines on or exclusively servicing industrial sites.

Rail related activities occurring within the boundary of industrial premises are to be assessed as part of the industrial premises using the INP guideline.

Where a non-network rail line exclusively extends beyond the boundary of the industrial premises, noise from this section of track should be assessed against recommended acceptable noise amenity criteria for industrial noise sources for the relevant receiver type in Table 2.1 of the INP.

Rail noise generated within the project lease boundary essentially becomes part of the total site operational noise, and consent criteria determined for the project would apply for this activity. Acceptable noise amenity criteria, also presented in Table 3.7, are applicable for rail movements between the RCM lease boundary and the Great Northern Railway network rail line.

4 NOISE IMPACT ASSESSMENT

4.1 Noise Model Parameters

4.1.1 Meteorology

Under various wind and temperature gradient conditions, noise may be increased or decreased compared with still-isothermal conditions – that is, no wind or temperature gradient. Atmospheric conditions that most affect noise propagation are temperature and wind velocity gradients. They can both enhance or reduce noise propagation from source to receiver due to refraction of sound propagating through the atmosphere, brought about by a change in sound speed with height.

Noise levels are increased when the wind blows from source to receiver or under temperature inversion conditions (both of which are sometimes referred to as 'adverse weather conditions'), and decreased when the wind blows from receiver to the source or under temperature lapse conditions.

Eleven years of meteorological data (2003 to 2013) from the Integra Coal Mine weather station was analysed to determine the frequency of occurrence of each of the modelled meteorological conditions, by season and time period. Integra Coal Mine adjoins RCM to the north, and data recorded at this weather station is considered representative of weather conditions in the region.

Sigma-theta data was analysed, in accordance with procedures in Appendix E of the INP, to determine the appropriate stability class and associated vertical temperature gradient for each weather record. A vertical temperature gradient of 4 degrees C per 100 metres was adopted for atmospheric stability class F to capture predictions for the upper end of the range specified in Table E1 of the INP.

Analysis of meteorological data indicates that wind from the north to northwest occurs most commonly during the night period in winter. Outside of winter, the frequency occurrence of this wind direction is quite low, and south to southeast winds prevail. As most of the receptors in this assessment are located south to southeast of the mine, the wind conditions for winter are generally responsible for the night period worst-case season 90th percentile results. Outside of winter, prevailing winds tend to mitigate noise propagation towards these more densely populated areas, resulting in, for the majority of time, much lower predictions than presented in this report. Appendix D lists the 260 meteorological conditions included in the assessment.

4.1.2 Mining Scenarios

Four primary operating stages were modelled representing the various stages of development throughout the life of mine. The stages are referred to as Year 2017, Year 2020, Year 2023, and Year 2026. Each stage was divided into two secondary scenarios, representing day and evening/night operation. Plant quantities are generally similar for day and evening/night scenarios, however, overburden haulage and emplacement is modelled in more shielded locations in the evening/night scenarios. For each stage, results for two night scenarios are presented. The first represents full night operations with all proposed night scenario plant operational. The second scenario represents a modified night period scenario, where coaling equipment and reject haulage is excluded. For the 2017 stage, the modified night operations scenario includes omission of an overburden excavator and associated fleet, as well as

coaling and reject equipment. For the 2023 stage, the full operations night period scenario does not include the Liebherr 9800 shovel and associated fleet, so is essentially also a 'modified operations' scenario. However, model results (not presented) indicate that operation of the full fleet would be possible during neutral atmospheric and non-enhancing meteorological conditions with no predicted exceedance of PSNL.

Numerous refinements were made for each stage plan to determine the most efficient mine plan layout with regard to managing noise emissions. Further details of proposed noise mitigation measures are provided in Section 4.1.3.

All known major noise sources were included in model scenarios. Plant (other than locomotives which were modelled as idling on the rail loop) was modelled at maximum sound power, and assuming all plant operates continuously and simultaneously. In reality, this rarely occurs; as such, modelled results are considered conservative. Modelled plant quantities represent in-service levels and include an allowance for availability and utilisation.

Table 4.1 list representative typical plant quantities included in each model stage. Figure B.1 to Figure B.10 in Appendix B show modelled plant locations and pit shell topography.

Table 4.1: OPEN CUT PLANT ITEMS INCLUDED IN MODELS

Description	Plant Quantities			
	2017	2020	2023	2026
Liebherr R9800 excavator	1	1	1	1
Hitachi EX5500 excavator	1	1	2	1
Caterpillar 994 front end loader	1	1	1	1
Caterpillar 992K front end loader	0	1	1	1
Caterpillar 992C front end loader	1	0	0	0
Caterpillar 16G grader	1	1	2	1
Caterpillar 24H grader	2	2	2	2
Caterpillar D10/D11 dozer	5	5	6	5
Bucyrus SK98 blast hole drill	1	1	1	1
Reeddrill SK50 blast hole drill	1	1	1	1
Reeddrill SK75 blast hole drill	1	1	1	1
Caterpillar 793FXQ rear dump truck	4	10	14	13
Caterpillar 789CXQ rear dump truck	0	2	4	5
Caterpillar 785CXQ watercart	0	1	2	2
Caterpillar 793B,C,D rear dump truck	6	0	2	0
Caterpillar 793F rear dump truck	1	1	1	0
Caterpillar 789C rear dump truck	5	3	1	0
Caterpillar 785C watercart	2	2	1	0
Caterpillar 777 watercart	1	1	1	1

Notes:

1. Table shows representative typical plant to allow for assessment.

Table 4.2: CHPP PLANT ITEMS INCLUDED IN MODELS (all stages)

Description	Quantity
CPP building (wash plant)	1
Breaker	1
Conveyors	6
Transfer stations with conveyor drives	6

Table 4.3: RAIL INFRASTRUCTURE INCLUDED IN MODELS (all stages)

Description	Quantity
Stockpile dozers	1
Locomotives on rail loop (idle)	3
Rail load out bin	1
Conveyors	4
Transfer stations with conveyor drives	3
Coal haul trucks (semi trailer)	3

4.1.3 Noise Control Measures

Noise controls and management strategies included in the modelling assessment are discussed in Sections 2.4 and 5.

4.1.4 Plant Sound Power

All acoustically significant noise sources on site are included in the models. Global Acoustics undertake regular sound power testing of mining equipment. Sound powers used in modelling, provided in Table 4.4, are, where possible based on measured in-service levels of plant operating at RCM. Where test data were not available, for instance for plant items not yet in service, sound power levels for similar plant items in use in the Hunter Valley were adopted. Equipment types provided are indicative to allow for assessment; RCM may use alternate equipment types with similar sound power.

As discussed in Section 2.4, the iterative modelling process identified a requirement for attenuation of certain plant items. Discussion of sound power adopted for these items is included in the following points:

- New haul trucks and watercarts will be fully attenuated. Existing trucks on site will remain un-attenuated until they are replaced;
- Dozers operating in exposed areas, such as overburden emplacement areas, will be restricted to 1st gear during period of adverse meteorological conditions;
- The Liebherr R9800 excavator is fitted with a low noise emission muffler/exhaust system, and, hydraulic cooling fan air inlet and air outlet silencers. The existing Hitachi EX5500 excavator and Caterpillar 994 front end loader are un-attenuated. Future excavators and loaders will be attenuated;

- Three blast hole drills were modelled with attenuated sound power levels;
- RCM proposes to clad the southern and eastern facades of the CPP. Global Acoustics measured the sound power of the facades on 20 October 2014 by measuring sound pressure level directly within each open area. Attenuated sound power levels of the facades representing the future sheeted state were calculated by applying a transmission loss measured at other CPP in the Hunter Valley. Allowances were made for openings in the facades to account for conveyor penetrations. Calculations assumed both facades will be sheeted from ground level to the eaves, and that sheeting will be either resiliently mounted, or constructed as an isolated barrier wall fixed to the main structure only at roof level.

Sound power for CHPP and rail load out infrastructure, other than the CPP, is consistent with previous ENA undertaken for RCM, including the PRP and Rix's Creek Rail Loop and Loading Facility Environmental Noise Assessment (Global Acoustics, 2012).

Haul truck sound powers were incorporated into haul routes by creating haul route strings along the length of each haul route. This method distributes the acoustic energy of the vehicles along the length of each route. Routes comprised a string of segments of fixed length, each segment having a sound power determined by the following:

- Sound power for type of trucks on route. Trucks travelling down ramps greater than 5% grade were allocated a reduced sound power;
- Number of each truck type on route in 15-minute period, based on loading unit load capacity;
- Speed of loaded truck on segment grade toward dump/ROM; and
- Speed of empty truck on segment grade from dump/ROM.

Truck speeds are relative to grade in direction of travel and were allocated in accordance with truck speed data collected from mine sites in the Hunter Valley. Speed determines the duration required to traverse each segment, an important variable when calculating L_{Aeq} for a specific time period. Graders and water carts were allocated sound powers in a similar manner. Haul truck and watercart sound powers shown in Table 4.4 are uphill loaded, full power levels.

Train sound powers were incorporated by creating strings of points representing the sections of track the train would traverse in each 15-minute period. The sound power of each string point was determined using the speed of the train at each point.

Sound power for the breaker was from data measured by Global Acoustics at RCM during September 2012.

Sound power for the locomotives was from data measured by Global Acoustics at Bloomfield Colliery during September 2012.

Sound power for conveyors, drives, rail bin, and dozers were based on representative sound power for similar items in service in the Hunter Valley.

Table 4.4: SOUND POWER DATA

Description ¹	Octave Band Sound Power Spectrum, L _{eq} dB									Total L _{eq} dB	
	31.5	63	125	250	500	1k	2k	4k	8k	Lin	A wt
Open Cut Sound Power											
Liebherr R9800 excavator	-	123	121	115	115	109	110	102	96	126	117
Hitachi EX5500 excavator	-	115	122	120	118	115	112	108	104	126	120
Caterpillar 994 front end loader	-	111	121	116	115	114	111	105	102	124	119
Caterpillar 992K front end loader	-	106	111	109	108	110	106	99	93	117	113
Caterpillar 992C front end loader	-	114	120	116	114	112	110	106	106	124	118
Caterpillar 16G grader	-	106	114	109	109	111	107	104	97	118	115
Caterpillar 24H grader	-	105	118	114	110	109	108	103	102	121	115
Caterpillar D10 dozer	-	110	119	113	114	111	107	97	90	122	116
Caterpillar D11 dozer	-	110	119	113	114	111	107	97	90	122	116
Bucyrus SK98 blast hole drill	-	109	111	110	111	106	105	98	94	117	112
Reedmill SK50 blast hole drill	-	104	109	111	109	106	104	97	96	116	111
Reedmill SK75 blast hole drill	-	106	111	113	111	108	106	99	98	118	113
Caterpillar 793FXQ rear dump truck	-	123	122	116	114	113	111	104	102	127	118
Caterpillar 789CXQ rear dump truck	-	119	118	113	109	110	109	100	93	123	115
Caterpillar 785CXQ watercart	-	112	120	115	113	109	108	101	106	123	116
Caterpillar 793B,C,D rear dump truck	-	119	123	119	120	117	113	108	104	127	122
Caterpillar 793F rear dump truck	-	128	126	122	121	117	115	110	111	131	123
Caterpillar 789C rear dump truck	-	120	122	121	120	115	113	109	111	127	122
Caterpillar 785C watercart	-	117	124	120	117	113	111	108	106	127	120
Caterpillar 777 watercart	-	116	117	113	113	112	111	107	106	122	117
CHPP Sound Power											

Description ¹	Octave Band Sound Power Spectrum, L _{eq} dB									Total L _{eq} dB	
	31.5	63	125	250	500	1k	2k	4k	8k	Lin	A wt
CPP north facade	130	123	113	111	110	108	105	99	87	131	113
CPP west facade	131	124	113	111	110	108	105	99	87	132	113
CPP east facade	127	122	113	106	102	93	88	83	80	129	104
CPP south facade	123	119	110	102	100	91	87	82	78	125	102
Breaker north facade	121	119	117	113	116	112	107	98	88	125	117
Breaker east facade	121	119	117	113	116	112	107	98	88	125	117
Breaker west facade	122	116	115	112	112	109	104	94	82	124	114
Breaker south facade	122	116	115	112	112	109	104	94	82	124	114
Conveyors per metre	-	77	77	76	76	73	69	61	53	83	78
Conveyor drives	-	87	86	94	94	90	85	80	85	99	95
Rail Infrastructure Sound Power											
Coal haul trucks (semi trailer)	-	100	108	103	106	103	103	97	94	113	109
Stockpile dozer	-	109	118	115	112	111	107	101	94	122	115
Locomotives (3)	116	118	112	103	102	100	96	89	79	121	105
Conveyors per metre	-	77	77	76	76	73	69	61	53	83	78
Conveyor drives	-	87	86	94	94	90	85	80	85	99	95
Rail loadout bin	-	110	107	98	97	97	98	91	79	112	103
Conveyors per metre	-	77	77	76	76	73	69	61	53	83	78
Conveyor drives	-	87	86	94	94	90	85	80	85	99	95

Notes:

1. Indicative equipment types to allow for assessment.

4.2 Operational Noise Assessment

4.2.1 Operational A-weighted Predictions

Table 4.5 presents results for neutral atmospheric conditions for the four modelled stages. Results are presented as a range of levels indicating the lowest and highest predictions within each NAG. NAG J and NAG K have predictions up to $L_{Aeq,15minute}$ 37 dB for the 2017 stage. Predictions for subsequent stages are less than $L_{Aeq,15minute}$ 32 dB for these two NAG. Predictions for all other NAG are less than or equal to $L_{Aeq,15minute}$ 35 dB for all stages. These results indicate that during neutral atmospheric conditions, noise impact is predicted to be minimal, and in many cases RCM would be inaudible.

Table 4.6 presents a summary of 90th percentile operational noise results for the four modelled stages. Results are presented as a range of levels for the worst case season, indicating the lowest and highest predictions within each NAG.

For each stage, results for two night scenarios are presented (N1 and N2). The first represents normal night operations with all proposed night plant operational. The second scenario represents a modified night period scenario, where coaling equipment and reject haulage is excluded. For the 2017 N2 scenario, an additional overburden excavator (and associated trucks) is also excluded. RCM are aware that it may be necessary to exclude (shut down) additional plant other than modelled in order to comply with noise limits negotiated with regulators. This is particularly evident for the 2017 stage, where scaling back to just one loading unit may be required during adverse meteorological conditions (as modelled).

All predictions in this section are based on use of the approved Rix's Creek rail loading facility. Comparison of results between the RCM and Integra rail loading facilities are presented in Section 4.2.2.

90th percentile predicted results for all private receptor locations included in the assessment are presented in Appendix A, Table A.1.

Figure 7 to Figure 11 show indicative night period modified operations scenario $L_{Aeq,15minute}$ noise contours for each stage. Noise contours for all night period scenarios are presented in Appendix C.

The following points provide a discussion of model predictions for each NAG.

- NAG A - 90th percentile $L_{Aeq,15minute}$ levels up to 42 dB are predicted at the most affected NSR, which constitutes a 4 dB exceedance of the PSNL. The modified night operations scenarios indicate that compliance with PSNL can be achieved for all stages, with the exception of a minor 1 dB exceedance at NSR 5 in Year 2023. All predictions comply with the proposed criterion for this NAG of $L_{Aeq,15minute}$ 42 dB. These predictions are based on use of the RCM rail loading facility. Comparison of results between the RCM and Integra rail loading facilities are presented in Section 4.2.2.
- NAG B - No exceedance of PSNL is predicted for the day period. Minor 1 dB exceedances of PSNL are predicted for the evening period for the 2017 stage, with compliance predicted

thereafter. During the night period, 90th percentile $L_{Aeq,15\text{minute}}$ up to 45 dB are predicted at the most affected NSR, which constitutes an 8 dB exceedance of PSNL. The modified night operations reduces predictions to $L_{Aeq,15\text{minute}}$ 41 dB, which is less than the proposed criterion for this NAG of $L_{Aeq,15\text{minute}}$ 42 dB. The nearest NSR in this NAG is located within approximately 1,500 metres of the CHPP, and within approximately 750 metres of the Great Northern Railway.

- NAG C - No exceedance of PSNL is predicted for the day period. Minor exceedances of PSNL of 1 to 2 dB are predicted for the evening period for the 2017 stage, with compliance predicted thereafter. During the night period, a 90th percentile $L_{Aeq,15\text{minute}}$ of 46 dB is predicted at the most affected NSR, which constitutes a PSNL exceedance of 9 dB. The modified night operations reduces the prediction for this NAG to $L_{Aeq,15\text{minute}}$ 41 dB, which is less than the proposed criterion for this NAG of $L_{Aeq,15\text{minute}}$ 42 dB.
- NAG D - 90th percentile $L_{Aeq,15\text{minute}}$ up to 43 dB are predicted at the most affected NSR during the day and evening periods in 2017 and 2020; this constitutes an exceedance of PSNL of up to 7 dB. However, it is likely that strong lapse conditions that usually prevail during the day period would typically result in this level not being realised. The exception may be during the early morning period in winter, and late evening when conditions transition to night, during which time operations may be modified to reduce emissions. Night period predictions for full operations exceed the proposed criterion of $L_{Aeq,15\text{minute}}$ 40 dB; however, modified night operations results do not exceed 38 dB.
- NAG E - 90th percentile $L_{Aeq,15\text{minute}}$ up to 40 and 41 dB are predicted at the most affected NSR during the evening and night periods respectively in 2017, which constitutes an exceedance of PSNL of up to 6 dB. In later stages the maximum predicted PSNL exceedance is 4 dB at night in 2020. Night period predictions for full operations exceed the proposed $L_{Aeq,15\text{minute}}$ 40 dB criterion by a minor 1 dB for the 2017 stage, however, modified night operations results do not exceed 35 dB.
- NAG F - As for most NAG, the worst case results are for the 2017 stage for which PSNL exceedances of 2, 3 and 4 dB are predicted at the most affected NSR for the day, evening and night periods respectively. Only a minor PSNL exceedance of 2 dB at night is predicted at the most affected NSR for the 2020 stage; no PSNL exceedances are predicted for 2023 and 2026. Predicted levels for both full and modified operations, at the most affected NSR, are less than the proposed $L_{Aeq,15\text{minute}}$ 40 dB criterion for all periods of all stages.
- NAG G - 90th percentile $L_{Aeq,15\text{minute}}$ up to 46 dB are predicted at the most affected NSR during the day and evening periods of 2017, which constitutes 7 and 8 dB exceedances of PSNL. In fact, PSNL exceedances are predicted for all periods and all stages, although it is likely that road traffic noise from the New England Highway would often mask mining noise during the day and evening periods at these NSR. No PSNL exceedances are predicted for the least affected NSR (for any period or stage). Night period predictions for full operations exceed the proposed $L_{Aeq,15\text{minute}}$ 40 dB criterion by up to 6 dB; however modified night operations results comply with the proposed criterion of 40 dB for all stages. The greatest impact is predicted for the 2017 stage, after which significant reductions in noise levels are predicted across all time periods as

the mine progresses.

- NAG H - 90th percentile $L_{Aeq,15minute}$ up to 44 dB are predicted at the most affected NSR during the day and evening periods, and up to 45 dB during the night period. The night result constitutes an 8 dB PSNL exceedance. Night period predictions for full operations exceed the proposed $L_{Aeq,15minute}$ 40 dB criterion by up to 5 dB, however, modified night operations results comply with this criterion for all stages. The greatest impact is predicted for 2017 after which significant reductions in noise levels are predicted across all time periods.
- NAG I - 90th percentile $L_{Aeq,15minute}$ of 40 dB are predicted at the most affected NSR during the evening and night periods for the 2017 stage, which constitutes a 3 dB PSNL exceedance. Minor day period exceedances of 2 and 1 dB are predicted for one NSR during the 2017 and 2020 stages. All other predictions for all other periods comply with PSNL. Night period predictions for the modified operations scenario are significantly less than the proposed $L_{Aeq,15minute}$ 40 dB criterion, whilst up to 40 dB is predicted for full operations.
- NAG J - This NAG has the highest predictions, and the greatest potential for noise impact. The greatest impact is predicted for the 2017 stage, after which significant reductions in noise levels are predicted across all time periods as the mine progresses. RCM is cognisant of the need to carefully manage noise levels in this area. Modifying operations to reduce levels to the proposed criterion of $L_{Aeq,15minute}$ 40 dB would result in beneficial reductions for NSR located further from the site in the same general direction. Day and evening period levels up to $L_{Aeq,15minute}$ 47 and 48 dB respectively are predicted for the worst affected NSR in the 2017 stage, which constitute 8 and 9 dB exceedances of PSNL. Modified operations for the day and evening periods were not assessed; however RCM are committed to managing noise emission from the site to achieve the proposed noise criterion as required. Modified night scenario results for 2017 exceed the proposed criterion by 2 dB, suggesting further modification of operations may be required than modelled during periods of particularly adverse weather.
- NAG K - Results for the most affected NSR in this NAG are similar to NAG J, although compliance with the proposed $L_{Aeq,15minute}$ 40 dB criterion is predicted for the modified night scenario. The greatest impact is predicted for the 2017 stage, after which significant reductions in noise levels are predicted across all time periods as the mine progresses.
- NAG L - A worst case 90th percentile $L_{Aeq,15minute}$ of 41 dB is predicted at the most affected NSR during the 2017 evening period; this constitutes a 4 dB PSNL exceedance. Night period predictions for both full and modified operations are less than the proposed $L_{Aeq,15minute}$ 40 dB criterion, although a minor 2 dB exceedance of PSNL is predicted for full night operations in 2017 (but are predicted to comply with PSNL for all other stages).
- NAG M - No exceedance of PSNL is predicted for the day period. 90th percentile $L_{Aeq,15minute}$ up to 41 dB are predicted at the most affected NSR during the 2017 evening period; this constitutes a 2 dB PSNL exceedance. Night period predictions for both full and modified operations are less than the proposed $L_{Aeq,15minute}$ 40 dB criterion, although a minor 2 dB exceedance of PSNL is predicted for full night operations in 2017 (but are predicted to comply

with PSNL for all other stages).

- NAG N - No exceedance of PSNL is predicted for any day period. A worst case 90th percentile $L_{Aeq,15minute}$ of 46 dB is predicted at the most affected NSR during the 2017 evening and night periods, which constitutes a 4 dB exceedance of the evening PSNL. It is likely that road traffic noise from the New England Highway would often mask mining noise during the day and evening periods at the most affected NSR. Night period predictions for full operations exceed the proposed $L_{Aeq,15minute}$ 40 dB criterion by up to 6 dB, however, modified night operations results comply with this criterion. The greatest impact is predicted for the 2017 stage, after which no exceedance of PSNL is predicted for any stage or time period. It is noted that NSR 175, 176, 178 and 179 are designated acquisition upon request in the Integra Open Cut Consolidated Approval. If these NSR are excluded there are no predicted PSNL exceedances for any period of any stage.
- NAG O - A worst case evening 90th percentile $L_{Aeq,15minute}$ of 42 dB is predicted at the most affected NSR for the 2017 stage; this constitutes a 7 dB PSNL exceedance. Day period PSNL exceedances of 3 and 1 dB are predicted for 2017 and 2020 with compliance predicted for later stages. Night period predictions for full operations exceed the proposed $L_{Aeq,15minute}$ 40 dB criterion by up to 3 dB; however modified night operations results comply with this criterion for all stages.

4.2.2 Rail Loading Infrastructure Options

At the time of this assessment, it is not known whether the Integra rail facility will continue to be used in the future, or if the RCM rail facility option will be progressed. Therefore, both rail loading facilities have been assessed. Table 4.7 presents 90th percentile model predictions for the Project based on operation of the Integra rail facility. The difference relative to the RCM rail facility predictions presented in Appendix A, Table A.1 are shown in brackets. A positive value indicates an increase is predicted due to operation of the Integra rail facility.

Results are presented for NSR within NAG A and B. NAG C and D were also modelled, but the difference in predictions between the two options is insignificant and so no results are presented. No evaluation of the difference between rail load facilities was undertaken for NAG E to O as noise levels at these will be dominated by other sources.

With the project utilising the Integra rail loadout facility, prediction for NAG B are generally +/- 1 dB relative to the RCM rail option. However, for NAG A the outcome is significantly different, with use of the Integra rail loadout facility resulting in predictions up to 9 dB higher than the RCM rail option (for the modified night operations scenario). The primary contributor to these higher levels is the dozer operating on the coal stockpiles at the Integra rail facility; it has been modelled in an exposed location high on the eastern side of the stockpiles, a worst case scenario. Noise emission is significantly less if the dozer operates lower and/or on the western side of the stockpiles.

It should be noted that these predictions are for adverse meteorological conditions, which are predicted to occur approximately 30 percent of time during the night period in the worst case season. The expected frequency of train loading at night at maximum production is approximately 6 trains per week.

The duration of loading is typically 2.5 hours. Statistically, the probability of train loading aligning with both adverse meteorological conditions, and, worst case operating location of the dozer is considered low. That is, it is not expected these levels would be realised on a regular basis. Additionally, the modelled scenario representing use of the Integra rail loadout facility is consistent with the existing situation. Therefore, noise levels of this magnitude would not be new to NSR in this area.

NSR within NAG A have intrusive noise criteria up to $L_{Aeq,15\text{minute}}$ 42 dB under the Integra Coal Operations Consolidated Approval (DA 08_0101 and 08_0102). It is considered equitable and logical for RCM to be afforded the same criteria when operating at the same facility.

4.2.3 Vacant Land Assessment

As described in Section 3.3.2, an assessment of operational noise impact over privately owned vacant land was undertaken. Noise contours were generated over the vacant lot areas for each of the four modelled stages. From these, the maximum envelope of predicted noise emissions was determined for each time period to determine the maximum extent of noise impact over the life of the Project. The night period assessment is based on the 'full operations' scenarios (N1). There is no vacant land where the night period criterion is exceeded as a result of the night period 'modified operations' scenarios (N2).

For each time period, the relevant noise contour corresponding to the recommended maximum noise levels from Table 2.1 of the INP was used to calculate the percentage of area exceeding the criterion. Results are presented in Table 4.5. Values in bold type indicate results that exceed 25 percent of the lot area. Lot 1 DP 121623 currently retains acquisition rights from both Integra and Ashton South East Open Cut consents, while Lot 1 DP 1136411 retains acquisition rights under the Ashton South East Open Cut. Lot 54 DP 252692 is held in joint ownership, by two landholders, as part of a large rural holding which adjoins Rixs Creek Mine and Ashton South east open Cut.

Figure 4, Figure 5 and **Figure 6** show the maximum extent contours for the day, evening and night (N1) periods respectively. Vacant lots are shown in blue, and relevant time period criterion contours are indicated by red lines.

Table 4.5: VACANT LAND ASSESSMENT RESULTS (%)

Lot Details		L_{Aeq} Criteria ¹			Percentage Area Exceeding Criterion		
Lot	DP	Day	Evening	Night	Day	Evening	Night
1	121623	55	50	45	<20	<20	53
1	1136411	55	50	45	<20	<20	81
2	804005	55	50	45	<20	<20	<20
3	1111313	55	50	45	<20	<20	<20
52	252692	55	50	45	<20	<20	<20
53	252692	55	50	45	<20	<20	22
54	252692	55	50	45	33	<20	23

Notes:

1. Recommended maximum noise levels from Table 2.1 of the INP; and
2. Bolded results exceed 25 percent.

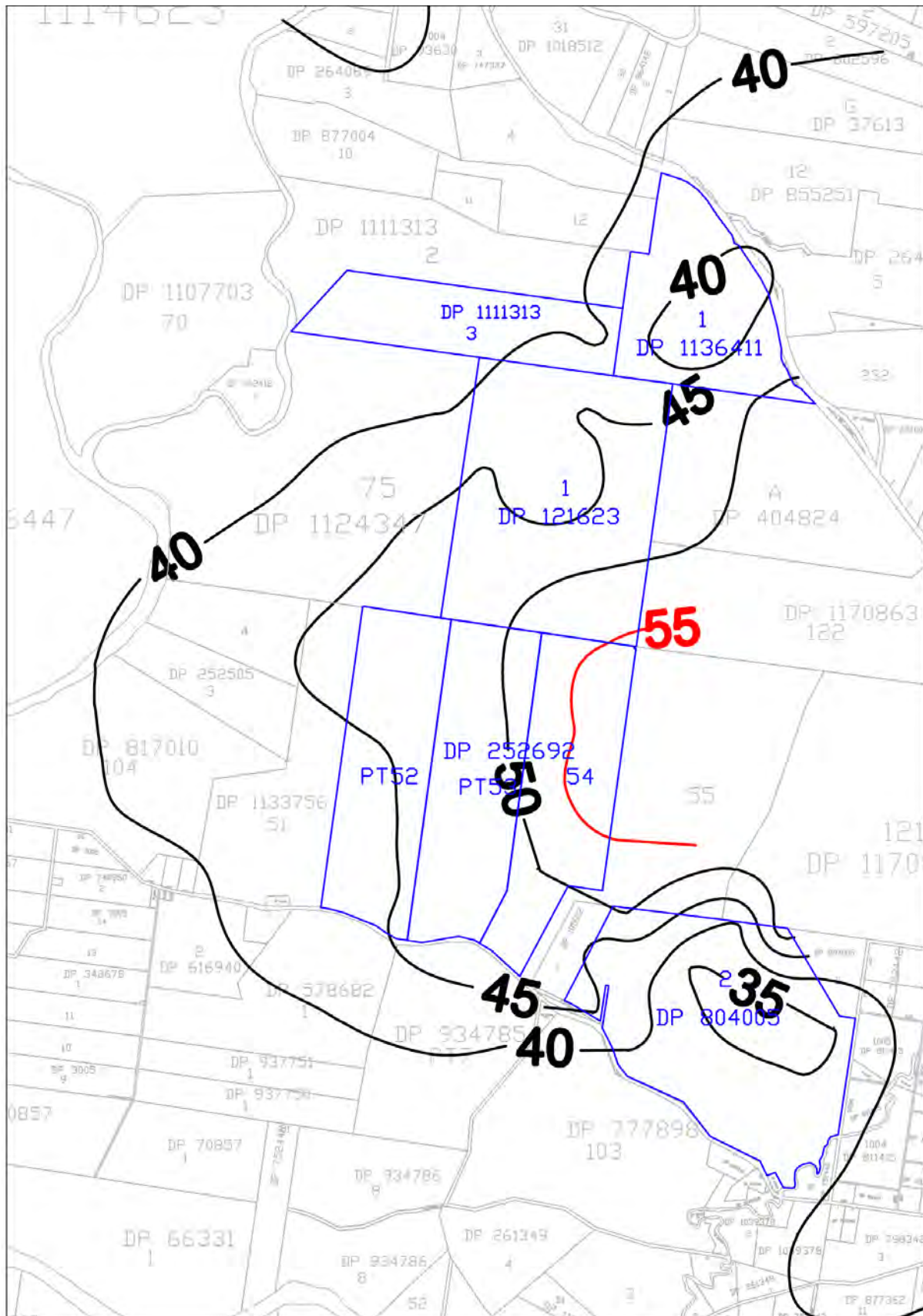
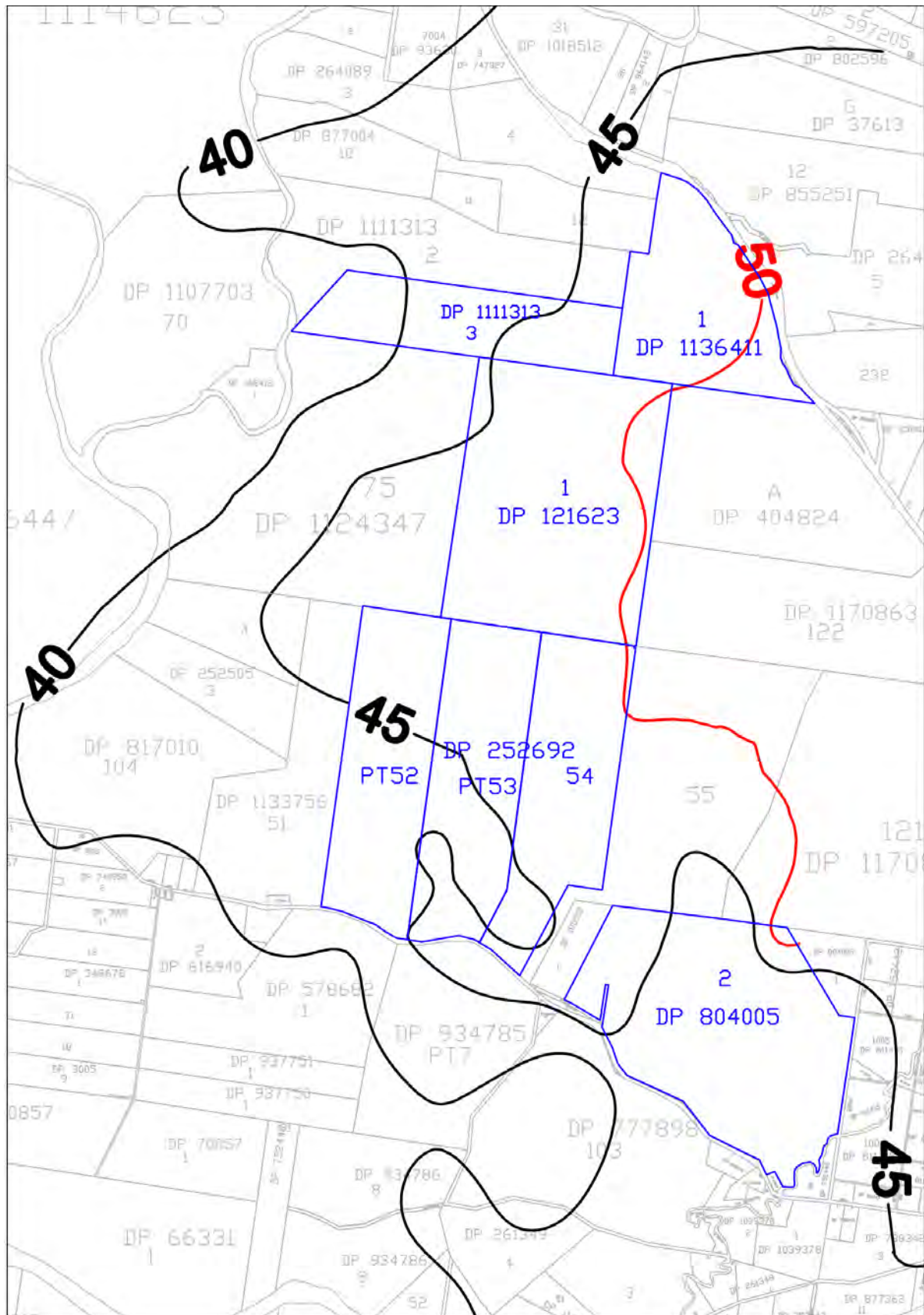


Figure 4 - Maximum Envelope Contours over Vacant Land - Day Period



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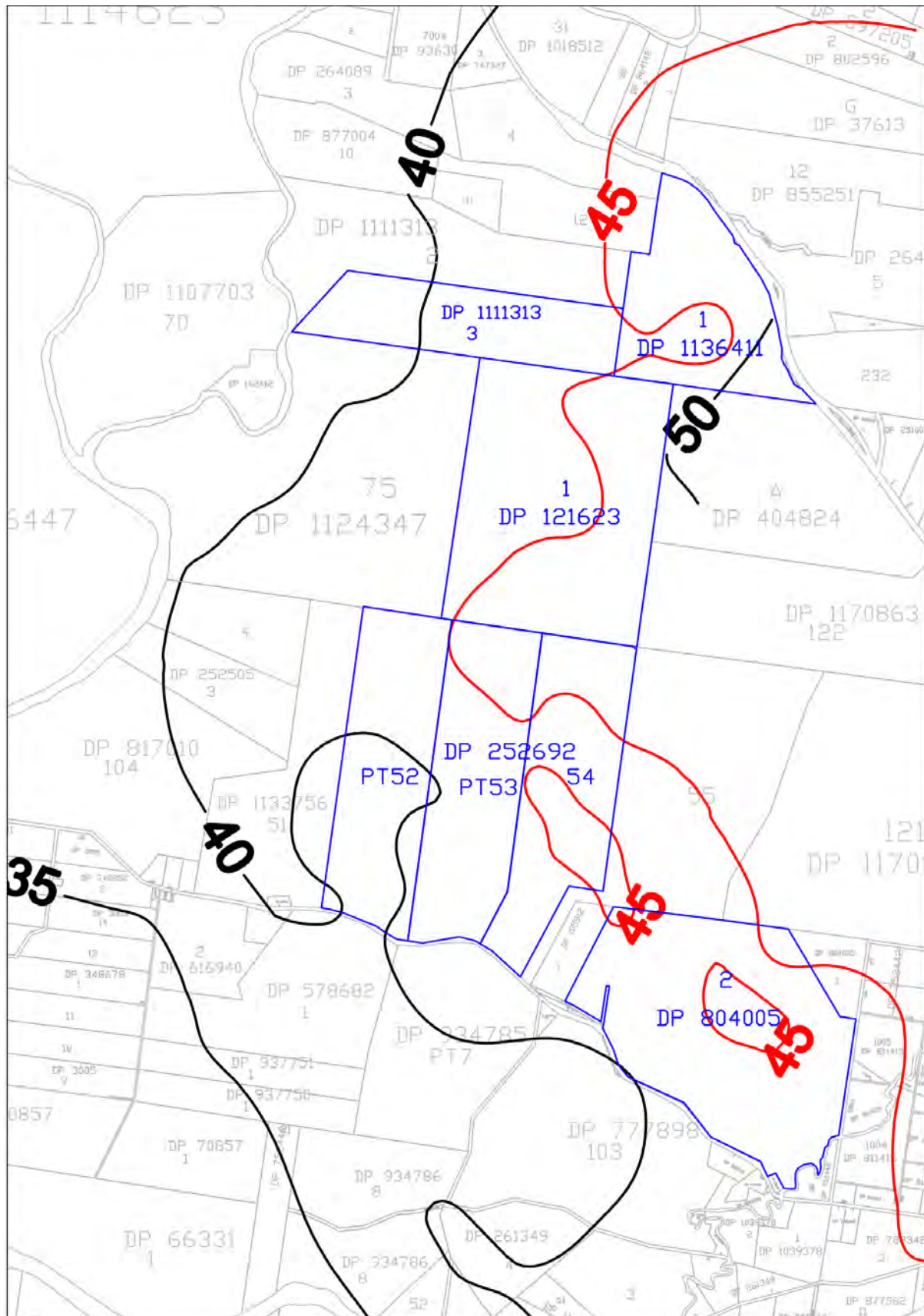


Figure 6 - Maximum Envelope Contours over Vacant Land - Night Period (N1 Scenarios)

Table 4.6: NEUTRAL ATMOSPHERE OPERATIONAL PREDICTIONS – $L_{Aeq,15\text{minute}}$ dB

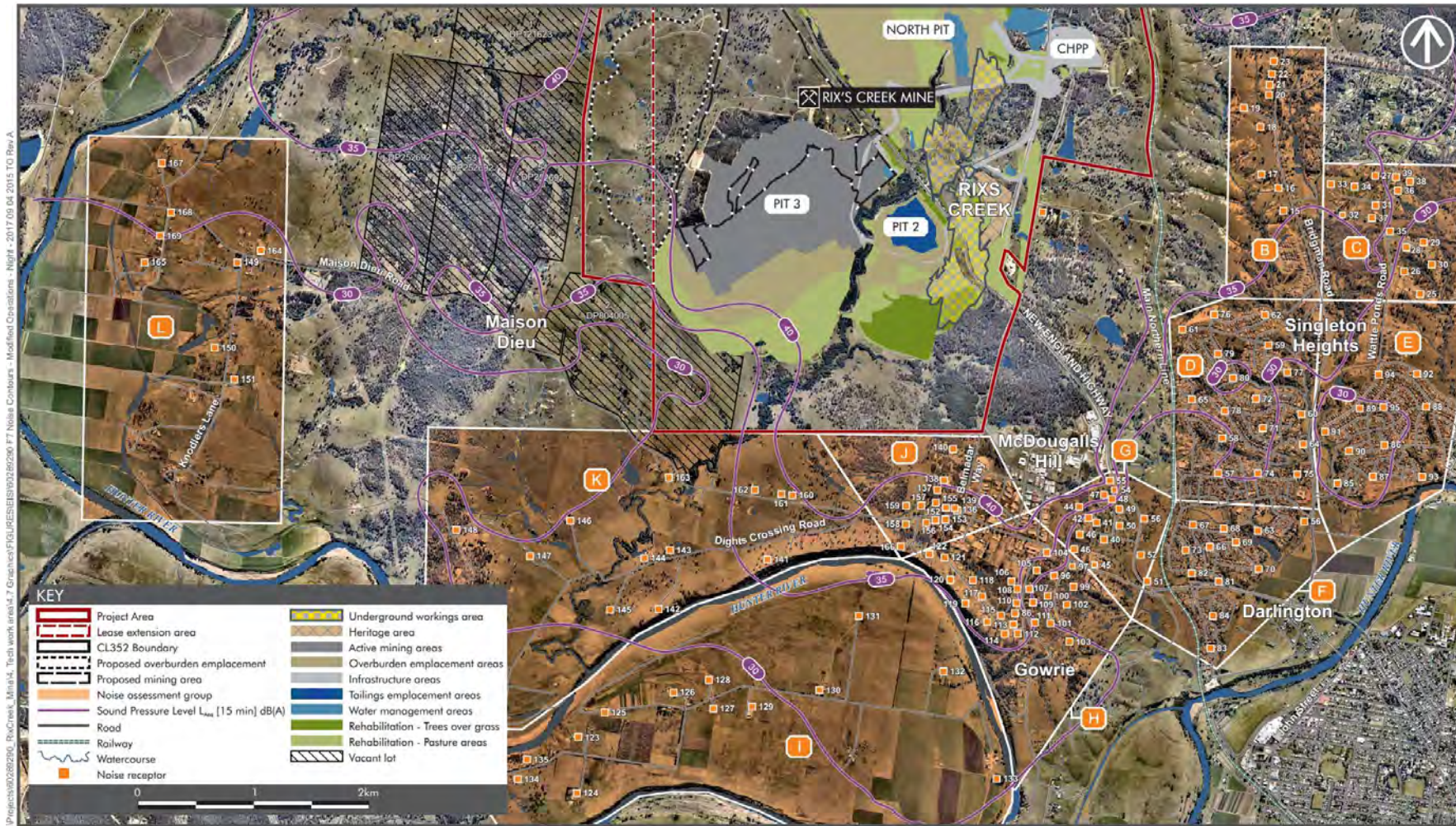
NAG	PSNL			2017				2020				2023				2026			
	Day	Eve	Night	Day	Eve	Night 1	Night 2	Day	Eve	Night 1	Night 2	Day	Eve	Night 1	Night 2	Day	Eve	Night 1	Night 2
A	38	38	38	19-34	19-34	19-34	13-29	17-32	15-30	15-30	13-27	15-30	14-29	14-29	13-28	15-29	14-28	14-28	13-27
B	43	42	37	32-32	32-32	32-32	24-24	30-30	29-29	29-29	24-24	28-28	27-27	27-27	25-25	28-28	26-26	26-26	24-24
C	43	42	37	25-33	25-33	25-33	17-25	23-31	21-30	21-30	16-24	21-28	20-28	20-28	18-26	21-29	20-27	20-27	18-25
D	36	36	35	24-30	25-30	25-30	16-22	22-27	21-27	21-27	17-22	20-25	19-25	19-25	17-22	20-25	19-24	19-24	16-22
E	36	36	35	18-26	18-26	18-26	12-18	16-24	15-23	15-23	11-18	15-22	14-21	14-21	13-19	15-22	14-20	14-20	12-18
F	36	36	35	22-24	21-24	21-24	14-16	20-22	18-20	18-20	14-16	18-20	16-19	16-19	14-16	18-20	16-18	16-18	13-16
G	39	39	37	23-34	23-34	23-34	16-23	22-31	19-29	19-29	15-24	20-28	18-26	18-26	16-23	20-28	17-27	17-27	15-23
H	38	38	37	25-31	25-33	25-33	16-25	23-29	21-28	21-28	18-23	21-26	20-25	20-25	17-21	20-27	19-25	19-25	16-21
I	37	37	37	21-25	21-26	21-26	14-19	21-25	17-23	17-23	14-19	17-20	15-19	15-19	13-17	19-22	14-18	14-18	11-16
J	39	39	37	28-33	28-37	28-37	22-32	28-32	24-30	24-30	21-25	23-28	22-27	22-27	20-24	25-29	21-27	21-27	19-24
K	35	35	35	25-34	22-37	22-37	15-31	25-31	19-32	19-32	16-26	19-26	17-26	17-26	15-24	22-27	16-25	16-25	14-20
L	37	37	37	25-28	21-25	21-25	12-16	24-30	14-19	14-19	12-17	19-22	14-18	14-18	11-15	17-23	13-17	13-17	10-15
M	39	39	38	25-26	21-24	21-24	14-14	25-26	16-17	16-17	13-15	19-21	15-17	15-17	14-15	20-21	16-17	16-17	14-15
N	45	42	39	22-29	23-35	23-35	13-17	20-24	16-21	16-21	13-18	18-22	15-20	15-20	14-18	18-22	15-20	15-20	14-18
O	35	35	35	24-28	27-33	27-33	18-19	22-25	19-20	19-20	17-19	20-22	19-20	19-20	18-19	21-23	19-20	19-20	17-19

Table 4.7: 90th PERCENTILE OPERATIONAL PREDICTIONS - L_{Aeq,15minute} dB

NAG	PSNL			2017				2020				2023				2026			
	Day	Eve	Night	Day	Eve	Night 1	Night 2	Day	Eve	Night 1	Night 2	Day	Eve	Night 1	Night 2	Day	Eve	Night 1	Night 2
A	38	38	38	25-40	27-41	28-42	25-38	26-39	23-39	24-40	22-38	22-38	22-38	23-39	23-39	24-38	22-38	22-39	22-38
B	43	42	37	42-43	42-43	44-45	37-40	40-41	40-41	42-43	36-40	39-40	38-40	40-42	38-41	39-41	39-40	41-42	39-41
C	43	42	37	33-44	31-44	33-46	26-40	31-41	27-42	29-44	23-41	28-40	25-40	26-42	25-41	30-40	27-40	28-42	25-41
D	36	36	35	36-42	34-43	35-43	26-35	32-39	33-43	34-44	24-37	30-38	29-39	30-40	27-38	30-38	31-39	32-39	29-38
E	36	36	35	24-39	25-40	29-41	16-33	21-38	21-39	23-39	15-34	23-36	18-36	20-37	18-35	23-36	22-36	27-37	19-35
F	36	36	35	34-38	36-39	37-39	23-29	31-36	34-37	35-38	23-31	30-34	29-33	30-33	25-30	29-34	29-34	30-35	25-32
G	39	39	37	32-45	35-46	36-46	21-40	31-43	24-42	25-44	22-40	28-41	25-41	25-42	22-40	25-40	25-40	26-41	22-39
H	38	38	37	31-44	36-44	37-45	29-39	27-42	28-42	28-42	23-39	26-39	26-39	26-40	22-38	24-38	25-38	25-38	22-37
I	37	37	37	34-39	38-40	37-40	25-33	33-38	30-36	30-35	27-33	27-33	26-33	26-32	21-30	29-34	29-34	30-34	22-32
J	39	39	37	38-47	42-48	42-49	36-42	35-45	31-44	31-44	27-42	30-42	29-40	29-41	25-38	31-42	30-41	31-42	26-39
K	35	35	35	37-45	41-47	41-47	31-40	36-42	38-43	36-43	33-37	28-36	33-37	31-38	29-33	32-39	33-37	32-38	27-33
L	37	37	37	35-40	36-41	33-39	20-33	33-38	29-38	27-35	19-33	25-36	26-39	23-35	20-34	24-35	22-37	19-33	16-32
M	39	39	38	37-38	40-41	39-40	27-30	36-38	33-35	31-34	24-30	28-32	34-34	29-33	28-32	28-33	28-32	26-31	23-30
N	45	42	39	33-40	39-46	38-46	26-35	31-38	31-38	31-38	27-36	25-37	27-39	26-39	23-38	29-37	25-39	24-39	23-38
O	35	35	35	35-38	38-42	39-43	31-34	33-36	33-37	34-38	32-35	33-35	32-35	34-37	33-36	32-35	32-35	34-36	33-36

Table 4.8: 90th PERCENTILE OPERATIONAL PREDICTIONS INTEGRA RAIL OPTION - L_{Aeq,15minute} dB

NSR	NAG	PSNL			2017				2020				2023				2026			
		Day	Eve	Night	Day	Eve	Night 1	Night 2	Day	Eve	Night 1	Night 2	Day	Eve	Night 1	Night 2	Day	Eve	Night 1	Night 2
2	A	38	38	38	42 (3)	42 (2)	44 (3)	42 (6)	42 (4)	41 (5)	42 (6)	41 (7)	41 (6)	41 (5)	42 (5)	42 (6)	41 (5)	41 (6)	42 (5)	42 (6)
3	A	38	38	38	37 (4)	37 (3)	39 (4)	37 (7)	36 (4)	35 (7)	37 (7)	37 (9)	35 (6)	35 (6)	37 (6)	37 (7)	36 (5)	35 (6)	37 (6)	37 (8)
4	A	38	38	38	42 (2)	43 (2)	44 (2)	41 (4)	41 (3)	41 (2)	42 (3)	41 (4)	40 (3)	41 (3)	42 (3)	41 (3)	40 (3)	40 (2)	42 (4)	41 (3)
5	A	38	38	38	42 (2)	43 (2)	43 (1)	42 (4)	41 (2)	42 (3)	42 (2)	42 (4)	41 (3)	41 (3)	42 (3)	42 (3)	41 (3)	41 (3)	42 (3)	42 (4)
6	A	38	38	38	40 (1)	41 (1)	42 (1)	39 (3)	39 (2)	39 (2)	40 (2)	39 (2)	38 (2)	39 (2)	39 (1)	39 (2)	38 (2)	38 (2)	39 (2)	39 (2)
7	A	38	38	38	42 (3)	43 (3)	44 (3)	42 (6)	41 (3)	42 (3)	43 (4)	42 (6)	41 (5)	41 (4)	42 (5)	42 (5)	41 (5)	41 (4)	42 (5)	42 (6)
8	A	38	38	38	40 (4)	40 (2)	42 (3)	40 (6)	39 (5)	40 (4)	41 (4)	40 (5)	38 (5)	40 (5)	41 (5)	40 (5)	38 (5)	39 (5)	41 (6)	40 (5)
9	A	38	38	38	39 (3)	40 (2)	41 (2)	38 (4)	38 (3)	39 (3)	40 (3)	38 (4)	37 (4)	38 (4)	39 (4)	38 (4)	38 (5)	38 (4)	39 (4)	38 (4)
10	A	38	38	38	38 (3)	39 (2)	40 (2)	37 (4)	37 (3)	38 (4)	39 (3)	37 (4)	37 (5)	37 (4)	38 (4)	38 (4)	37 (5)	37 (4)	38 (4)	38 (4)
11	A	38	38	38	27 (2)	29 (2)	30 (2)	27 (2)	28 (2)	27 (4)	27 (3)	27 (5)	25 (3)	26 (4)	27 (4)	27 (4)	27 (2)	26 (4)	27 (4)	27 (5)
12	A	38	38	38	31 (5)	32 (4)	35 (2)	33 (5)	31 (4)	31 (6)	33 (3)	33 (5)	30 (8)	31 (8)	33 (4)	33 (5)	31 (7)	31 (8)	33 (5)	33 (5)
13	A	38	38	38	38 (2)	39 (1)	40 (1)	37 (3)	38 (2)	38 (2)	38 (1)	37 (3)	37 (3)	37 (2)	37 (2)	37 (2)	37 (3)	37 (2)	28 (2)	37 (2)
14	A	38	38	38	39 (2)	39 (1)	40 (1)	38 (4)	38 (3)	38 (2)	39 (2)	38 (4)	37 (3)	38 (4)	38 (3)	38 (4)	37 (2)	38 (3)	38 (2)	38 (3)
24	A	38	38	38	43 (3)	43 (3)	44 (2)	41 (7)	41 (4)	41 (5)	42 (4)	41 (6)	40 (5)	41 (5)	42 (5)	41 (6)	41 (5)	41 (6)	42 (5)	41 (6)
15	B	43	42	37	42 (0)	42 (0)	44 (0)	36 (-1)	40 (0)	41 (0)	43 (0)	36 (0)	39 (0)	38 (0)	40 (0)	38 (0)	39 (0)	39 (0)	40 (-1)	38 (-1)
16	B	43	42	37	42 (0)	42 (0)	44 (0)	36 (-1)	40 (-1)	41 (0)	43 (0)	36 (-1)	39 (0)	38 (-1)	40 (0)	38 (-1)	39 (0)	39 (0)	40 (-1)	38 (-1)
17	B	43	42	37	42 (-1)	42 (-1)	44 (0)	37 (-1)	41 (0)	41 (0)	43 (0)	35 (-2)	39 (0)	39 (0)	40 (-1)	38 (-1)	39 (0)	39 (0)	41 (0)	39 (0)
18	B	43	42	37	43 (0)	43 (1)	44 (0)	39 (0)	41 (1)	42 (1)	43 (0)	39 (1)	39 (0)	39 (0)	41 (0)	40 (0)	40 (0)	40 (1)	41 (0)	40 (0)
19	B	43	42	37	43 (0)	43 (0)	45 (0)	40 (0)	42 (1)	42 (1)	43 (0)	39 (1)	40 (0)	40 (0)	42 (0)	41 (0)	40 (0)	40 (0)	42 (0)	41 (1)
20	B	43	42	37	42 (-1)	43 (1)	45 (1)	40 (1)	41 (0)	41 (1)	42 (0)	39 (1)	39 (0)	40 (1)	42 (1)	41 (1)	40 (0)	40 (1)	42 (0)	41 (1)
21	B	43	42	37	42 (0)	43 (0)	45 (1)	40 (0)	41 (0)	41 (0)	43 (0)	40 (1)	39 (-1)	40 (0)	42 (0)	41 (0)	40 (0)	40 (1)	42 (0)	41 (1)
22	B	43	42	37	42 (0)	43 (0)	45 (1)	41 (1)	41 (0)	42 (1)	43 (0)	41 (1)	40 (0)	41 (1)	42 (0)	41 (0)	40 (0)	41 (1)	42 (0)	41 (0)



AECOM

90TH PERCENTILE NOISE CONTOURS - MODIFIED OPERATIONS SCENARIO - NIGHT PERIOD - YEAR 2017 - SOUTH

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FIGURE 7

Figure 7: Indicative 90th Percentile Noise Contours – 2017 Modified Night Period Scenario – South

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ABN 94 094 985 734

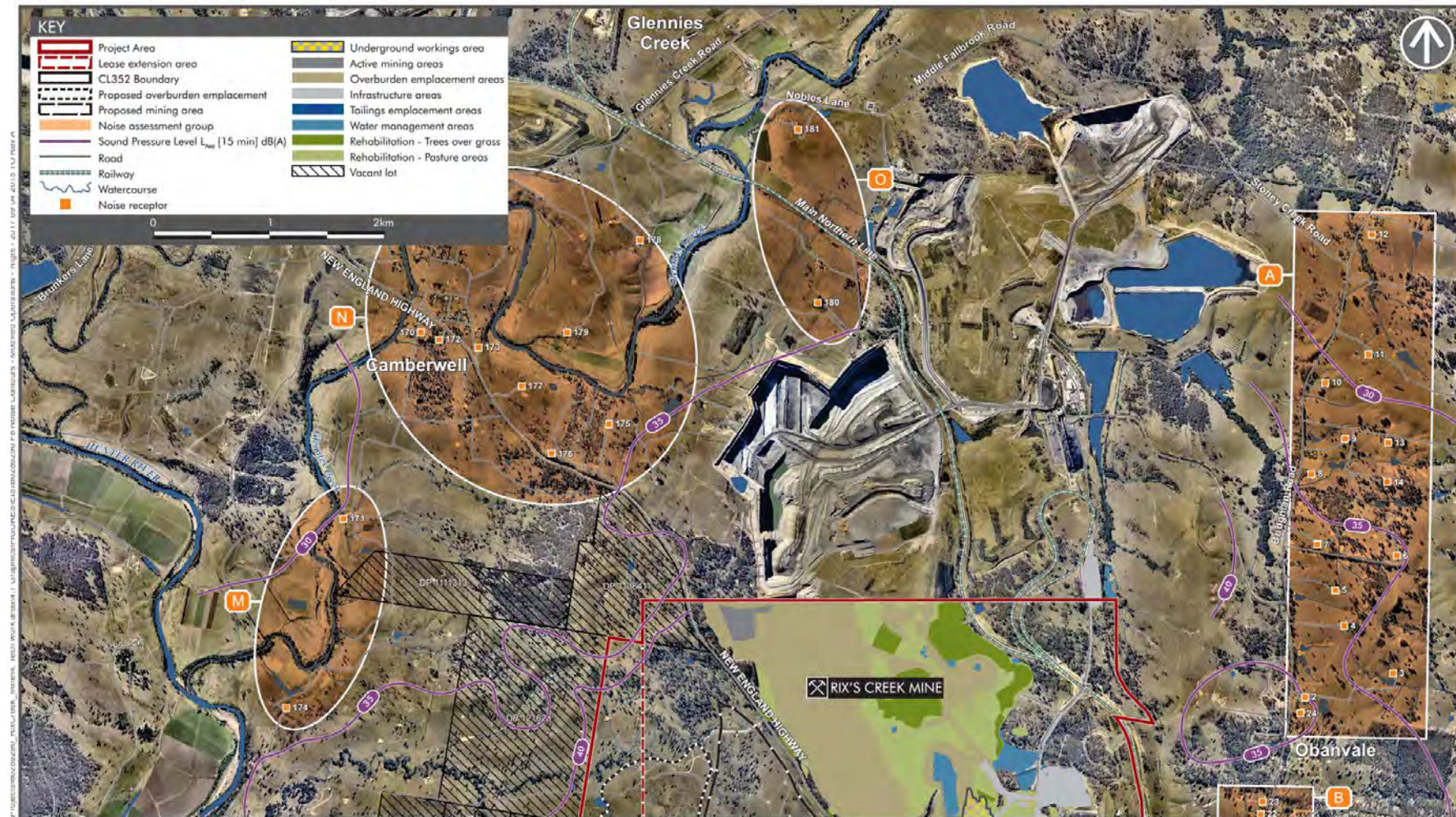


FIGURE 8

Figure 8: Indicative 90th Percentile Noise Contours – 2017 Modified Night Period Scenario – North

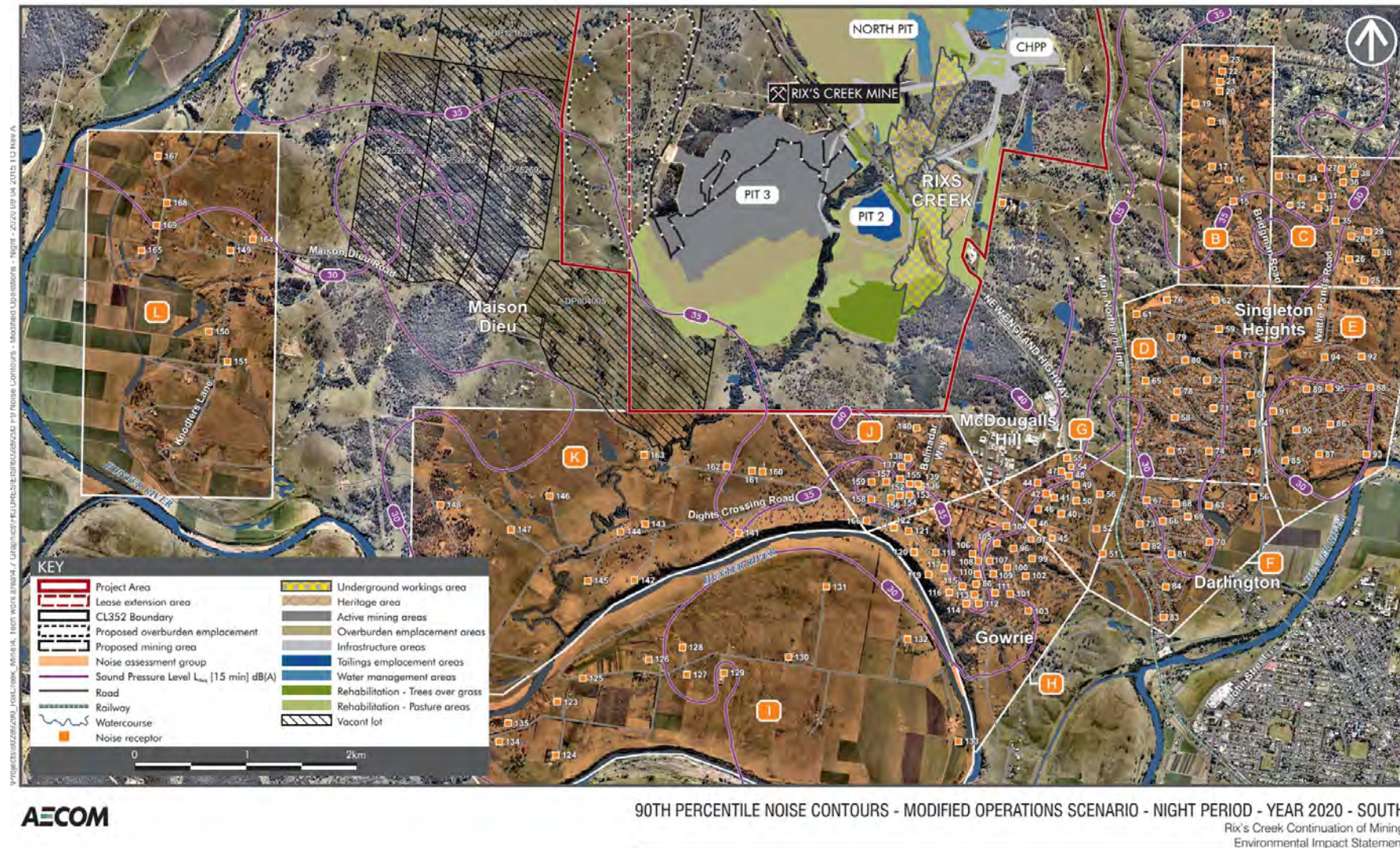


FIGURE 9

Figure 9: Indicative 90th Percentile Noise Contours - 2020 Modified Night Period Scenario - South

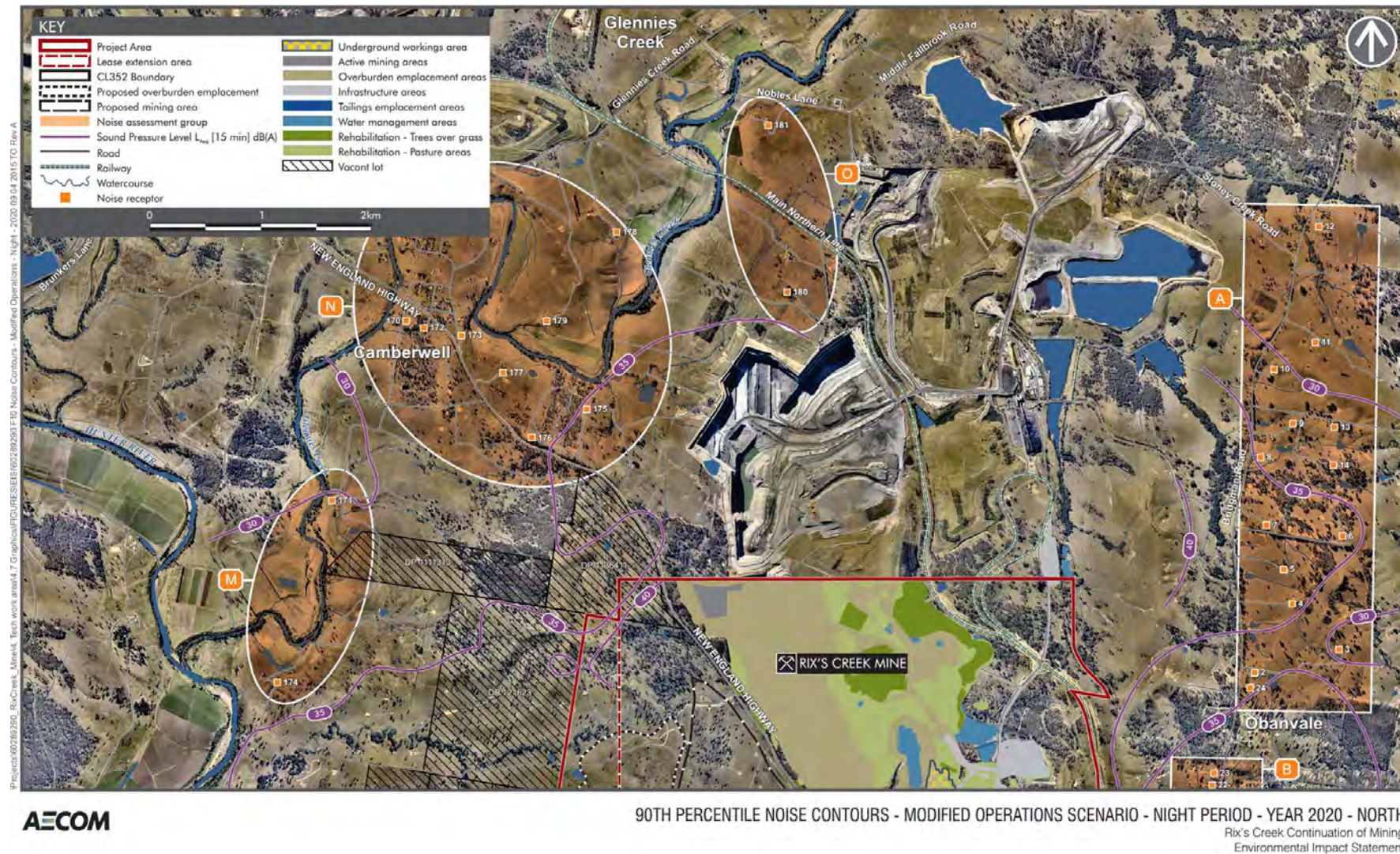
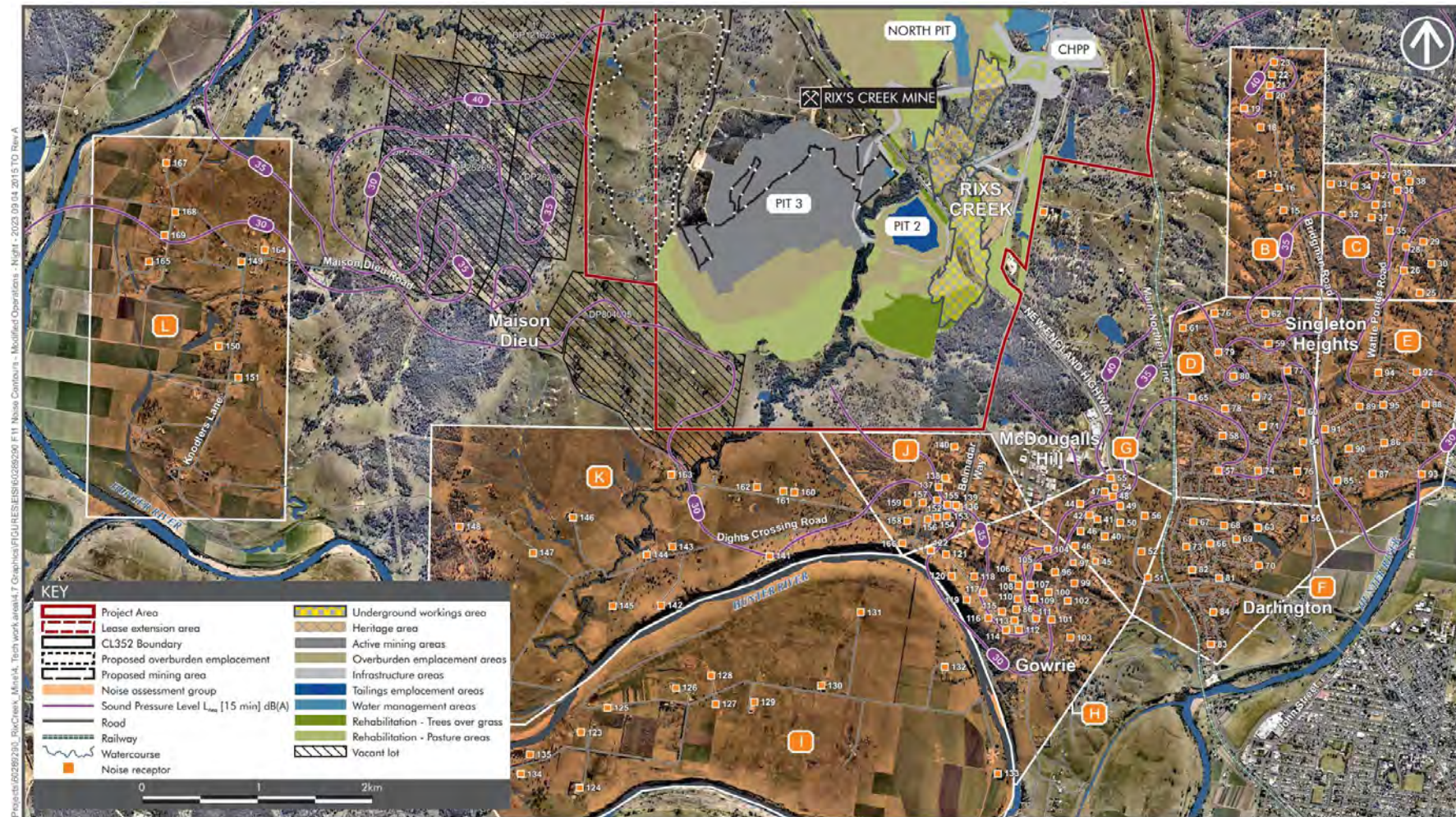


FIGURE 10

Figure 10: Indicative 90th Percentile Noise Contours - 2020 Modified Night Period Scenario - North



90TH PERCENTILE NOISE CONTOURS - MODIFIED OPERATIONS SCENARIO - NIGHT PERIOD - YEAR 2023 - SOUTH
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FIGURE 11

Figure 11: Indicative 90th Percentile Noise Contours - 2023 Modified Night Period Scenario - South

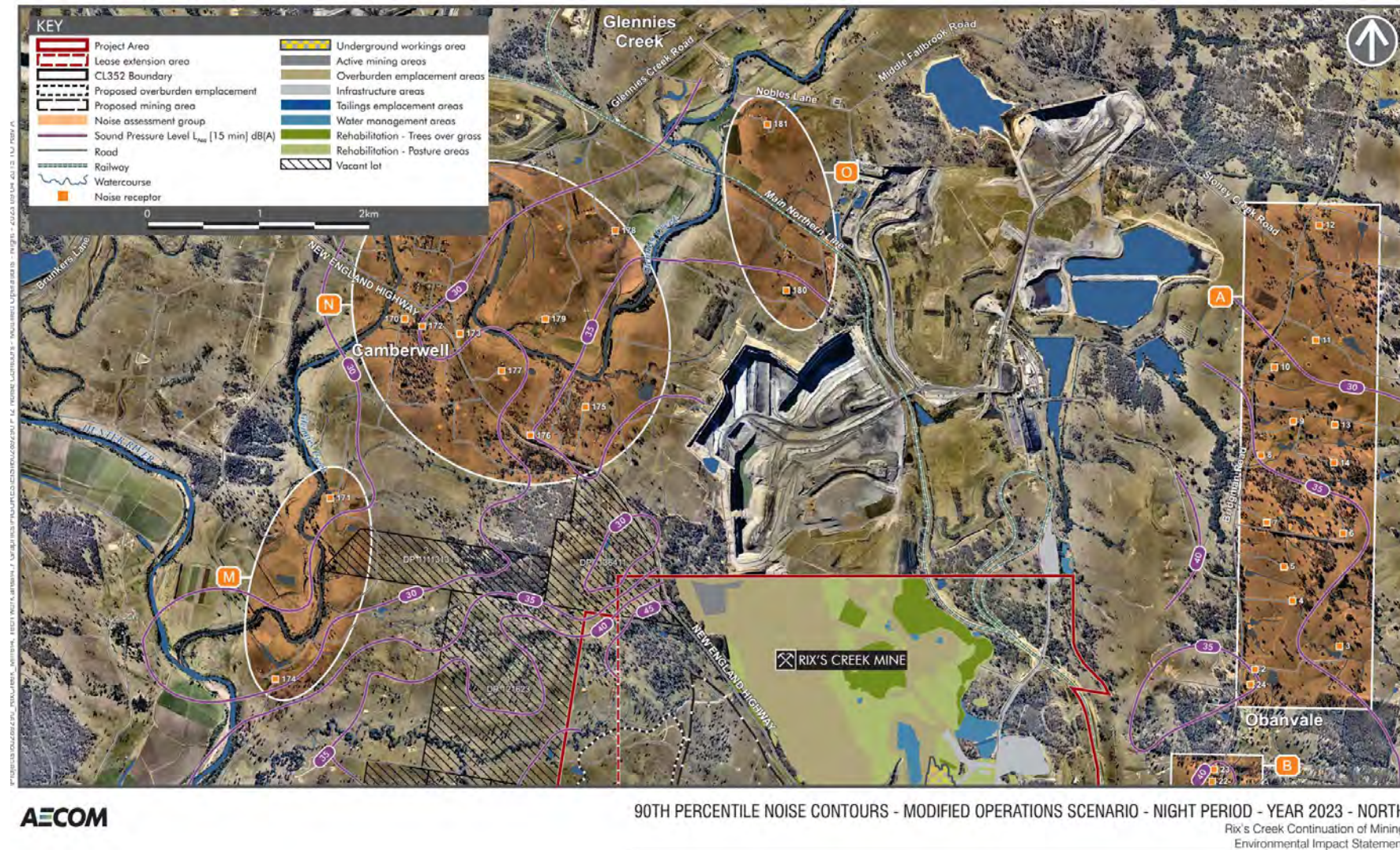
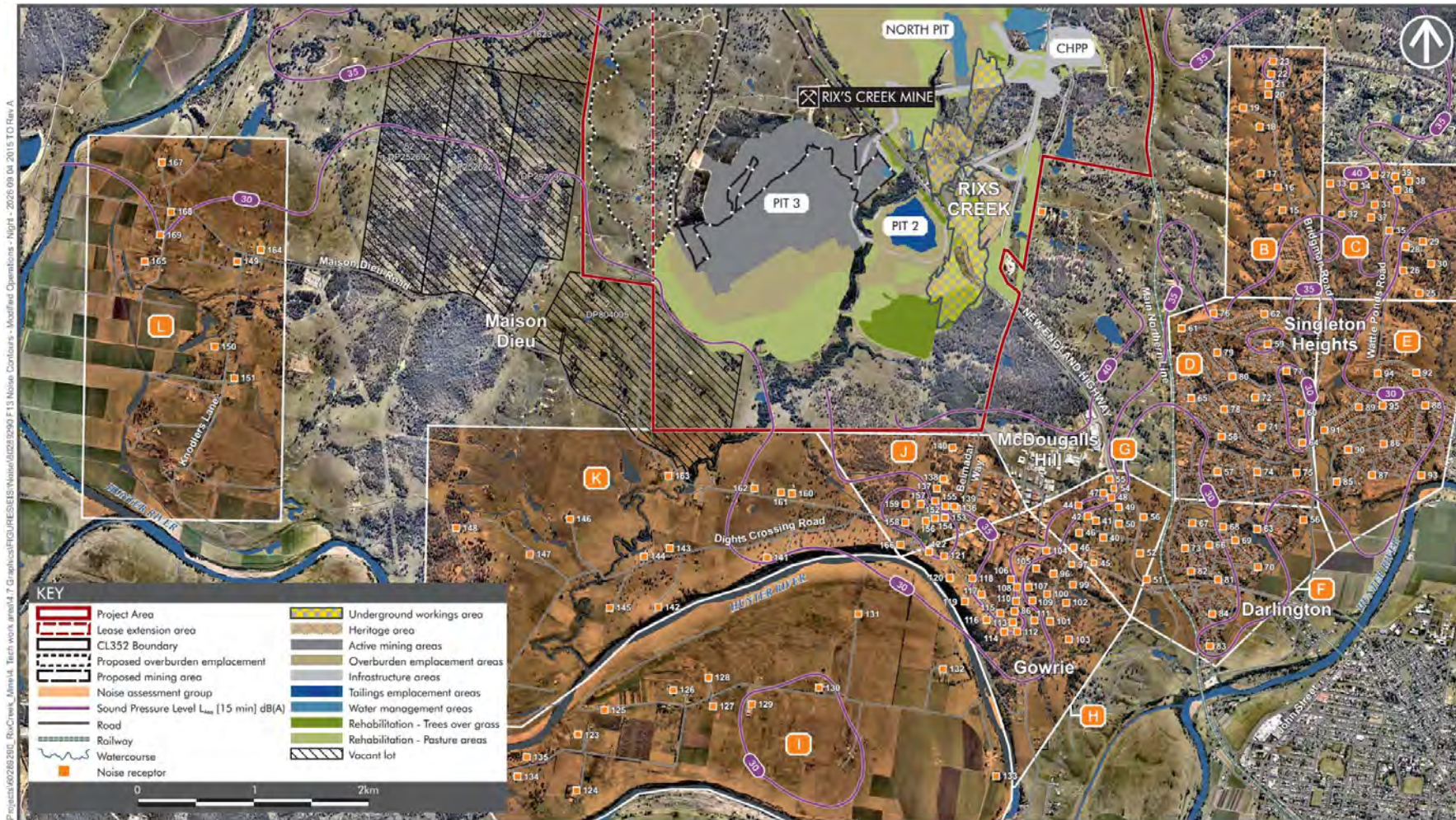


FIGURE 12

Figure 12: Indicative 90th Percentile Noise Contours - 2023 Modified Night Period Scenario - North



90TH PERCENTILE NOISE CONTOURS - MODIFIED OPERATIONS SCENARIO - NIGHT PERIOD - YEAR 2026 - SOUTH

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FIGURE 13

Figure 13: Indicative 90th Percentile Noise Contours - 2026 Modified Night Period Scenario - South

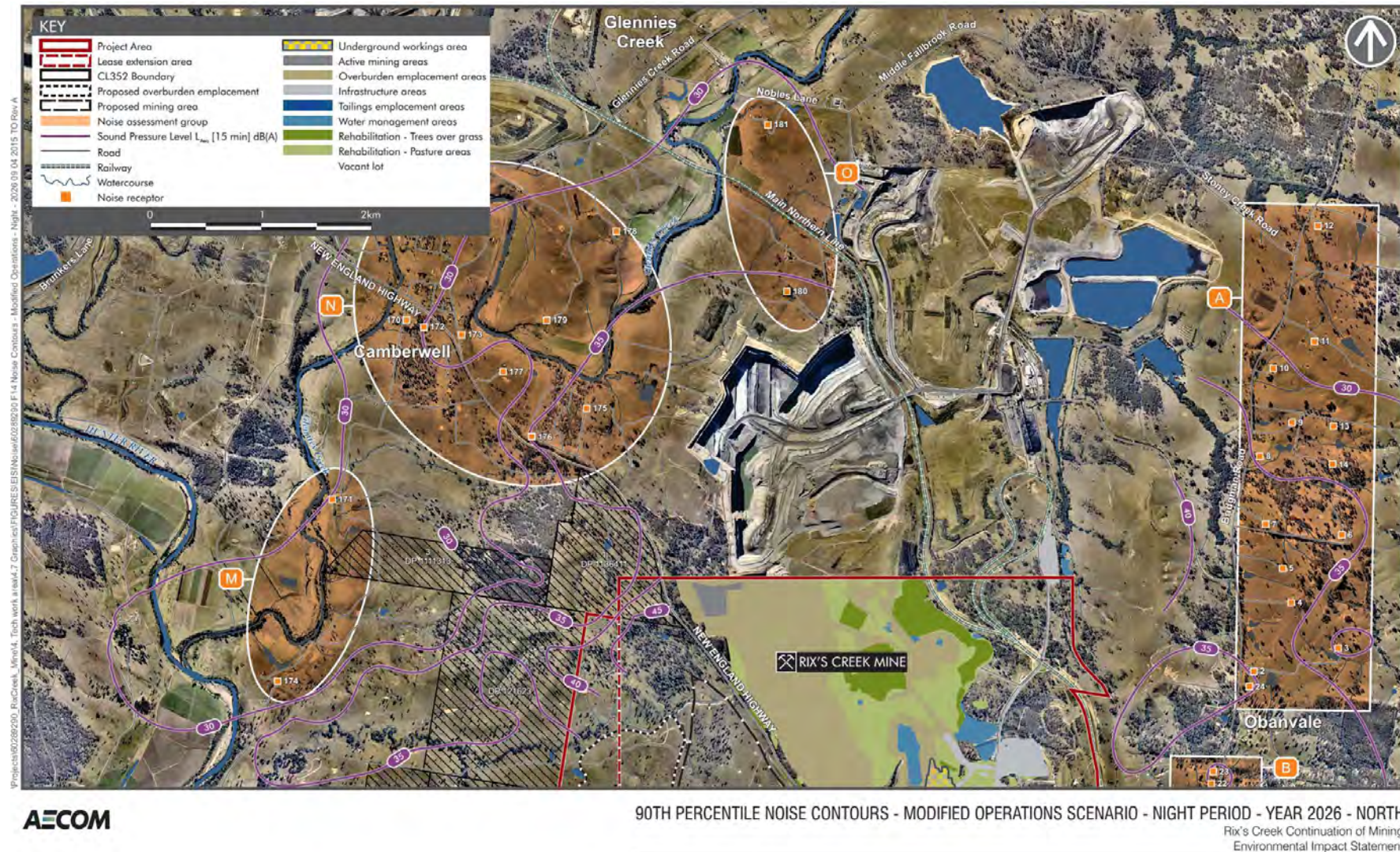


FIGURE 14

Figure 14: Indicative 90th Percentile Noise Contours - 2026 Modified Night Period Scenario - North

4.3 Sleep Disturbance Assessment

4.3.1 Sleep Disturbance Methodology

Potential sleep disturbance impact was assessed by predicting levels from plant items known to generate noise levels that at times stand out above the general mining continuum. Shovel and excavator bucket noise, first pass loads into empty truck trays, rear dump truck exhaust and dozer track noise are recognised as sources which can generate high, short term noise levels that may cause sleep disturbance.

The following sources were modelled to assess sleep disturbance:

- Impact noise generated by excavator buckets impacting truck bodies or hard ground material, or rocks impacting the bottom of empty haul truck trays was modelled at each dig location. A maximum sound power of L_{WA} 130 dB was adopted for each impact event;
- Dozer track slap was modelled at each exposed dozer operating location, typically overburden emplacement areas. A maximum sound power of L_{WA} 119 dB representing dozer operation in 1st gear reverse was adopted; and
- Haul truck exhaust surges were modelled by assessing a maximum sound power event of L_{WA} 118 dB at each overburden emplacement area, and at exposed sections along haul routes.

Assessment of sleep disturbance for each model stage involved modelling each of these sources, and then combining the highest prediction with results for the remainder of operational plant to obtain an estimate of possible short-term maximum noise emissions.

4.3.2 Sleep Disturbance Results

Table 4.8 presents a summary of 90th percentile sleep disturbance results for the four modelled stages. Results are presented as a range of levels for the worst case season, indicating the lowest and highest predictions within each NAG.

As for operational A-weighted noise, results are presented for each stage for two night scenarios (N1 and N2).

Results of the sleep disturbance models are less than the relevant $L_{A1,1\text{minute}}$ criterion for all NAG except for J and K. For these, moderate exceedances of up to 3 dB are predicted for night scenario 1 in 2017, and minor exceedances of 1 dB in 2020. However, predictions indicate compliance with the criterion would be achieved for the modified operations night scenario in both cases. These results indicate that RCM should be able to manage sleep disturbance impact by modifying operations as required. As such, there is no sleep disturbance impact predicted.

Table 4.9: SLEEP DISTURBANCE PREDICTIONS - $L_{A1,1\text{minute}}$ dB

NAG	Criterion	2017		2020		2023		2026	
		Night 1	Night 2	Night 1	Night 2	Night 1	Night 2	Night 1	Night 2
A	48	28-42	25-38	25-40	23-38	24-39	24-39	24-39	23-38
B	47	44-45	39-42	42-44	39-41	41-43	40-42	41-43	40-42
C	47	34-47	28-42	30-45	26-43	28-43	27-43	29-43	28-42
D	45	36-45	32-42	36-45	32-42	33-43	32-42	36-42	35-41
E	45	29-42	21-38	24-41	20-39	23-40	22-39	34-39	33-38
F	45	37-41	28-38	36-41	30-38	31-38	29-38	33-38	31-37
G	47	37-47	27-44	29-46	27-44	29-45	27-44	29-43	27-42
H	47	37-46	31-43	30-45	27-43	29-44	27-43	27-42	26-41
I	47	38-42	33-38	31-39	28-38	29-38	27-37	34-39	32-38
J	47	42-50	37-47	33-48	31-46	32-46	30-46	35-45	33-44
K	45	42-48	34-45	38-46	35-44	34-44	33-43	34-43	32-42
L	47	33-40	23-37	29-38	23-37	24-38	23-38	20-34	19-34
M	48	40-41	32-36	34-38	31-36	33-37	32-37	27-31	24-30
N	49	38-47	27-40	31-41	28-40	27-42	24-41	25-40	24-39
O	45	39-43	32-35	34-38	33-36	34-37	33-36	34-36	33-36

Notes:

1. Results in bold type exceed the criterion (if applicable)

4.4 Low Frequency Noise Assessment

As discussed in Section 2 low frequency noise is assessed using both the INP C minus A method, and, through comparison of total predicted C-weighted levels at NSR with an upper limit criterion (Broner method).

An assessment of low frequency noise was undertaken considering all receptors, across all stages, across all time periods. Total C-weighted predictions were less than $L_{Ceq,15\text{minute}}$ 60 dB for all receptors, for all stages modelled.

Table 4.9 presents C-weighted results for neutral atmospheric conditions for the four modelled stages. Results are presented as a range of levels indicating the lowest and highest predictions within each NAG.

Table 4.10 presents a summary of 90th percentile C-weighted operational noise results for the four modelled stages. Results are presented as a range of levels for the worst case season, indicating the lowest and highest predictions within each NAG. As for A-weighted noise, results are presented for each stage for two night scenarios (N1 and N2).

The greatest low frequency noise impact is predicted for NAG B, with predictions up to $L_{Ceq, 15 \text{ minute}}$ 58 dB during adverse meteorological conditions. The primary contributor of low frequency noise for this area is the CHPP, in particular the CPP (wash plant). As discussed previously, RCM are committed

to cladding the two critical sides of the CPP. Modelling indicates the cladding will reduce C-weighted predictions by 3 to 4 dB for NAG B, a significant reduction representing a halving or more of the low frequency noise energy. It should be noted that the transmission loss characteristics of sheeting material results in significantly greater attenuation of higher frequencies. Accordingly, sheeting the CPP, as a noise control, results in greater reductions to A-weighted than C-weighted emissions, widening the gap between predicted C-weighted and A-weighted levels. The result is that C minus A differences for the clad (quieter) CPP scenario are greater than for the unclad scenario. INP guidelines suggest a 5 dB modifying factor penalty for low frequency noise content be applied where the C minus A result is greater than or equal to 15 dB. In this instance, it clear that cladding the CPP will provide significant reductions to both low frequency and A-weighted noise levels, which will improve the overall acoustic environment for nearby receptors. As the C minus A method results in a perverse environmental outcome in this instance, a modifying factor penalty has not been applied.

Predictions up to $L_{Ceq,15minute}$ 58 dB are also predicted for NAG J during adverse meteorological conditions for the 2017 stage at full operation. Corresponding A-weighted totals are similarly high, and the resulting C minus A difference is 9 dB. The modified operations night scenario indicates C-weighted levels would reduce to $L_{Ceq,15minute}$ 51 dB at the most affected NSR, indicating that low frequency noise in this area can be managed through modification of operations. It is noted that the C minus A difference for the modified operations night scenario remains at 9 dB, indicating that responding to elevated A-weighted levels in this area will also manage low frequency noise.

C-weighted predictions are included in Table A.2 in Appendix A. C minus A results are presented in Table A.3 in Appendix A.

Table 4.10: NEUTRAL ATMOSPHERE LOW FREQUENCY NOISE PREDICTIONS- $L_{Ceq,15minute}$ dB

NAG	Criteria			2017				2020				2023				2026			
	Day	Eve	Night	Day	Eve	Night 1	Night 2	Day	Eve	Night 1	Night 2	Day	Eve	Night 1	Night 2	Day	Eve	Night 1	Night 2
A	65	65	60	36-47	43-53	44-54	42-52	43-52	41-52	42-53	41-52	41-51	41-52	42-53	42-53	42-52	41-52	42-53	42-53
B	65	65	60	45-45	52-52	53-53	49-49	52-52	50-50	51-51	48-48	51-51	50-50	51-51	50-50	51-51	50-50	52-52	50-50
C	65	65	60	39-47	44-55	45-56	41-53	45-54	41-53	42-54	40-52	43-53	41-53	42-54	41-53	44-53	41-53	42-54	41-53
D	65	65	60	39-44	45-52	46-53	41-47	46-51	43-51	43-52	41-47	44-50	42-49	43-50	41-49	44-49	44-50	45-51	42-49
E	65	65	60	33-40	38-50	39-51	34-46	38-50	35-48	36-49	34-46	38-49	34-48	35-48	34-47	38-48	37-48	39-49	35-48
F	65	65	60	37-39	46-49	47-49	39-42	46-49	43-46	44-46	39-43	44-47	42-45	42-45	40-42	43-47	43-46	44-47	40-44
G	65	65	60	38-45	45-55	45-55	37-51	45-54	39-51	39-52	37-50	42-53	39-52	40-52	37-51	40-52	40-52	41-52	37-51
H	65	65	60	39-45	47-54	48-55	41-50	42-53	40-51	40-51	39-49	42-52	40-50	40-51	38-49	40-51	40-50	41-51	38-49
I	65	65	60	36-41	50-52	50-51	40-45	47-51	43-49	43-49	41-48	42-48	41-48	41-47	37-46	43-47	43-48	44-48	37-46
J	65	65	60	43-48	52-57	52-58	46-52	48-56	44-53	45-53	43-51	46-54	44-52	44-52	42-51	46-53	45-53	45-53	42-52
K	65	65	60	38-46	53-55	52-55	43-48	48-53	49-51	49-51	46-49	43-49	46-49	44-49	42-47	45-50	47-51	46-50	41-48
L	65	65	60	36-40	47-53	45-51	39-48	43-51	43-51	41-50	35-48	39-50	40-51	38-49	36-49	38-50	38-51	36-49	33-48
M	65	65	60	38-39	51-52	49-51	43-46	49-49	47-48	45-47	42-45	44-47	47-48	44-47	44-47	44-48	46-48	43-47	42-46
N	65	65	60	39-46	48-55	48-55	42-49	45-51	43-50	43-50	42-48	42-50	42-51	42-51	42-50	45-52	42-52	42-52	41-52
O	65	65	60	41-44	50-53	51-54	46-48	48-50	47-49	48-50	47-48	48-49	47-49	48-50	48-50	48-50	48-50	49-51	48-50

Table 4.11: 90th PERCENTILE LOW FREQUENCY NOISE PREDICTIONS- $L_{Ceq,15minute}$ dB

NAG	Criteria			2017				2020				2023				2026			
	Day	Eve	Night	Day	Eve	Night 1	Night 2	Day	Eve	Night 1	Night 2	Day	Eve	Night 1	Night 2	Day	Eve	Night 1	Night 2
A	65	65	60	41-52	43-53	44-54	42-52	43-52	41-52	42-53	41-52	41-51	41-52	42-53	42-53	42-52	41-52	42-53	42-53
B	65	65	60	53-56	52-56	53-58	49-57	52-56	50-55	51-57	48-57	51-55	50-55	51-57	50-57	51-56	50-55	52-57	50-57
C	65	65	60	47-54	44-55	45-56	41-53	45-54	41-53	42-54	40-52	43-53	41-53	42-54	41-53	44-53	41-53	42-54	41-53
D	65	65	60	47-53	45-52	46-53	41-47	46-51	43-51	43-52	41-47	44-50	42-49	43-50	41-49	44-49	44-50	45-51	42-49
E	65	65	60	39-51	38-50	39-51	34-46	38-50	35-48	36-49	34-46	38-49	34-48	35-48	34-47	38-48	37-48	39-49	35-48
F	65	65	60	47-50	46-49	47-49	39-42	46-49	43-46	44-46	39-43	44-47	42-45	42-45	40-42	43-47	43-46	44-47	40-44
G	65	65	60	45-55	45-55	45-55	37-51	45-54	39-51	39-52	37-50	42-53	39-52	40-52	37-51	40-52	40-52	41-52	37-51
H	65	65	60	44-54	47-54	48-55	41-50	42-53	40-51	40-51	39-49	42-52	40-50	40-51	38-49	40-51	40-50	41-51	38-49
I	65	65	60	47-51	50-52	50-51	40-45	47-51	43-49	43-49	41-48	42-48	41-48	41-47	37-46	43-47	43-48	44-48	37-46
J	65	65	60	50-56	52-57	52-58	46-52	48-56	44-53	45-53	43-51	46-54	44-52	44-52	42-51	46-53	45-53	45-53	42-52
K	65	65	60	49-55	53-55	52-55	43-48	48-53	49-51	49-51	46-49	43-49	46-49	44-49	42-47	45-50	47-51	46-50	41-48
L	65	65	60	45-51	47-53	45-51	39-48	43-51	43-51	41-50	35-48	39-50	40-51	38-49	36-49	38-50	38-51	36-49	33-48
M	65	65	60	48-49	51-52	49-51	43-46	49-49	47-48	45-47	42-45	44-47	47-48	44-47	44-47	44-48	46-48	43-47	42-46
N	65	65	60	44-51	48-55	48-55	42-49	45-51	43-50	43-50	42-48	42-50	42-51	42-51	42-50	45-52	42-52	42-52	41-52
O	65	65	60	48-50	50-53	51-54	46-48	48-50	47-49	48-50	47-48	48-49	47-49	48-50	48-50	48-50	48-50	49-51	48-50

4.5 Cumulative Noise Assessment

Other industrial noise sources around RCM with potential to cause cumulative noise impact to receptors within the assessment area include:

- Integra Coal Operations mine (ICO);
- Mount Thorley Warkworth mine (MTW);
- Hunter Valley Operation mine (HVO);
- Ravensworth Surface Operations mine (RSO);
- Ashton mine; and
- Mount Owen mine

Of these mines, MTW, HVO, RSO, Ashton and Mount Owen are geographically located at sufficient distance from RCM, and directionally such that noise enhanced from RCM would be attenuated from these mines (at receptors between); cumulative noise impact with these mines is not considered likely.

Integra Coal Operations does however have potential to cause cumulative noise impact with RCM. Four NAG are assessed for cumulative noise with ICO using Year 2017 modified night scenario intrusive noise predictions for RCM, and intrusive noise predictions contained in the Integra ENA for ICO. A review of results presented in the Integra ENA indicates the Year 1 Full Pit Extent scenario results are generally worst-case; these have been adopted for assessment of cumulative noise. RCM predictions for NAG A and B are based on the Integra rail loading facility scenarios to consider the worst-case situation. Cumulative noise levels would likely be less if the RCM rail facility option was progressed.

- NAG A is located approximately northeast of RCM, and east of ICO. The relative angle between noise propagation paths from the active pit areas in each mine is approximately 60 degrees. When noise is enhanced from one mine, approximately cross wind conditions with minor enhancement would occur from the other. On this basis, two scenarios have been assessed:
 1. Adverse meteorological conditions predictions for RCM combined with neutral atmospheric conditions for ICO; and
 2. Adverse meteorological conditions predictions for ICO combined with neutral atmospheric conditions for RCM.
- NAG B is located approximately east of RCM, and southeast of ICO. This NAG is located relatively close to the RCM CHPP, so when noise is enhanced from ICO, it is possible that enhancement would also occur from the RCM CHPP and ROM pad area. Therefore, to consider worst-case cumulative noise impact, adverse meteorological conditions predictions for both sites were combined.

- NAG M is located approximately west of RCM, and southwest of ICO. The relative angle between noise propagation paths from the active pit areas in each mine is approximately 90 degrees. When noise is enhanced from one mine, approximately cross wind conditions would occur from the other. On this basis, two scenarios have been assessed:
 1. Adverse meteorological conditions predictions for RCM combined with neutral atmospheric conditions for ICO; and
 2. Adverse meteorological conditions predictions for ICO combined with neutral atmospheric conditions for RCM.
- NAG N is located approximately north-northwest of RCM, and west- of ICO. The relative angle between noise propagation paths from the active pit areas in each mine is approximately 60 degrees. When noise is enhanced from one mine, approximately cross wind conditions with minor enhancement would occur from the other. On this basis, two scenarios have been assessed:
 1. Adverse meteorological conditions predictions for RCM combined with neutral atmospheric conditions for ICO; and
 2. Adverse meteorological conditions predictions for ICO combined with neutral atmospheric conditions for RCM.

The noise sensitive night period has the lowest amenity criterion, and is the period with the most potential for cumulative noise impact to occur. Therefore, only the night period has been assessed. Intrusive noise predictions in both assessments are L_{Aeq} 15 minute, and predictions in both assessments are based on worst-case plant operating configurations. For comparison with the acceptable amenity criterion, which is averaged over the nine hour night period, 3 dB was subtracted from combined intrusive noise levels to account for variability in noise emission throughout the night due to changes in operations, and variability in atmospheric conditions.

4.5.1 Cumulative Noise Results

Table 4.11 presents cumulative noise results. Combined results with two values are for scenarios 1 and 2 described above. NSR 11, 175, 176, 178 and 179, indicated with grey shading, have acquisition rights with ICO and the criterion is deemed not to apply at these locations. A minor exceedance of 1 dB is predicted at NSR 177; ICO is primarily responsible for predicted levels in that case.

Table 4.12: CUMULATIVE NOISE RESULTS – dB

NAG	NSR	Criterion ³ L _{Aeq,period}	RCM Prediction		ICO Prediction		Combined L _{Aeq,15minute}	Combined L _{Aeq,period}
			Adverse	Neutral	Adverse	Neutral		
A	2	40	42	30	38	29	42/39	39/36
A	4	40	41	29	39	30	41/39	38/36
A	5	40	42	30	40	30	42/40	39/37
A	6	40	39	28	38	30	40/38	37/35
A	7	40	42	28	41	31	42/41	39/38
A	8	40	40	23	40	30	40/40	37/37
A	9	40	38	23	41	32	39/41	36/38
A	10	40	37	25	41	32	38/41	35/38
A	11	NA ²	27	19	35	26	30/35	27/32
A	13	40	37	24	39	31	38/39	35/36
A	14	40	38	23	39	30	39/39	36/36
A	24	40	41	30	38	27	41/39	38/36
B	18	40	39	28	35	21	40	37
B	19	40	40	27	35	21	41	38
B	20	40	40	26	34	20	41	38
B	21	40	40	26	35	21	41	38
B	22	40	41	27	34	21	42	39
B	23	40	41	27	34	21	42	39
M	171	40	40	21	37	22	40/37	37/34
M	174	40	39	24	34	21	39/34	36/31
N	172	40	39	24	38	30	40/38	37/35
N	175	NA ²	46	35	48	44	48/48	45/45
N	176	NA ²	45	33	46	40	46/46	43/43
N	177	40	42	25	44	34	43/44	40/41
N	178	NA ²	41	31	46	42	45/46	42/43
N	179	NA ²	42	33	46	41	45/46	42/43

Notes:

1. Results in bold type exceed the criterion (if applicable);
2. Grey shading indicated NSR has acquisition rights with ICO, criterion deemed not to apply; and
3. Acceptable amenity criterion for night period.

4.6 Road Traffic Noise Assessment

AECOM has undertaken a traffic impact assessment (TIA) for the Project. Road traffic flow volumes and distribution of traffic on the road network used for assessment of noise impact is based on data provided in the TIA.

RCM is accessed via the New England Highway and Rix's Lane. The New England Highway is characterised by high traffic flow volumes during the morning and afternoon peak periods, largely due to mining related traffic to and from other mines in the Hunter Valley and the main population centres. Rix's Lane is a local road servicing only RCM and one private residence. The private residence has a private agreement with RCM; therefore criteria are not applicable at that location.

The change in road traffic noise levels along the New England Highway resulting from traffic increases due to the project would not be measurable or perceptible.

4.7 Rail Noise Assessment

As discussed in Section 3.8, rail noise within the boundary of industrial premises is assessed as part of the industrial premises using the INP guideline. A train has been modelled on each of the RCM and Integra rail loading loops in all operational noise models; therefore, predictions for these rail activities are included within the operational noise assessment.

Where a non-network rail line extends beyond the boundary of the industrial premises, noise from this section of track should be assessed against the recommended acceptable noise amenity criteria for industrial noise sources for the relevant receiver type in Table 2.1 of the INP.

For the RCM rail option, a train was modelled as a string of points at 100 metre intervals along the section of track from the intersection with the Great Northern Railway to the start of the rail loop, a 2-kilometre section. A speed of 40 km/h and a train length of 1300 metres was assumed, resulting in a five-minute period required for a train to traverse this section of track. The resulting 90th percentile for the night period at the nearest NSR (61) is $L_{Aeq,5minute}$ 31 dB for a single pass by event, which corresponds to $L_{Aeq,period}$ 11 dB averaged over a 9-hour period. Over 850 train movements could occur before the night period amenity criterion of $L_{Aeq,9hour}$ 40 dB is reached, a scenario that could never occur.

For the Integra rail option, a train was modelled idling on the track for a full 15-minute period. The resulting 90th percentile for the night period was $L_{Aeq,15minute}$ 28 dB at the most affected NSR (7). On this basis, a train could theoretically idle on the loop continuously and not exceed the $L_{Aeq,period}$ night criterion of 40 dB.

Rail noise impact is not predicted to occur as a result of the Project.

5 MANAGEMENT AND MONITORING

5.1 Operational Controls

Table 5.1 lists possible noise controls, and provides discussion on whether these controls are considered feasible and/or reasonable.

Table 5.1: NOISE CONTROL OPTIONS

Control	Feasible?	Reasonable?
At source	Controlling noise at the source is considered feasible. The net benefit provided depends on the proportion of equipment that is controlled, and the degree of mitigation provided. Based on RCM fleet forecasting and model predictions, benefit obtained from noise source control would be seen at around the 2020 stage when more than half of the proposed attenuated fleet would be operational, with greater benefit thereafter. Benefit at the 2017 stage is marginal. Cladding the critical sides of the CPP is a feasible option.	RCM view this as a reasonable option for new equipment, but the cost of retrofitting existing equipment is considered prohibitively expensive. RCM view controlling noise emission for the CPP as a reasonable option, and is prepared to clad the two critical sides of CPP. The estimated costs of implementing these control options are \$8.3 million for mobile equipment, and, \$680,000 to treat the CPP.
Propagation path	Providing topographical shielding to the propagation path may be feasible during certain meteorological conditions, although any benefit provided is reduced during adverse meteorological conditions as the wave front is refracted over emplacement areas used for shielding. Hauling overburden to more shielded emplacement areas during adverse meteorological conditions is a feasible option, but relocating excavating and loading equipment is not. Constructing a road side bund to the exposed section of the out of pit coal haul route is a feasible option. Constructing a barrier to the exposed side of the ROM coal bin is a feasible option.	It is reasonable that pit shells, emplacement areas and haul routes are optimised to take maximum advantage of emplacement areas for topographical shielding. A road side bund to the coal haul route is considered reasonable. Construction of a 6 metre high barrier to the exposed side of the ROM coal bin is considered reasonable.
At receptor	Controlling noise at the receptor is a feasible option.	RCM does not consider this a reasonable option. RCM is an existing operation with legacy noise issues, which predates the majority of NSR. The density of housing in most NAG is such that a requirement to provide receptor mitigation treatment would render the operation unviable.

As described in Section 2.4, a number of noise controls and management strategies were developed during the modelling assessment. The following noise controls were included in the final noise models:

- Various levels were provided for overburden emplacement to allow shielded emplacement to occur deeper in the pit during adverse meteorological conditions;
- Haul route alignments within the pit maximise the available topographical shielding provided by the pit shell;
- For the maximum production rate scenario (2023), two high elevation emplacement areas were developed, to the north and south of the pit, separated by approximately 1300 metres;
- All blast hole drills were modelled as attenuated drills;
- The proportion of mobile equipment modelled as attenuated for each stage was in accordance with the RCM fleet replacement forecast summary;
- Dozers were modelled with 1st gear operation;
- A 4.5 metre high earth bund was included to reduce noise emission to the south of the coal haul route;
- A 6 metre high acoustic barrier was included adjacent the ROM bin;
- An earth barrier was modelled to the east side of the ROM pad (already constructed);
- The south and east facades of the CPP were modelled as attenuated (sheeted). Refer to Section 4.1.4 for detail; and
- Separate day and night operating configurations were modelled to consider modified (scaled down) operations for the night period.

It is Global Acoustics opinion that these noise control measures are consistent with industry best practice, and that there are no such measures available other than those proposed.

5.2 Management Strategies

RCM currently operates according to a noise mitigation plan that involves the following procedures:

- RCM has developed a predictive noise model for the mine that is updated daily. Meteorological data from the Hunter Valley Meteorological Sounding Group Joint Venture (HVMSGJV) and meteorological forecasts for the RCM site are used to develop half hourly predictions of noise enhancement conditions;
- Noise model predictions are used at the daily production meetings to plan evening and night time operations;

- Modifications to operating configurations are planned to minimise potential off-site noise impacts if elevated noise levels are predicted;
- Competent and trained site personnel undertake attended noise monitoring during the night period, with priority given to receptor areas for which elevated noise predictions were provided (if any);
- If noise levels exceeding a trigger level criterion are measured, operations at the site are modified to reduce noise emission. Modifications include plant being relocated within the pit to operate in areas that provide a high degree of topographical shielding, and/or, equipment is progressively shut down, starting with plant operating in the most exposed areas. A trigger of L_{Aeq} 40 dB has been utilised during 2014;
- Follow up attended monitoring is undertaken to determine the effectiveness of modifications implemented; and
- Measurements and actions are documented.

RCM has been operating with this management system in place since August 2014. RCM propose to continue implementing this proactive approach to managing noise, and seek to refine and calibrate the predictive noise model on an ongoing basis.

5.3 Monitoring

In addition to the attended monitoring undertaken by site personnel outlined in Section 5.2, Global Acoustics undertakes independent attended compliance monitoring one night per month at six locations around the site. These locations, and the NAG these represent are listed in Table 5.2.

Table 5.2: ATTENDED NOISE MONITORING LOCATIONS

Location Descriptor ID	NAG	Monitoring Location
RC1	N	Camberwell – McInerneys Road
RC2	J and K	Maison Dieu Road Industrial Estate Area
RC3	D and E	Singleton Heights – Rodd Close
RC4	B and C	Wattle Ponds – Retreat Road
RC5	H	Gowrie – Llanrian Drive
RC6	I	Long Point – Long Point Road

Based on the results of this assessment, these locations are considered adequate for continued monitoring of compliance, with minor refinements at each location to ensure monitoring is undertaken at the location likely to receive the greatest impact. It is recommended RCM develop a noise management plan consistent with current industry practice to formalise both the in-house noise mitigation plan, and the compliance monitoring program.

RCM does not propose to install a real time noise monitoring network. Rather, they propose to continue

managing noise using a combination of proactive noise modelling based on predictive meteorological forecasting, and, utilisation of a full time community response officer to monitor off site noise levels during the sensitive night period, and provide real time feedback to site management based on attended noise measurement.

6 CONCLUSION

This environmental noise assessment considered operational noise, construction noise, low frequency noise, cumulative noise, sleep disturbance, road traffic noise and rail noise associated with the Project.

Results of this assessment indicate that exceedance of PSNL is likely during adverse meteorological conditions for all NAG. The greatest impact is predicted for the year 2017 stage, which is quite similar to the existing operation. Noise levels are predicted to reduce significantly over the following stages as RCM acquire a higher proportion of attenuated equipment, and develop a pit shell form that allows for haulage of waste material to topographically shielded areas deeper in the pit during adverse meteorological conditions.

In accordance with Section 10 of the INP, where noise levels exceed PSNL the regulator and noise source manager may need to negotiate achievable noise limits for the operation. The achievable noise limits may be greater than PSNL. Achievable noise limits will result after applying all reasonable and feasible noise controls to the current operation. It is Global Acoustics opinion that all reasonable and feasible noise controls have been considered and applied in this assessment.

RCM propose the following intrusive noise criteria be applied to the Project:

- $L_{Aeq,15minute}$ 40 dB for NAG D to O inclusive, applicable to all time periods; and
- $L_{Aeq,15minute}$ 42 dB for NAG A, B and C, applicable to all time periods.

RCM acknowledge these criteria are significantly lower than some model predictions, and are cognisant of the requirement to modify operations as required to comply with them. RCM understand the risk involved, but has undertaken analysis of the likely loss of production involved and associated cost implications. As discussed in Section 4.1.1, the weather conditions primarily responsible for night predictions for NAG located south to southeast of the site typically prevail only in winter. Outside of winter, prevailing weather conditions tend to mitigate noise toward these areas. RCM has advised there is sufficient flexibility within the production schedule to modify operations on a regular basis RCM estimate one overburden excavator and associated fleet can be shut down for approximately 30 percent of the winter period, which RCM consider will provide sufficient latitude to avoid operating at full production during periods of adverse weather. RCM, in accordance with their noise management plan, uses predictive noise modelling and attended measurement to both proactively and reactively implement modifications to operations as required to reduce noise emission.

RCM is a long established mining operation, with legacy noise issues stemming from an outdated consent. The acoustic environment around the site is generally complex, with many areas heavily affected by road traffic and rail noise. Despite currently operating with standard (un-attenuated) equipment, RCM receive relatively few complaints regarding noise and are currently operating in compliance with consent conditions. RCM predates many of the noise affected areas around the mine.

RCM has committed to procuring attenuated equipment for future acquisitions, cladding the two critical sides of the CPP, providing barriers to noise sources where reasonable and feasible to do so, and

managing noise to set limits through modification of operations as required. In overall terms, the acoustic environment will improve relative to both the historic and existing situation, albeit at significant financial cost to RCM.

In conclusion, whilst the proposed modification is predicted to exceed PSNL, RCM is committed to managing noise emission from the site to reasonable and achievable levels, resulting in significant improvement to the noise environment around the site relative to the historical situation.

Global Acoustics Pty Ltd

7 REFERENCES

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Appendix

A OPERATIONAL NOISE RESULTS

Table A.1: 90th PERCENTILE OPERATIONAL PREDICTIONS- $L_{Aeq,15\text{minute}}$ dB

NSR ID	NAG	PSNL			2017				2020				2023				2026			
		Day	Eve	Night	Day	Eve	Night 1	Night 2	Day	Eve	Night 1	Night 2	Day	Eve	Night 1	Night 2	Day	Eve	Night 1	Night 2
1	NONE	NA	NA	NA	52	54	54	45	50	58	58	47	48	48	49	46	48	49	49	47
2	A	38	38	38	39	40	41	36	38	36	36	34	35	36	37	36	36	35	37	36
3	A	38	38	38	33	34	35	30	32	28	30	28	29	29	31	30	31	29	31	29
4	A	38	38	38	40	41	42	37	38	39	39	37	37	38	39	38	37	38	38	38
5	A	38	38	38	40	41	42	38	39	39	40	38	38	38	39	39	38	38	39	38
6	A	38	38	38	39	40	41	36	37	37	38	37	36	37	38	37	36	36	37	37
7	A	38	38	38	39	40	41	36	38	39	39	36	36	37	37	37	36	37	37	36
8	A	38	38	38	36	38	39	34	34	36	37	35	33	35	36	35	33	34	35	35
9	A	38	38	38	36	38	39	34	35	36	37	34	33	34	35	34	33	34	35	34
10	A	38	38	38	35	37	38	33	34	34	36	33	32	33	34	34	32	33	34	34
11	A	38	38	38	25	27	28	25	26	23	24	22	22	22	23	23	25	22	23	22
12	A	38	38	38	26	28	33	28	27	25	30	28	22	23	29	28	24	23	28	28
13	A	38	38	38	36	38	39	34	36	36	37	34	34	35	35	35	34	35	36	35
14	A	38	38	38	37	38	39	34	35	36	37	34	34	34	35	34	35	35	36	35
24	A	38	38	38	40	40	42	34	37	36	38	35	35	36	37	35	36	35	37	35
15	B	43	42	37	42	42	44	37	40	41	43	36	39	38	40	38	39	39	41	39
16	B	43	42	37	42	42	44	37	41	41	43	37	39	39	40	39	39	39	41	39
17	B	43	42	37	43	43	44	38	41	41	43	37	39	39	41	39	39	39	41	39
18	B	43	42	37	43	42	44	39	40	41	43	38	39	39	41	40	40	39	41	40
19	B	43	42	37	43	43	45	40	41	41	43	38	40	40	42	41	40	40	42	40
20	B	43	42	37	43	42	44	39	41	40	42	38	39	39	41	40	40	39	42	40
21	B	43	42	37	42	43	44	40	41	41	43	39	40	40	42	41	40	39	42	40

NSR ID	NAG	PSNL			2017				2020				2023				2026			
		Day	Eve	Night	Day	Eve	Night 1	Night 2	Day	Eve	Night 1	Night 2	Day	Eve	Night 1	Night 2	Day	Eve	Night 1	Night 2
22	B	43	42	37	42	43	44	40	41	41	43	40	40	40	42	41	40	40	42	41
23	B	43	42	37	43	43	45	40	41	41	43	40	40	40	42	41	41	40	42	41
25	C	43	42	37	34	32	34	26	31	27	29	23	28	25	26	25	30	27	28	25
26	C	43	42	37	36	35	36	27	34	32	34	27	31	30	31	29	31	29	31	29
27	C	43	42	37	44	44	46	40	41	41	42	38	40	39	42	41	39	39	41	40
28	C	43	42	37	36	35	36	29	34	31	33	27	31	29	31	30	32	28	30	29
29	C	43	42	37	33	31	33	26	31	29	30	24	29	27	29	27	30	27	28	27
30	C	43	42	37	36	35	37	28	34	33	35	25	31	29	31	29	31	29	31	29
31	C	43	42	37	43	43	45	39	41	41	43	39	40	39	41	40	39	39	41	40
32	C	43	42	37	42	42	44	37	40	41	43	37	39	38	40	38	38	38	40	39
33	C	43	42	37	42	42	44	38	41	40	43	37	39	39	41	39	39	39	41	40
34	C	43	42	37	43	44	45	40	41	42	44	41	40	40	42	41	40	40	42	41
35	C	43	42	37	41	42	43	35	39	39	41	35	38	37	39	37	37	37	38	37
36	C	43	42	37	39	38	39	34	37	37	39	32	36	35	37	36	34	34	35	35
37	C	43	42	37	43	43	45	39	41	41	42	38	40	39	41	40	39	39	41	40
38	C	43	42	37	37	36	37	33	36	33	35	33	33	33	34	34	34	33	34	34
39	C	43	42	37	37	36	37	30	35	33	34	29	32	31	33	31	33	30	32	31
57	D	36	36	35	39	40	41	31	36	39	40	33	34	34	35	31	35	36	36	34
58	D	36	36	35	38	39	40	29	34	36	37	32	32	31	32	27	32	34	35	31
59	D	36	36	35	41	43	43	35	39	42	43	37	38	39	40	38	38	39	39	38
60	D	36	36	35	37	35	37	28	34	33	34	24	31	30	31	29	31	31	32	29
61	D	36	36	35	41	41	42	31	37	42	43	31	35	35	36	32	37	37	37	32
62	D	36	36	35	38	39	40	32	35	39	40	32	33	34	35	33	33	35	36	32

NSR ID	NAG	PSNL			2017				2020				2023				2026			
		Day	Eve	Night	Day	Eve	Night 1	Night 2	Day	Eve	Night 1	Night 2	Day	Eve	Night 1	Night 2	Day	Eve	Night 1	Night 2
64	D	36	36	35	36	34	35	26	32	35	36	26	30	29	30	27	30	31	32	29
65	D	36	36	35	39	41	42	32	37	40	41	32	34	34	35	32	35	36	37	33
71	D	36	36	35	40	41	41	33	38	40	41	34	36	35	36	33	36	37	37	35
72	D	36	36	35	40	41	42	34	38	41	41	35	37	36	37	35	36	37	38	35
74	D	36	36	35	39	40	41	31	36	39	40	33	34	34	35	31	34	35	36	33
75	D	36	36	35	38	37	39	30	36	37	37	28	34	32	33	29	33	34	34	32
76	D	36	36	35	42	42	43	35	39	43	44	35	37	37	39	37	37	38	39	36
77	D	36	36	35	36	35	36	28	33	34	35	28	30	30	31	29	31	31	33	29
78	D	36	36	35	40	41	42	32	38	41	42	33	35	36	36	33	36	37	38	35
79	D	36	36	35	41	41	43	34	38	42	43	35	37	37	38	36	37	38	38	35
80	D	36	36	35	37	36	37	27	34	35	36	27	31	31	31	28	35	35	36	31
85	E	36	36	35	39	39	40	32	36	38	38	33	35	34	35	32	35	35	36	34
86	E	36	36	35	37	37	38	31	36	36	37	31	34	33	35	33	33	33	34	33
87	E	36	36	35	39	39	40	32	36	37	38	33	35	34	35	34	34	35	35	33
88	E	36	36	35	37	36	38	30	35	34	36	31	34	32	34	33	33	32	34	33
89	E	36	36	35	39	40	41	33	38	39	39	34	36	36	37	35	36	36	37	35
90	E	36	36	35	39	40	41	33	37	38	39	34	36	35	36	35	35	36	36	34
91	E	36	36	35	39	39	40	33	36	38	39	32	35	34	35	33	34	35	36	34
92	E	36	36	35	36	35	36	26	34	32	35	24	31	29	32	30	30	29	30	27
93	E	36	36	35	36	37	38	28	33	36	36	31	31	32	32	30	31	32	32	30
94	E	36	36	35	24	25	29	16	21	21	23	15	23	18	20	18	23	22	27	19
95	E	36	36	35	39	40	41	32	38	38	39	33	36	35	37	35	35	36	37	35
56	F	36	36	35	36	37	37	25	31	35	35	23	32	29	30	26	30	31	32	27

NSR ID	NAG	PSNL			2017				2020				2023				2026			
		Day	Eve	Night	Day	Eve	Night 1	Night 2	Day	Eve	Night 1	Night 2	Day	Eve	Night 1	Night 2	Day	Eve	Night 1	Night 2
63	F	36	36	35	38	39	39	28	36	37	37	30	33	33	33	30	34	34	34	31
66	F	36	36	35	36	38	39	26	32	37	38	31	30	30	32	27	30	32	33	28
67	F	36	36	35	36	37	38	23	31	37	38	31	30	30	31	25	29	30	31	25
68	F	36	36	35	37	39	39	27	35	37	38	31	33	32	33	26	33	34	35	32
69	F	36	36	35	37	38	39	24	35	37	38	31	34	32	33	27	33	34	34	32
70	F	36	36	35	37	38	39	29	35	36	38	31	34	33	33	29	33	34	34	32
73	F	36	36	35	34	36	37	25	32	35	36	28	30	29	30	25	29	29	30	25
81	F	36	36	35	36	38	38	29	33	36	37	31	31	31	32	27	31	32	33	29
82	F	36	36	35	35	36	37	27	33	35	36	29	31	31	32	26	31	31	32	28
83	F	36	36	35	36	37	38	29	34	34	35	30	33	31	32	27	32	32	33	31
84	F	36	36	35	37	37	38	29	34	34	35	30	33	32	33	27	32	32	33	30
40	G	39	39	37	32	36	38	27	33	33	33	27	29	29	30	24	28	29	30	25
41	G	39	39	37	34	37	38	28	34	33	33	27	31	30	31	25	30	30	31	27
42	G	39	39	37	36	39	40	29	35	33	33	30	32	31	32	26	32	31	33	29
43	G	39	39	37	35	37	38	28	33	34	34	29	31	31	31	28	31	31	32	28
44	G	39	39	37	44	45	45	39	42	41	43	38	40	40	40	38	39	39	39	37
45	G	39	39	37	34	37	38	27	31	34	34	30	31	30	31	25	30	31	33	27
46	G	39	39	37	34	37	38	28	32	33	33	28	31	30	31	25	30	30	32	27
47	G	39	39	37	44	45	45	39	42	41	44	39	41	41	41	39	39	39	40	38
48	G	39	39	37	43	44	44	39	41	39	41	38	40	40	40	39	38	39	39	38
49	G	39	39	37	33	36	37	22	32	28	29	23	28	26	27	23	25	25	26	23
50	G	39	39	37	33	36	36	26	32	32	32	24	29	28	29	23	27	28	29	24
51	G	39	39	37	37	38	39	29	34	34	35	31	33	31	33	26	32	32	33	28

NSR ID	NAG	PSNL			2017				2020				2023				2026			
		Day	Eve	Night	Day	Eve	Night 1	Night 2	Day	Eve	Night 1	Night 2	Day	Eve	Night 1	Night 2	Day	Eve	Night 1	Night 2
52	G	39	39	37	35	37	38	27	33	32	34	29	30	29	31	24	30	31	33	26
53	G	39	39	37	34	35	36	21	31	24	25	22	28	25	25	22	25	26	27	22
54	G	39	39	37	45	45	46	39	42	42	44	40	41	41	41	40	40	40	41	39
55	G	39	39	37	45	46	46	40	43	42	44	40	41	41	42	40	40	40	41	39
96	H	38	38	37	43	43	44	37	41	41	41	38	38	37	39	37	37	36	38	36
97	H	38	38	37	34	38	39	30	31	35	35	29	31	30	30	25	32	32	34	28
98	H	38	38	37	31	36	37	30	27	28	28	23	26	26	26	22	24	25	25	22
99	H	38	38	37	32	37	37	29	28	31	31	24	28	28	28	23	26	27	28	23
100	H	38	38	37	33	38	38	30	31	32	32	27	29	29	29	24	28	29	29	24
101	H	38	38	37	35	39	39	30	33	35	35	30	31	30	30	25	31	31	32	26
102	H	38	38	37	33	37	38	29	30	34	34	27	29	29	29	23	28	29	30	24
103	H	38	38	37	37	39	39	31	34	35	35	31	33	31	32	27	33	32	33	29
104	H	38	38	37	44	44	45	39	41	41	42	39	39	39	40	38	38	38	38	36
105	H	38	38	37	36	40	40	32	33	36	36	29	32	32	32	28	31	32	32	28
106	H	38	38	37	44	44	45	38	42	42	42	39	39	38	40	38	38	37	38	37
107	H	38	38	37	36	39	39	31	33	34	34	28	31	30	30	25	30	30	30	26
108	H	38	38	37	43	43	44	37	41	41	42	38	39	38	39	38	38	37	38	36
109	H	38	38	37	35	39	39	30	33	34	34	29	30	30	31	26	30	31	31	26
110	H	38	38	37	43	43	44	37	41	41	41	38	38	37	39	37	37	37	38	36
111	H	38	38	37	41	42	43	36	40	39	39	34	37	36	38	36	37	36	37	35
112	H	38	38	37	42	43	43	37	40	40	40	38	38	37	39	37	37	37	38	36
113	H	38	38	37	43	43	44	37	41	41	41	38	38	37	39	38	37	37	38	36
114	H	38	38	37	42	42	43	37	40	39	39	35	38	37	39	37	37	36	37	36

NSR ID	NAG	PSNL			2017				2020				2023				2026			
		Day	Eve	Night	Day	Eve	Night 1	Night 2	Day	Eve	Night 1	Night 2	Day	Eve	Night 1	Night 2	Day	Eve	Night 1	Night 2
115	H	38	38	37	43	43	44	37	41	40	40	35	38	37	39	37	37	37	38	36
116	H	38	38	37	43	43	44	37	41	39	40	35	38	37	38	36	37	37	37	35
117	H	38	38	37	43	43	44	37	41	40	40	35	38	37	38	36	38	37	38	36
118	H	38	38	37	42	43	43	36	40	35	35	32	37	35	37	34	37	36	37	35
119	H	38	38	37	43	43	43	36	41	39	39	34	37	36	37	35	37	37	37	35
120	H	38	38	37	43	43	44	36	41	37	37	34	37	35	36	33	38	37	37	35
121	H	38	38	37	42	43	43	36	39	34	34	32	34	32	35	33	36	35	35	29
122	H	38	38	37	43	43	43	36	41	35	35	32	34	32	33	30	36	35	35	30
123	I	37	37	37	37	39	38	26	35	35	35	33	31	31	31	26	30	32	32	28
124	I	37	37	37	36	38	38	27	34	34	34	32	31	31	30	26	30	32	32	29
125	I	37	37	37	38	39	39	25	35	36	35	33	31	32	32	27	31	32	32	28
126	I	37	37	37	38	40	40	30	36	35	35	32	30	33	32	26	32	33	32	28
127	I	37	37	37	39	39	39	28	37	34	33	29	32	32	31	25	32	32	33	29
128	I	37	37	37	39	40	40	28	37	34	34	29	32	33	32	26	33	33	33	28
129	I	37	37	37	39	39	39	30	37	35	34	31	33	31	32	25	33	33	34	31
130	I	37	37	37	39	39	39	31	38	34	33	29	33	31	32	25	34	34	34	32
131	I	37	37	37	34	39	39	33	33	31	30	27	27	28	28	24	29	29	30	24
132	I	37	37	37	36	38	38	31	33	30	30	28	28	26	26	21	30	31	31	22
133	I	37	37	37	37	38	38	31	36	31	31	29	33	32	32	30	33	32	32	30
134	I	37	37	37	36	38	37	28	34	34	33	31	31	32	32	29	30	31	31	28
135	I	37	37	37	37	38	38	28	34	35	34	32	31	32	32	29	30	32	31	28
136	J	39	39	37	46	46	47	39	43	42	42	37	40	39	40	38	40	40	40	38
137	J	39	39	37	46	47	47	40	44	44	44	42	41	40	41	37	41	41	41	39

NSR ID	NAG	PSNL			2017				2020				2023				2026			
		Day	Eve	Night	Day	Eve	Night 1	Night 2	Day	Eve	Night 1	Night 2	Day	Eve	Night 1	Night 2	Day	Eve	Night 1	Night 2
138	J	39	39	37	46	47	48	41	44	43	44	40	41	40	41	38	41	41	41	39
139	J	39	39	37	46	46	47	39	44	42	42	37	40	39	40	38	40	40	40	38
140	J	39	39	37	47	48	49	42	45	43	44	40	42	40	41	37	42	41	42	39
152	J	39	39	37	46	46	46	39	44	41	41	37	40	39	40	38	41	40	41	39
153	J	39	39	37	39	42	42	37	36	32	33	29	31	30	30	27	32	31	32	27
154	J	39	39	37	39	42	42	36	36	32	32	29	31	30	30	27	33	32	33	28
155	J	39	39	37	46	47	47	40	44	42	42	37	40	40	40	36	41	41	41	39
156	J	39	39	37	41	42	42	36	37	32	33	30	32	30	30	27	32	32	32	28
157	J	39	39	37	38	42	42	37	35	32	32	29	30	29	30	28	31	30	31	27
158	J	39	39	37	44	44	44	38	42	32	32	29	33	30	31	28	36	32	33	26
159	J	39	39	37	39	42	42	36	36	31	31	27	31	29	29	25	32	31	31	26
166	J	39	39	37	44	45	45	37	42	36	36	34	37	36	36	31	38	38	38	36
141	K	35	35	35	43	45	45	37	41	40	40	36	34	36	37	31	37	37	36	32
142	K	35	35	35	40	42	42	33	38	38	37	33	32	35	34	30	33	35	34	30
143	K	35	35	35	40	43	42	33	37	39	38	34	31	33	33	30	34	35	35	29
144	K	35	35	35	40	43	42	33	37	38	38	34	32	33	33	29	34	35	34	28
145	K	35	35	35	39	42	41	32	37	38	37	34	31	34	33	29	33	34	34	28
146	K	35	35	35	38	43	42	31	37	39	37	33	28	34	31	29	33	35	34	27
147	K	35	35	35	37	42	41	31	36	38	36	33	28	36	32	29	32	34	34	28
148	K	35	35	35	40	41	41	31	38	38	37	35	30	36	33	29	33	34	32	28
160	K	35	35	35	45	47	47	40	42	43	43	37	36	37	37	33	39	37	38	33
161	K	35	35	35	45	47	46	40	41	43	42	37	36	37	38	33	39	37	38	33
162	K	35	35	35	44	45	45	37	40	42	41	35	34	35	34	32	38	37	37	31

NSR ID	NAG	PSNL			2017				2020				2023				2026			
		Day	Eve	Night	Day	Eve	Night 1	Night 2	Day	Eve	Night 1	Night 2	Day	Eve	Night 1	Night 2	Day	Eve	Night 1	Night 2
163	K	35	35	35	39	44	43	32	38	40	39	33	31	33	32	30	32	33	33	27
149	L	37	37	37	39	38	36	26	36	31	29	24	28	30	27	25	29	30	27	23
150	L	37	37	37	36	36	33	20	34	30	28	22	25	26	23	20	25	23	21	19
151	L	37	37	37	37	37	35	20	34	31	28	25	28	27	24	21	29	25	23	20
164	L	37	37	37	39	39	37	26	38	33	31	29	31	33	30	27	30	33	30	27
165	L	37	37	37	35	36	33	25	33	29	27	19	27	28	23	21	24	22	19	16
167	L	37	37	37	39	41	38	32	38	37	35	33	36	39	35	34	35	37	33	32
168	L	37	37	37	40	41	39	33	38	38	35	33	36	39	35	34	34	37	33	31
169	L	37	37	37	39	40	38	31	37	37	35	32	36	38	35	34	34	36	32	31
171	M	39	39	38	37	41	40	30	36	35	34	30	32	34	33	32	33	32	31	30
174	M	39	39	38	38	40	39	27	38	33	31	24	28	34	29	28	28	28	26	23
170	N	45	42	39	33	39	38	26	31	31	31	27	25	27	26	23	29	25	24	23
172	N	45	42	39	36	39	39	30	34	33	33	30	32	35	34	34	33	34	33	33
173	N	45	42	39	36	40	40	31	35	35	34	32	32	33	32	31	33	34	34	34
175	N	45	42	39	40	46	46	35	38	38	38	36	37	39	39	38	37	39	39	38
176	N	45	42	39	40	45	45	34	38	38	38	35	35	38	38	36	37	38	38	37
177	N	45	42	39	36	42	42	27	32	33	33	28	27	30	30	27	30	28	28	26
178	N	45	42	39	37	41	41	31	34	35	35	33	34	36	36	35	34	35	35	34
179	N	45	42	39	38	42	42	32	36	36	36	33	34	35	35	34	34	35	35	34
180	O	35	35	35	38	42	43	34	36	37	38	35	35	35	37	36	35	35	36	36
181	O	35	35	35	35	38	39	31	33	33	34	32	33	32	34	33	32	32	34	33

Notes:

1. Results in bold type exceed PSNL.

Table A.2: 90th PERCENTILE LOW FREQUENCY NOISE PREDICTIONS- $L_{Ceq,15minute}$ dB

NSR ID	NAG	Criteria			2017				2020				2023				2026			
		Day	Eve	Night	Day	Eve	Night 1	Night 2	Day	Eve	Night 1	Night 2	Day	Eve	Night 1	Night 2	Day	Eve	Night 1	Night 2
1	NONE	NA	NA	NA	60	61	61	54	59	63	63	55	58	57	57	55	57	57	58	56
2	A	65	65	60	51	52	52	51	52	50	51	51	51	51	51	51	51	51	52	51
3	A	65	65	60	48	48	49	48	49	47	47	47	47	47	48	48	48	47	48	47
4	A	65	65	60	51	53	54	52	51	52	53	52	50	52	53	53	51	52	53	53
5	A	65	65	60	52	53	54	52	52	51	52	52	51	51	52	52	52	51	52	52
6	A	65	65	60	51	52	53	50	51	50	51	50	50	50	51	51	51	50	51	50
7	A	65	65	60	51	53	54	52	51	52	53	52	50	52	52	52	50	52	52	52
8	A	65	65	60	48	50	52	51	48	49	51	51	47	49	51	51	48	48	51	51
9	A	65	65	60	48	51	51	50	48	50	50	50	47	49	50	50	48	49	50	50
10	A	65	65	60	48	50	51	49	48	48	50	49	47	48	50	50	48	48	50	49
11	A	65	65	60	41	43	44	42	43	41	42	41	41	41	42	42	43	41	42	42
12	A	65	65	60	42	43	45	43	43	41	43	42	41	41	43	43	42	41	43	42
13	A	65	65	60	50	51	51	49	50	50	50	49	49	50	50	50	50	50	50	50
14	A	65	65	60	50	51	51	50	50	50	50	49	49	50	50	50	50	50	51	50
24	A	65	65	60	49	50	51	48	50	48	48	47	48	48	49	49	50	49	50	49
15	B	65	65	60	53	52	53	49	52	50	51	48	51	50	51	50	51	50	52	50
16	B	65	65	60	53	52	53	50	52	50	52	49	51	50	51	51	51	50	52	50
17	B	65	65	60	54	53	54	52	53	52	53	51	52	52	53	52	53	52	53	52
18	B	65	65	60	55	55	57	56	55	54	56	56	54	54	56	56	55	54	56	56
19	B	65	65	60	55	55	57	56	55	54	56	55	54	54	56	56	54	54	56	56
20	B	65	65	60	55	55	57	56	55	54	56	56	54	54	56	56	54	54	56	56
21	B	65	65	60	55	55	58	56	55	54	57	56	54	54	57	57	55	54	57	57

NSR ID	NAG	Criteria			2017				2020				2023				2026			
		Day	Eve	Night	Day	Eve	Night 1	Night 2	Day	Eve	Night 1	Night 2	Day	Eve	Night 1	Night 2	Day	Eve	Night 1	Night 2
22	B	65	65	60	55	56	58	57	55	55	57	57	55	55	57	57	55	55	57	57
23	B	65	65	60	56	56	58	57	56	55	57	57	55	55	57	57	56	55	57	57
25	C	65	65	60	47	44	45	41	45	41	42	40	43	41	42	41	44	41	42	41
26	C	65	65	60	47	45	46	42	46	43	44	42	45	43	44	43	45	43	44	43
27	C	65	65	60	54	54	56	52	53	52	54	52	53	52	54	53	53	52	53	53
28	C	65	65	60	49	47	48	45	48	45	46	44	46	45	46	46	47	45	46	45
29	C	65	65	60	47	46	46	45	47	44	45	44	45	45	45	45	46	45	45	45
30	C	65	65	60	49	47	48	45	48	45	46	44	46	45	46	45	47	45	46	45
31	C	65	65	60	53	53	55	52	53	51	53	51	52	51	53	52	52	51	53	52
32	C	65	65	60	52	52	53	49	51	49	51	48	51	49	51	50	50	50	51	50
33	C	65	65	60	53	53	54	51	53	51	52	51	52	51	53	52	52	52	53	52
34	C	65	65	60	54	55	56	53	54	53	54	52	53	53	54	53	53	53	54	53
35	C	65	65	60	52	52	53	49	51	49	50	47	51	49	50	49	50	50	51	49
36	C	65	65	60	51	50	51	49	51	48	49	47	50	49	50	50	49	48	49	49
37	C	65	65	60	53	54	55	52	53	51	52	51	52	51	52	52	52	51	53	52
38	C	65	65	60	50	48	49	47	49	46	47	47	47	47	48	48	48	47	48	47
39	C	65	65	60	50	49	49	47	49	47	47	46	47	47	48	47	48	47	47	47
57	D	65	65	60	50	50	50	44	48	48	48	45	47	46	46	44	47	47	48	45
58	D	65	65	60	49	48	49	43	47	45	45	43	46	44	44	42	46	46	46	43
59	D	65	65	60	52	52	52	47	51	50	51	47	50	49	50	49	49	50	51	49
60	D	65	65	60	49	46	47	41	47	43	43	41	45	43	44	43	45	44	45	42
61	D	65	65	60	52	51	51	45	50	50	50	45	48	47	48	46	49	49	49	46
62	D	65	65	60	49	49	49	45	48	48	48	45	46	46	46	45	46	47	47	45

NSR ID	NAG	Criteria			2017				2020				2023				2026			
		Day	Eve	Night	Day	Eve	Night 1	Night 2	Day	Eve	Night 1	Night 2	Day	Eve	Night 1	Night 2	Day	Eve	Night 1	Night 2
64	D	65	65	60	48	45	46	41	46	44	44	41	44	42	43	41	44	44	45	42
65	D	65	65	60	50	50	50	44	49	48	49	44	47	45	46	44	47	48	48	45
71	D	65	65	60	51	50	51	45	50	48	49	45	49	47	47	45	48	49	49	47
72	D	65	65	60	51	50	51	45	50	49	49	46	49	48	48	47	48	48	49	47
74	D	65	65	60	50	50	50	44	49	47	48	45	47	46	46	44	47	48	48	46
75	D	65	65	60	50	48	49	42	48	45	45	41	47	44	45	42	46	46	46	45
76	D	65	65	60	53	52	53	47	51	51	52	47	49	49	50	48	49	50	50	48
77	D	65	65	60	47	46	46	42	46	44	45	42	45	43	44	43	45	44	45	43
78	D	65	65	60	51	51	51	45	50	49	50	45	48	47	48	46	48	49	49	47
79	D	65	65	60	52	51	52	46	50	50	51	46	49	48	49	47	49	49	49	47
80	D	65	65	60	48	47	47	43	47	45	46	43	45	44	44	43	47	47	48	44
85	E	65	65	60	50	50	51	45	49	47	48	45	48	47	47	45	48	48	48	46
86	E	65	65	60	49	48	49	43	49	45	46	43	47	45	46	45	46	46	46	45
87	E	65	65	60	50	50	50	45	49	47	47	45	48	47	48	46	47	48	48	47
88	E	65	65	60	49	48	49	43	48	45	46	44	47	45	47	46	46	46	47	46
89	E	65	65	60	51	50	51	46	50	48	49	46	49	48	48	47	48	48	49	47
90	E	65	65	60	50	50	51	46	49	48	48	46	48	47	48	47	48	48	49	47
91	E	65	65	60	50	49	50	44	49	47	47	44	48	46	47	45	47	47	47	46
92	E	65	65	60	48	46	47	41	47	42	43	40	44	41	43	42	43	42	43	41
93	E	65	65	60	47	48	48	43	45	46	46	44	44	44	45	43	45	45	45	43
94	E	65	65	60	39	38	39	34	38	35	36	34	38	34	35	34	38	37	39	35
95	E	65	65	60	50	50	51	46	50	48	49	46	49	48	48	47	48	48	49	48
56	F	65	65	60	47	46	47	39	46	43	44	39	46	42	42	40	44	44	45	41

NSR ID	NAG	Criteria			2017				2020				2023				2026			
		Day	Eve	Night	Day	Eve	Night 1	Night 2	Day	Eve	Night 1	Night 2	Day	Eve	Night 1	Night 2	Day	Eve	Night 1	Night 2
63	F	65	65	60	50	49	49	42	49	46	46	43	47	45	45	42	47	46	47	44
66	F	65	65	60	47	47	48	41	46	46	46	43	45	43	44	42	44	45	46	42
67	F	65	65	60	47	46	47	40	46	45	46	43	44	42	43	40	43	43	44	40
68	F	65	65	60	49	49	49	40	48	46	46	42	47	44	45	40	46	46	47	44
69	F	65	65	60	48	48	49	40	48	46	46	42	47	44	45	41	46	46	47	44
70	F	65	65	60	49	48	49	41	48	45	46	43	47	44	45	42	46	46	47	44
73	F	65	65	60	47	47	48	41	46	44	45	42	44	42	43	41	43	43	44	40
81	F	65	65	60	48	48	48	42	47	45	46	43	45	43	44	41	45	45	46	42
82	F	65	65	60	47	47	48	41	47	44	45	42	45	43	44	41	44	44	45	42
83	F	65	65	60	49	47	48	41	47	44	45	42	47	44	45	41	45	45	46	43
84	F	65	65	60	49	49	49	41	48	45	45	43	47	44	45	41	45	45	46	42
40	G	65	65	60	45	47	48	41	46	43	44	41	44	42	42	40	43	43	44	41
41	G	65	65	60	47	48	48	42	48	44	44	42	45	43	44	41	44	44	45	42
42	G	65	65	60	48	49	49	42	48	44	44	42	46	43	44	41	45	44	45	42
43	G	65	65	60	47	48	48	42	46	45	45	42	45	44	44	42	44	44	45	42
44	G	65	65	60	54	55	55	50	53	49	50	48	53	51	51	49	51	51	51	49
45	G	65	65	60	47	48	49	42	46	45	45	42	45	43	43	41	44	44	45	42
46	G	65	65	60	46	47	48	41	46	44	44	41	45	43	43	40	44	44	44	41
47	G	65	65	60	54	54	55	50	53	50	51	49	53	51	52	50	51	51	51	50
48	G	65	65	60	54	53	54	50	53	48	49	48	52	51	51	50	51	50	51	50
49	G	65	65	60	45	46	46	38	45	40	40	38	42	40	40	38	41	40	41	38
50	G	65	65	60	46	46	46	39	46	41	41	38	43	40	41	38	42	41	42	39
51	G	65	65	60	48	48	49	41	48	44	45	43	46	43	44	40	45	45	46	41

NSR ID	NAG	Criteria			2017				2020				2023				2026			
		Day	Eve	Night	Day	Eve	Night 1	Night 2	Day	Eve	Night 1	Night 2	Day	Eve	Night 1	Night 2	Day	Eve	Night 1	Night 2
52	G	65	65	60	47	47	48	40	46	42	43	41	44	42	43	39	43	44	45	40
53	G	65	65	60	46	45	45	37	46	39	39	37	43	39	40	37	40	40	41	37
54	G	65	65	60	54	55	55	51	54	51	52	50	53	52	52	51	52	52	52	51
55	G	65	65	60	55	55	55	51	54	51	52	50	53	52	52	51	52	52	52	51
96	H	65	65	60	53	53	54	48	52	50	50	48	51	49	50	48	50	49	50	48
97	H	65	65	60	46	48	49	42	45	44	44	41	45	42	43	40	45	45	46	41
98	H	65	65	60	44	47	48	41	42	40	40	39	42	40	40	38	40	40	41	38
99	H	65	65	60	44	47	48	41	43	42	42	40	43	41	41	39	42	42	42	39
100	H	65	65	60	46	48	49	42	45	43	43	40	44	42	42	39	42	43	43	39
101	H	65	65	60	47	49	50	42	46	44	45	42	45	42	43	39	44	44	45	40
102	H	65	65	60	45	48	49	42	44	43	43	40	44	42	42	39	43	43	43	40
103	H	65	65	60	48	49	50	43	47	45	45	43	46	44	44	40	45	45	46	41
104	H	65	65	60	54	54	55	50	53	50	51	49	52	50	51	49	51	50	51	49
105	H	65	65	60	48	50	50	43	47	45	45	42	46	44	44	41	44	44	45	42
106	H	65	65	60	54	54	55	48	53	51	51	49	52	50	50	49	51	50	51	49
107	H	65	65	60	47	49	50	42	46	43	43	41	45	42	42	39	43	43	43	40
108	H	65	65	60	54	53	54	48	53	50	50	48	51	49	50	48	50	49	50	48
109	H	65	65	60	47	49	49	43	46	44	44	41	45	43	43	40	43	44	44	41
110	H	65	65	60	54	53	54	48	52	50	50	48	51	49	50	48	50	49	50	48
111	H	65	65	60	53	53	54	48	52	48	48	45	50	48	49	48	49	49	49	47
112	H	65	65	60	54	53	54	49	52	50	50	48	51	49	50	49	50	50	50	49
113	H	65	65	60	54	53	54	49	52	50	50	48	51	49	50	49	50	50	50	48
114	H	65	65	60	53	53	54	48	52	49	49	46	51	49	50	48	50	49	50	48

NSR ID	NAG	Criteria			2017				2020				2023				2026			
		Day	Eve	Night	Day	Eve	Night 1	Night 2	Day	Eve	Night 1	Night 2	Day	Eve	Night 1	Night 2	Day	Eve	Night 1	Night 2
115	H	65	65	60	54	53	54	48	52	49	49	46	51	49	50	48	50	50	50	48
116	H	65	65	60	54	53	54	48	53	49	49	46	51	49	50	48	50	50	50	48
117	H	65	65	60	54	53	54	48	53	49	49	46	51	48	49	47	50	50	50	48
118	H	65	65	60	53	53	53	47	52	45	45	44	49	47	48	46	49	49	49	46
119	H	65	65	60	54	53	54	47	53	49	49	46	50	48	49	47	50	50	50	47
120	H	65	65	60	54	53	54	47	53	47	47	45	50	47	48	45	50	49	49	46
121	H	65	65	60	53	53	53	47	51	45	45	43	48	44	45	44	48	47	47	41
122	H	65	65	60	54	53	53	47	52	45	46	44	48	45	45	43	48	47	47	42
123	I	65	65	60	50	51	51	42	49	48	48	47	46	46	45	42	45	47	47	44
124	I	65	65	60	50	51	51	45	49	49	48	48	47	47	47	45	47	48	48	46
125	I	65	65	60	51	51	51	45	50	49	49	48	47	48	47	45	46	48	48	46
126	I	65	65	60	50	52	51	42	49	47	47	46	45	45	45	40	45	47	46	41
127	I	65	65	60	51	51	51	40	50	45	45	42	46	45	44	39	46	46	46	42
128	I	65	65	60	51	51	51	40	50	45	45	42	47	45	45	40	46	47	46	41
129	I	65	65	60	51	51	51	42	50	46	45	43	47	44	44	40	46	46	47	44
130	I	65	65	60	50	50	51	43	51	45	44	42	47	44	44	40	47	47	47	44
131	I	65	65	60	47	50	50	44	47	43	43	41	42	42	42	39	43	43	44	39
132	I	65	65	60	48	50	50	43	47	43	43	42	44	41	41	37	43	45	45	37
133	I	65	65	60	50	50	51	44	50	44	44	43	48	45	45	43	47	46	46	43
134	I	65	65	60	50	51	51	45	49	49	48	47	47	47	47	46	46	48	47	45
135	I	65	65	60	50	52	51	45	49	49	49	48	47	48	47	46	46	48	48	46
136	J	65	65	60	56	56	56	49	55	51	51	48	52	50	51	49	52	52	52	50
137	J	65	65	60	56	56	57	50	55	53	53	51	53	51	51	49	53	53	53	50

NSR ID	NAG	Criteria			2017				2020				2023				2026			
		Day	Eve	Night	Day	Eve	Night 1	Night 2	Day	Eve	Night 1	Night 2	Day	Eve	Night 1	Night 2	Day	Eve	Night 1	Night 2
138	J	65	65	60	56	57	57	50	56	52	52	50	54	51	52	49	53	53	53	50
139	J	65	65	60	56	56	56	49	55	51	51	48	52	50	51	49	52	52	52	50
140	J	65	65	60	56	57	58	51	56	52	52	50	54	51	52	49	53	52	53	50
152	J	65	65	60	56	56	56	49	55	51	51	48	52	51	51	49	52	52	52	50
153	J	65	65	60	50	52	52	47	49	44	45	43	46	44	44	42	46	45	45	42
154	J	65	65	60	50	52	52	46	49	44	45	43	46	44	44	42	46	45	45	42
155	J	65	65	60	56	57	57	52	55	53	53	51	53	52	52	51	53	53	53	52
156	J	65	65	60	52	52	52	48	49	46	46	45	47	45	45	44	46	46	46	44
157	J	65	65	60	50	52	52	47	48	46	46	45	47	45	45	44	46	46	46	44
158	J	65	65	60	54	53	54	48	53	45	45	44	47	45	45	44	48	46	46	43
159	J	65	65	60	50	52	52	46	48	45	45	44	46	44	44	43	46	45	45	43
166	J	65	65	60	55	54	55	48	54	48	48	47	50	48	48	46	50	50	50	48
141	K	65	65	60	54	55	54	48	52	51	50	49	49	49	49	47	49	51	50	48
142	K	65	65	60	52	54	54	48	51	51	50	49	48	49	49	47	48	50	49	47
143	K	65	65	60	50	53	53	44	49	49	49	47	45	46	45	43	47	48	48	42
144	K	65	65	60	50	54	53	44	49	49	49	46	45	46	45	43	47	48	47	42
145	K	65	65	60	51	53	53	44	50	49	49	47	46	47	46	43	46	48	47	42
146	K	65	65	60	49	54	53	43	48	50	49	47	43	46	44	42	45	48	47	41
147	K	65	65	60	49	53	53	43	48	50	49	47	43	47	45	43	46	48	47	41
148	K	65	65	60	51	53	52	44	50	50	49	47	46	48	46	43	46	47	46	42
160	K	65	65	60	55	55	55	48	53	51	51	47	49	47	48	45	50	50	50	45
161	K	65	65	60	55	55	55	48	53	51	51	47	49	47	48	44	50	49	50	45
162	K	65	65	60	54	55	54	46	52	51	50	47	48	47	47	45	49	49	49	44

NSR ID	NAG	Criteria			2017				2020				2023				2026			
		Day	Eve	Night	Day	Eve	Night 1	Night 2	Day	Eve	Night 1	Night 2	Day	Eve	Night 1	Night 2	Day	Eve	Night 1	Night 2
163	K	65	65	60	50	54	54	44	49	50	49	47	45	46	45	43	45	47	47	42
149	L	65	65	60	49	51	49	45	48	47	46	45	44	45	44	43	44	46	44	42
150	L	65	65	60	46	47	45	39	45	44	42	39	41	42	40	39	40	41	40	38
151	L	65	65	60	48	49	47	40	46	46	44	43	43	43	41	40	43	42	41	39
164	L	65	65	60	50	51	50	46	49	48	47	46	47	47	46	45	47	48	47	45
165	L	65	65	60	45	47	45	40	43	43	41	35	39	40	38	36	38	38	36	33
167	L	65	65	60	51	53	51	48	51	51	50	48	50	51	49	49	50	51	49	48
168	L	65	65	60	51	53	51	48	51	51	50	48	50	51	49	49	49	51	49	47
169	L	65	65	60	51	52	51	47	50	51	49	48	50	51	49	49	49	51	48	47
171	M	65	65	60	49	52	51	46	49	48	47	45	47	48	47	47	48	48	47	46
174	M	65	65	60	48	51	49	43	49	47	45	42	44	47	44	44	44	46	43	42
170	N	65	65	60	44	48	48	42	45	43	43	42	42	42	42	42	45	42	42	41
172	N	65	65	60	47	50	50	45	48	46	46	44	47	49	48	48	48	49	48	48
173	N	65	65	60	47	51	51	46	48	47	47	45	46	47	47	46	49	49	49	48
175	N	65	65	60	51	55	55	48	51	50	50	48	50	51	51	50	51	52	52	51
176	N	65	65	60	51	54	54	49	51	50	50	48	50	51	51	50	52	52	52	52
177	N	65	65	60	46	50	50	43	46	45	45	42	43	43	43	42	45	43	43	43
178	N	65	65	60	49	52	52	46	49	49	49	47	48	49	50	49	50	50	50	49
179	N	65	65	60	49	52	52	47	50	49	49	48	48	49	49	49	50	50	50	49
180	O	65	65	60	50	53	54	48	50	49	50	48	49	49	50	50	50	50	51	50
181	O	65	65	60	48	50	51	46	48	47	48	47	48	47	48	48	48	48	49	48

Notes:

1. Results in bold type exceed the relevant criterion (if applicable)

Table A.3: 90th PERCENTILE C MINUS A PREDICTIONS - dB

NSR ID	NAG	Criterion	2017				2020				2023				2026			
			Day	Eve	Night 1	Night 2	Day	Eve	Night 1	Night 2	Day	Eve	Night 1	Night 2	Day	Eve	Night 1	Night 2
1	NONE	NA	8	7	7	9	9	5	5	8	10	9	8	9	9	8	9	9
2	A	15	12	12	11	15	14	14	15	17	16	15	14	15	15	16	15	15
3	A	15	15	14	14	18	17	19	17	19	18	18	17	18	17	18	17	18
4	A	15	11	12	12	15	13	13	14	15	13	14	14	15	14	14	15	15
5	A	15	12	12	12	14	13	12	12	14	13	13	13	13	14	13	13	14
6	A	15	12	12	12	14	14	13	13	13	14	13	13	14	15	14	14	13
7	A	15	12	13	13	16	13	13	14	16	14	15	15	15	14	15	15	16
8	A	15	12	12	13	17	14	13	14	16	14	14	15	16	15	14	16	16
9	A	15	12	13	12	16	13	14	13	16	14	15	15	16	15	15	15	16
10	A	15	13	13	13	16	14	14	14	16	15	15	16	16	16	15	16	15
11	A	15	16	16	16	17	17	18	18	19	19	19	19	19	18	19	19	20
12	A	15	16	15	12	15	16	16	13	14	19	18	14	15	18	18	15	14
13	A	15	14	13	12	15	14	14	13	15	15	15	15	15	16	15	14	15
14	A	15	13	13	12	16	15	14	13	15	15	16	15	16	15	15	15	15
24	A	15	9	10	9	14	13	12	10	12	13	12	12	14	14	14	13	14
15	B	15	11	10	9	12	12	9	8	12	12	12	11	12	12	11	11	11
16	B	15	11	10	9	13	11	9	9	12	12	11	11	12	12	11	11	11
17	B	15	11	10	10	14	12	11	10	14	13	13	12	13	14	13	12	13
18	B	15	12	13	13	17	15	13	13	18	15	15	15	16	15	15	15	16
19	B	15	12	12	12	16	14	13	13	17	14	14	14	15	14	14	14	16

NSR ID	NAG	Criterion	2017				2020				2023				2026			
			Day	Eve	Night 1	Night 2	Day	Eve	Night 1	Night 2	Day	Eve	Night 1	Night 2	Day	Eve	Night 1	Night 2
20	B	15	12	13	13	17	14	14	14	18	15	15	15	16	14	15	14	16
21	B	15	13	12	14	16	14	13	14	17	14	14	15	16	15	15	15	17
22	B	15	13	13	14	17	14	14	14	17	15	15	15	16	15	15	15	16
23	B	15	13	13	13	17	15	14	14	17	15	15	15	16	15	15	15	16
25	C	15	13	12	11	15	14	14	13	17	15	16	16	16	14	14	14	16
26	C	15	11	10	10	15	12	11	10	15	14	13	13	14	14	14	13	14
27	C	15	10	10	10	12	12	11	12	14	13	13	12	12	14	13	12	13
28	C	15	13	12	12	16	14	14	13	17	15	16	15	16	15	17	16	16
29	C	15	14	15	13	19	16	15	15	20	16	18	16	18	16	18	17	18
30	C	15	13	12	11	17	14	12	11	19	15	16	15	16	16	16	15	16
31	C	15	10	10	10	13	12	10	10	12	12	12	12	12	13	12	12	12
32	C	15	10	10	9	12	11	8	8	11	12	11	11	12	12	12	11	11
33	C	15	11	11	10	13	12	11	9	14	13	12	12	13	13	13	12	12
34	C	15	11	11	11	13	13	11	10	11	13	13	12	12	13	13	12	12
35	C	15	11	10	10	14	12	10	9	12	13	12	11	12	13	13	13	12
36	C	15	12	12	12	15	14	11	10	15	14	14	13	14	15	14	14	14
37	C	15	10	11	10	13	12	10	10	13	12	12	11	12	13	12	12	12
38	C	15	13	12	12	14	13	13	12	14	14	14	14	14	14	14	14	13
39	C	15	13	13	12	17	14	14	13	17	15	16	15	16	15	17	15	16
57	D	15	11	10	9	13	12	9	8	12	13	12	11	13	12	11	12	11
58	D	15	11	9	9	14	13	9	8	11	14	13	12	15	14	12	11	12

NSR ID	NAG	Criterion	2017				2020				2023				2026			
			Day	Eve	Night 1	Night 2	Day	Eve	Night 1	Night 2	Day	Eve	Night 1	Night 2	Day	Eve	Night 1	Night 2
59	D	15	11	9	9	12	12	8	8	10	12	10	10	11	11	11	12	11
60	D	15	12	11	10	13	13	10	9	17	14	13	13	14	14	13	13	13
61	D	15	11	10	9	14	13	8	7	14	13	12	12	14	12	12	12	14
62	D	15	11	10	9	13	13	9	8	13	13	12	11	12	13	12	11	13
64	D	15	12	11	11	15	14	9	8	15	14	13	13	14	14	13	13	13
65	D	15	11	9	8	12	12	8	8	12	13	11	11	12	12	12	11	12
71	D	15	11	9	10	12	12	8	8	11	13	12	11	12	12	12	12	12
72	D	15	11	9	9	11	12	8	8	11	12	12	11	12	12	11	11	12
74	D	15	11	10	9	13	13	8	8	12	13	12	11	13	13	13	12	13
75	D	15	12	11	10	12	12	8	8	13	13	12	12	13	13	12	12	13
76	D	15	11	10	10	12	12	8	8	12	12	12	11	11	12	12	11	12
77	D	15	11	11	10	14	13	10	10	14	15	13	13	14	14	13	12	14
78	D	15	11	10	9	13	12	8	8	12	13	11	12	13	12	12	11	12
79	D	15	11	10	9	12	12	8	8	11	12	11	11	11	12	11	11	12
80	D	15	11	11	10	16	13	10	10	16	14	13	13	15	12	12	12	13
85	E	15	11	11	11	13	13	9	10	12	13	13	12	13	13	13	12	12
86	E	15	12	11	11	12	13	9	9	12	13	12	11	12	13	13	12	12
87	E	15	11	11	10	13	13	10	9	12	13	13	13	12	13	13	13	14
88	E	15	12	12	11	13	13	11	10	13	13	13	13	13	13	14	13	13
89	E	15	12	10	10	13	12	9	10	12	13	12	11	12	12	12	12	12
90	E	15	11	10	10	13	12	10	9	12	12	12	12	12	13	12	13	13

NSR ID	NAG	Criterion	2017				2020				2023				2026			
			Day	Eve	Night 1	Night 2	Day	Eve	Night 1	Night 2	Day	Eve	Night 1	Night 2	Day	Eve	Night 1	Night 2
91	E	15	11	10	10	11	13	9	8	12	13	12	12	12	13	12	11	12
92	E	15	12	11	11	15	13	10	8	16	13	12	11	12	13	13	13	14
93	E	15	11	11	10	15	12	10	10	13	13	12	13	13	14	13	13	13
94	E	15	15	13	10	18	17	14	13	19	15	16	15	16	15	15	12	16
95	E	15	11	10	10	14	12	10	10	13	13	13	11	12	13	12	12	13
56	F	15	11	9	10	14	15	8	9	16	14	13	12	14	14	13	13	14
63	F	15	12	10	10	14	13	9	9	13	14	12	12	12	13	12	13	13
66	F	15	11	9	9	15	14	9	8	12	15	13	12	15	14	13	13	14
67	F	15	11	9	9	17	15	8	8	12	14	12	12	15	14	13	13	15
68	F	15	12	10	10	13	13	9	8	11	14	12	12	14	13	12	12	12
69	F	15	11	10	10	16	13	9	8	11	13	12	12	14	13	12	13	12
70	F	15	12	10	10	12	13	9	8	12	13	11	12	13	13	12	13	12
73	F	15	13	11	11	16	14	9	9	14	14	13	13	16	14	14	14	15
81	F	15	12	10	10	13	14	9	9	12	14	12	12	14	14	13	13	13
82	F	15	12	11	11	14	14	9	9	13	14	12	12	15	13	13	13	14
83	F	15	13	10	10	12	13	10	10	12	14	13	13	14	13	13	13	12
84	F	15	12	12	11	12	14	11	10	13	14	12	12	14	13	13	13	12
40	G	15	13	11	10	14	13	10	11	14	15	13	12	16	15	14	14	16
41	G	15	13	11	10	14	14	11	11	15	14	13	13	16	14	14	14	15
42	G	15	12	10	9	13	13	11	11	12	14	12	12	15	13	13	12	13
43	G	15	12	11	10	14	13	11	11	13	14	13	13	14	13	13	13	14

NSR ID	NAG	Criterion	2017				2020				2023				2026			
			Day	Eve	Night 1	Night 2	Day	Eve	Night 1	Night 2	Day	Eve	Night 1	Night 2	Day	Eve	Night 1	Night 2
44	G	15	10	10	10	11	11	8	7	10	13	11	11	11	12	12	12	12
45	G	15	13	11	11	15	15	11	11	12	14	13	12	16	14	13	12	15
46	G	15	12	10	10	13	14	11	11	13	14	13	12	15	14	14	12	14
47	G	15	10	9	10	11	11	9	7	10	12	10	11	11	12	12	11	12
48	G	15	11	9	10	11	12	9	8	10	12	11	11	11	13	11	12	12
49	G	15	12	10	9	16	13	12	11	15	14	14	13	15	16	15	15	15
50	G	15	13	10	10	13	14	9	9	14	14	12	12	15	15	13	13	15
51	G	15	11	10	10	12	14	10	10	12	13	12	11	14	13	13	13	13
52	G	15	12	10	10	13	13	10	9	12	14	13	12	15	13	13	12	14
53	G	15	12	10	9	16	15	15	14	15	15	14	15	15	15	14	14	15
54	G	15	9	10	9	12	12	9	8	10	12	11	11	11	12	12	11	12
55	G	15	10	9	9	11	11	9	8	10	12	11	10	11	12	12	11	12
96	H	15	10	10	10	11	11	9	9	10	13	12	11	11	13	13	12	12
97	H	15	12	10	10	12	14	9	9	12	14	12	13	15	13	13	12	13
98	H	15	13	11	11	11	15	12	12	16	16	14	14	16	16	15	16	16
99	H	15	12	10	11	12	15	11	11	16	15	13	13	16	16	15	14	16
100	H	15	13	10	11	12	14	11	11	13	15	13	13	15	14	14	14	15
101	H	15	12	10	11	12	13	9	10	12	14	12	13	14	13	13	13	14
102	H	15	12	11	11	13	14	9	9	13	15	13	13	16	15	14	13	16
103	H	15	11	10	11	12	13	10	10	12	13	13	12	13	12	13	13	12
104	H	15	10	10	10	11	12	9	9	10	13	11	11	11	13	12	13	13

NSR ID	NAG	Criterion	2017				2020				2023				2026			
			Day	Eve	Night 1	Night 2	Day	Eve	Night 1	Night 2	Day	Eve	Night 1	Night 2	Day	Eve	Night 1	Night 2
105	H	15	12	10	10	11	14	9	9	13	14	12	12	13	13	12	13	14
106	H	15	10	10	10	10	11	9	9	10	13	12	10	11	13	13	13	12
107	H	15	11	10	11	11	13	9	9	13	14	12	12	14	13	13	13	14
108	H	15	11	10	10	11	12	9	8	10	12	11	11	10	12	12	12	12
109	H	15	12	10	10	13	13	10	10	12	15	13	12	14	13	13	13	15
110	H	15	11	10	10	11	11	9	9	10	13	12	11	11	13	12	12	12
111	H	15	12	11	11	12	12	9	9	11	13	12	11	12	12	13	12	12
112	H	15	12	10	11	12	12	10	10	10	13	12	11	12	13	13	12	13
113	H	15	11	10	10	12	11	9	9	10	13	12	11	11	13	13	12	12
114	H	15	11	11	11	11	12	10	10	11	13	12	11	11	13	13	13	12
115	H	15	11	10	10	11	11	9	9	11	13	12	11	11	13	13	12	12
116	H	15	11	10	10	11	12	10	9	11	13	12	12	12	13	13	13	13
117	H	15	11	10	10	11	12	9	9	11	13	11	11	11	12	13	12	12
118	H	15	11	10	10	11	12	10	10	12	12	12	11	12	12	13	12	11
119	H	15	11	10	11	11	12	10	10	12	13	12	12	12	13	13	13	12
120	H	15	11	10	10	11	12	10	10	11	13	12	12	12	12	12	12	11
121	H	15	11	10	10	11	12	11	11	11	14	12	10	11	12	12	12	12
122	H	15	11	10	10	11	11	10	11	12	14	13	12	13	12	12	12	12
123	I	15	13	12	13	16	14	13	13	14	15	15	14	16	15	15	15	16
124	I	15	14	13	13	18	15	15	14	16	16	16	17	19	17	16	16	17
125	I	15	13	12	12	20	15	13	14	15	16	16	15	18	15	16	16	18

NSR ID	NAG	Criterion	2017				2020				2023				2026			
			Day	Eve	Night 1	Night 2	Day	Eve	Night 1	Night 2	Day	Eve	Night 1	Night 2	Day	Eve	Night 1	Night 2
126	I	15	12	12	11	12	13	12	12	14	15	12	13	14	13	14	14	13
127	I	15	12	12	12	12	13	11	12	13	14	13	13	14	14	14	13	13
128	I	15	12	11	11	12	13	11	11	13	15	12	13	14	13	14	13	13
129	I	15	12	12	12	12	13	11	11	12	14	13	12	15	13	13	13	13
130	I	15	11	11	12	12	13	11	11	13	14	13	12	15	13	13	13	12
131	I	15	13	11	11	11	14	12	13	14	15	14	14	15	14	14	14	15
132	I	15	12	12	12	12	14	13	13	14	16	15	15	16	13	14	14	15
133	I	15	13	12	13	13	14	13	13	14	15	13	13	13	14	14	14	13
134	I	15	14	13	14	17	15	15	15	16	16	15	15	17	16	17	16	17
135	I	15	13	14	13	17	15	14	15	16	16	16	15	17	16	16	17	18
136	J	15	10	10	9	10	12	9	9	11	12	11	11	11	12	12	12	12
137	J	15	10	9	10	10	11	9	9	9	12	11	10	12	12	12	12	11
138	J	15	10	10	9	9	12	9	8	10	13	11	11	11	12	12	12	11
139	J	15	10	10	9	10	11	9	9	11	12	11	11	11	12	12	12	12
140	J	15	9	9	9	9	11	9	8	10	12	11	11	12	11	11	11	11
152	J	15	10	10	10	10	11	10	10	11	12	12	11	11	11	12	11	11
153	J	15	11	10	10	10	13	12	12	14	15	14	14	15	14	14	13	15
154	J	15	11	10	10	10	13	12	13	14	15	14	14	15	13	13	12	14
155	J	15	10	10	10	12	11	11	11	14	13	12	12	15	12	12	12	13
156	J	15	11	10	10	12	12	14	13	15	15	15	15	17	14	14	14	16
157	J	15	12	10	10	10	13	14	14	16	17	16	15	16	15	16	15	17

NSR ID	NAG	Criterion	2017				2020				2023				2026			
			Day	Eve	Night 1	Night 2	Day	Eve	Night 1	Night 2	Day	Eve	Night 1	Night 2	Day	Eve	Night 1	Night 2
158	J	15	10	9	10	10	11	13	13	15	14	15	14	16	12	14	13	17
159	J	15	11	10	10	10	12	14	14	17	15	15	15	18	14	14	14	17
166	J	15	11	9	10	11	12	12	12	13	13	12	12	15	12	12	12	12
141	K	15	11	10	9	11	11	11	10	13	15	13	12	16	12	14	14	16
142	K	15	12	12	12	15	13	13	13	16	16	14	15	17	15	15	15	17
143	K	15	10	10	11	11	12	10	11	13	14	13	12	13	13	13	13	13
144	K	15	10	11	11	11	12	11	11	12	13	13	12	14	13	13	13	14
145	K	15	12	11	12	12	13	11	12	13	15	13	13	14	13	14	13	14
146	K	15	11	11	11	12	11	11	12	14	15	12	13	13	12	13	13	14
147	K	15	12	11	12	12	12	12	13	14	15	11	13	14	14	14	13	13
148	K	15	11	12	11	13	12	12	12	12	16	12	13	14	13	13	14	14
160	K	15	10	8	8	8	11	8	8	10	13	10	11	12	11	13	12	12
161	K	15	10	8	9	8	12	8	9	10	13	10	10	11	11	12	12	12
162	K	15	10	10	9	9	12	9	9	12	14	12	13	13	11	12	12	13
163	K	15	11	10	11	12	11	10	10	14	14	13	13	13	13	14	14	15
149	L	15	10	13	13	19	12	16	17	21	16	15	17	18	15	16	17	19
150	L	15	10	11	12	19	11	14	14	17	16	16	17	19	15	18	19	19
151	L	15	11	12	12	20	12	15	16	18	15	16	17	19	14	17	18	19
164	L	15	11	12	13	20	11	15	16	17	16	14	16	18	17	15	17	18
165	L	15	10	11	12	15	10	14	14	16	12	12	15	15	14	16	17	17
167	L	15	12	12	13	16	13	14	15	15	14	12	14	15	15	14	16	16

NSR ID	NAG	Criterion	2017				2020				2023				2026			
			Day	Eve	Night 1	Night 2	Day	Eve	Night 1	Night 2	Day	Eve	Night 1	Night 2	Day	Eve	Night 1	Night 2
168	L	15	11	12	12	15	13	13	15	15	14	12	14	15	15	14	16	16
169	L	15	12	12	13	16	13	14	14	16	14	13	14	15	15	15	16	16
171	M	15	12	11	11	16	13	13	13	15	15	14	14	15	15	16	16	16
174	M	15	10	11	10	16	11	14	14	18	16	13	15	16	16	18	17	19
170	N	15	11	9	10	16	14	12	12	15	17	15	16	19	16	17	18	18
172	N	15	11	11	11	15	14	13	13	14	15	14	14	14	15	15	15	15
173	N	15	11	11	11	15	13	12	13	13	14	14	15	15	16	15	15	14
175	N	15	11	9	9	13	13	12	12	12	13	12	12	12	14	13	13	13
176	N	15	11	9	9	15	13	12	12	13	15	13	13	14	15	14	14	15
177	N	15	10	8	8	16	14	12	12	14	16	13	13	15	15	15	15	17
178	N	15	12	11	11	15	15	14	14	14	14	13	14	14	16	15	15	15
179	N	15	11	10	10	15	14	13	13	15	14	14	14	15	16	15	15	15
180	O	15	12	11	11	14	14	12	12	13	14	14	13	14	15	15	15	14
181	O	15	13	12	12	15	15	14	14	15	15	15	14	15	16	16	15	15

APPENDIX

B MODELLED SOURCE LOCATIONS

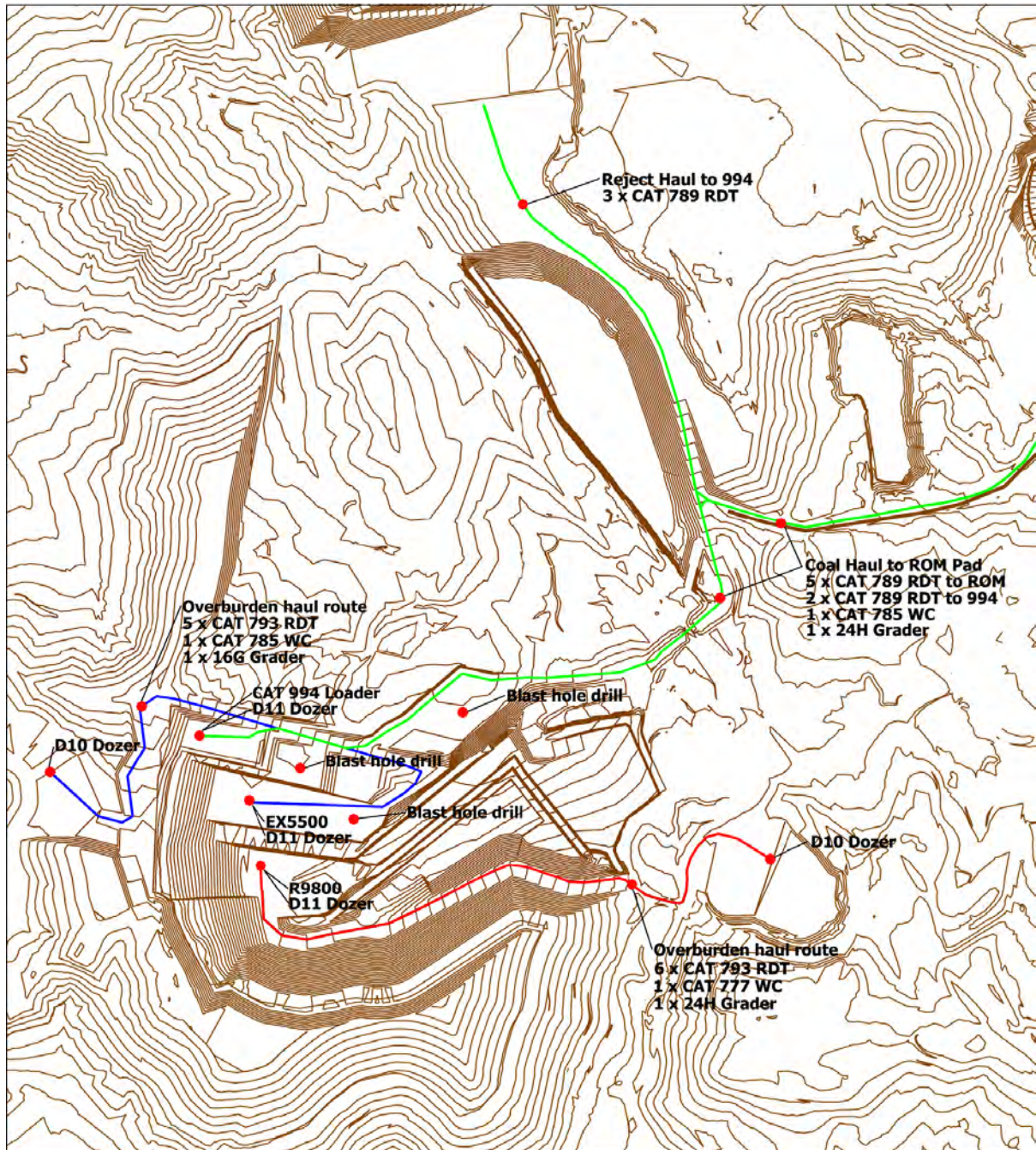


Figure B-1 Modelled Source Locations - 2017 Day Period Scenario

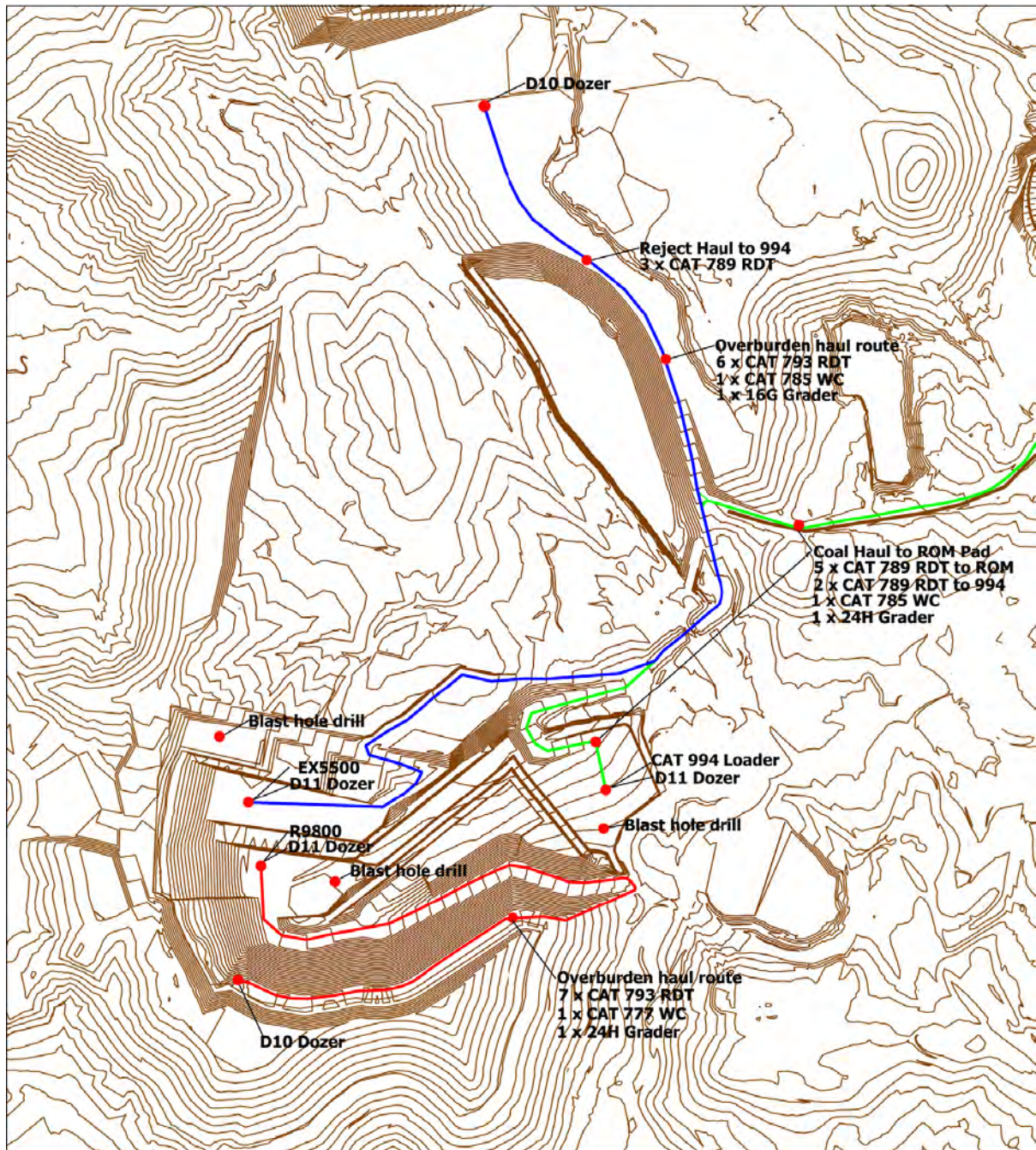


Figure B-2 Modelled Source Locations - 2017 Evening/Night Period Scenario

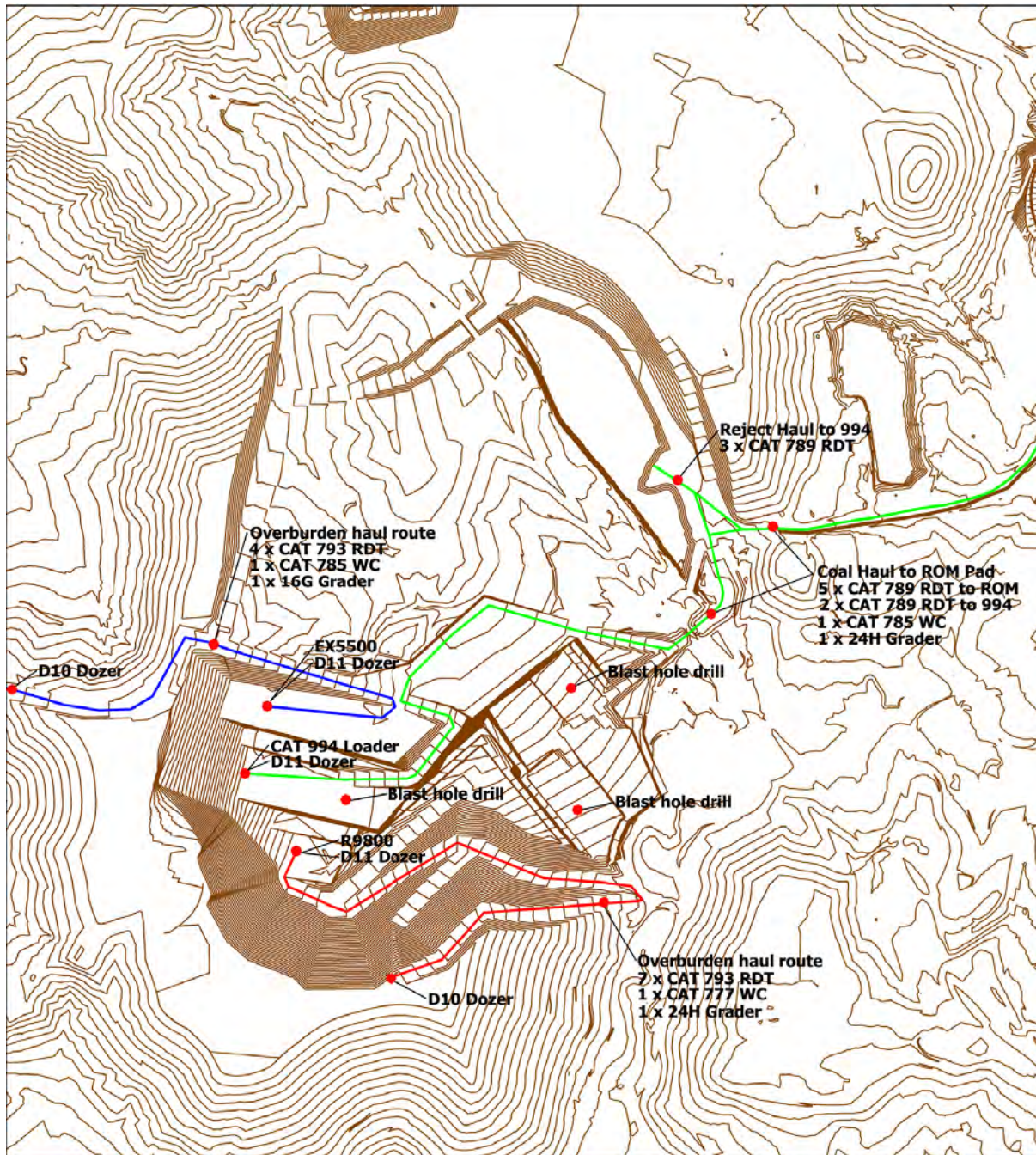


Figure B-3 Modelled Source Locations - 2020 Day Period Scenario

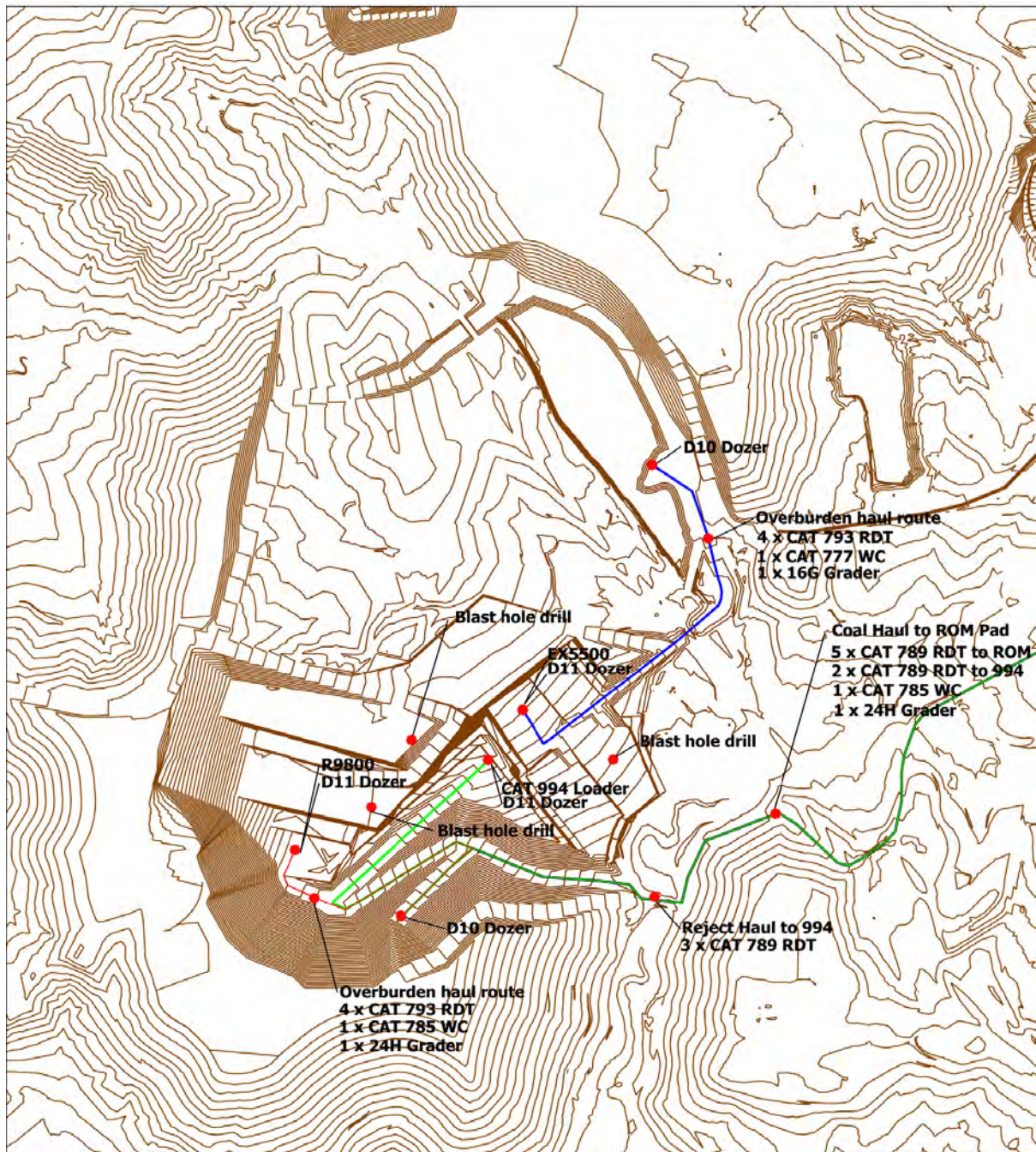


Figure B-4 Modelled Source Locations - 2020 Evening/Night Period Scenario

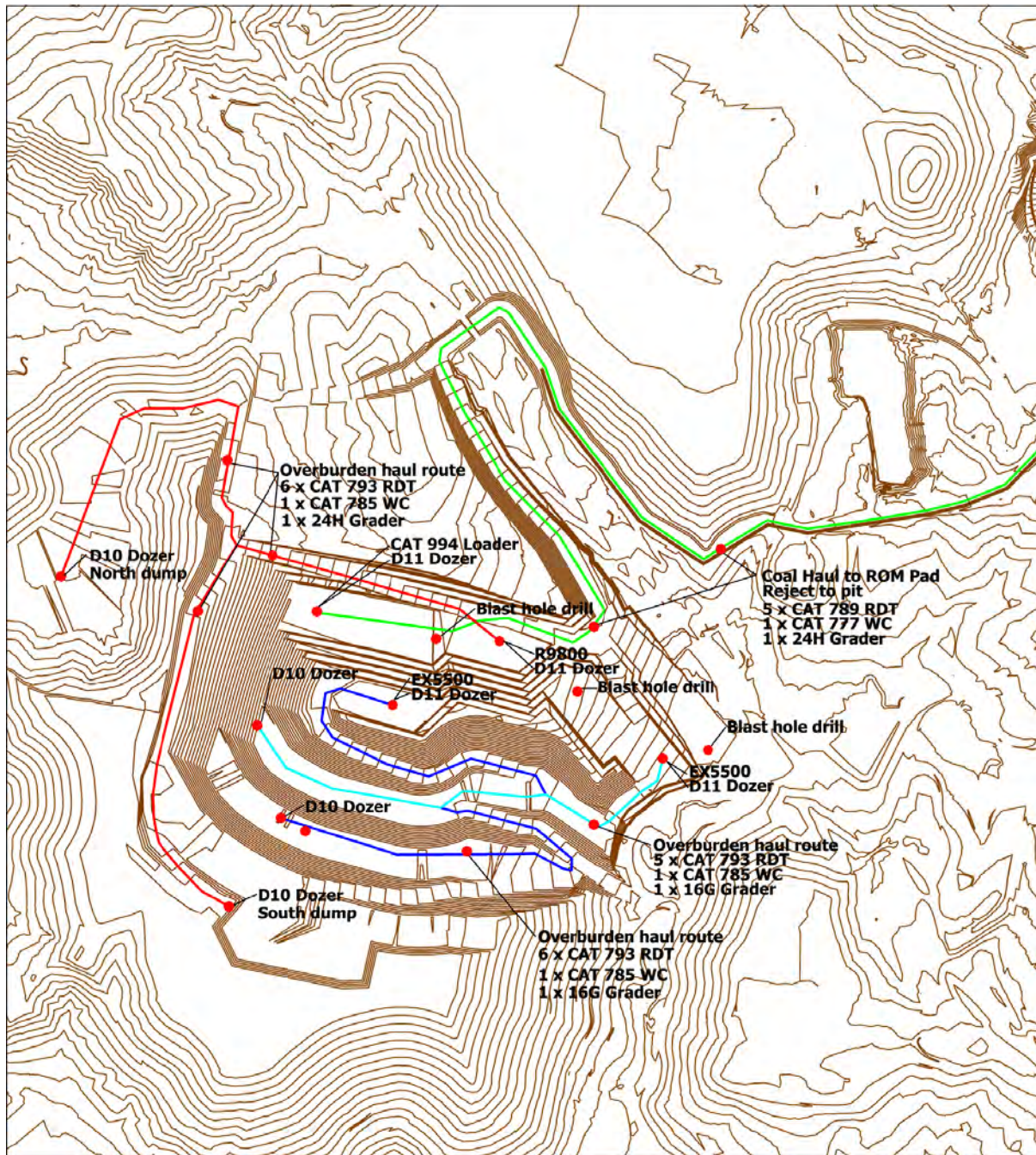


Figure B-5 Modelled Source Locations - 2023 Day Period Scenario

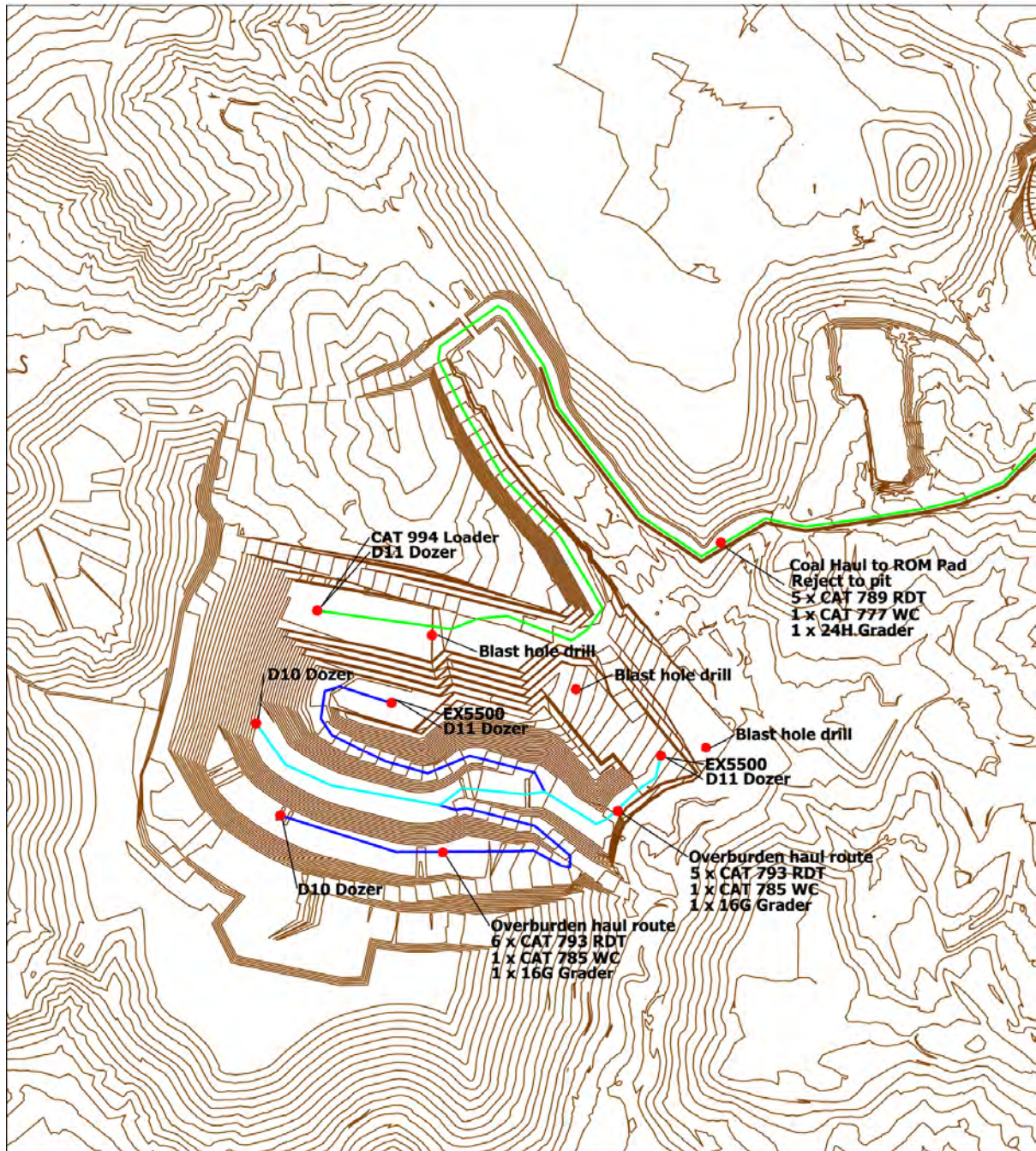


Figure B-6 Modelled Source Locations - 2023 Evening/Night Period Scenario (modified operations)

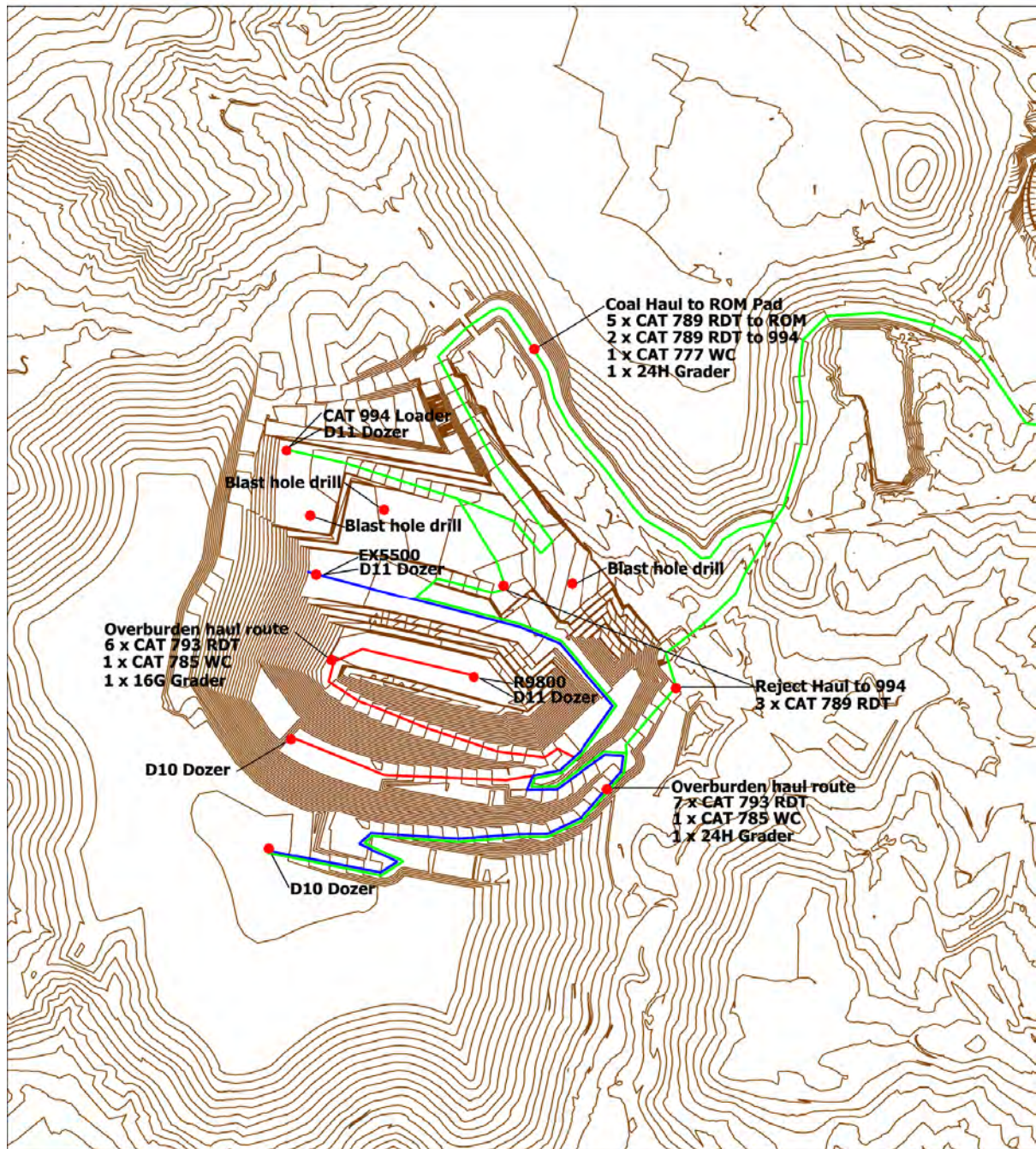


Figure B-7 Modelled Source Locations - 2026 Day Period Scenario

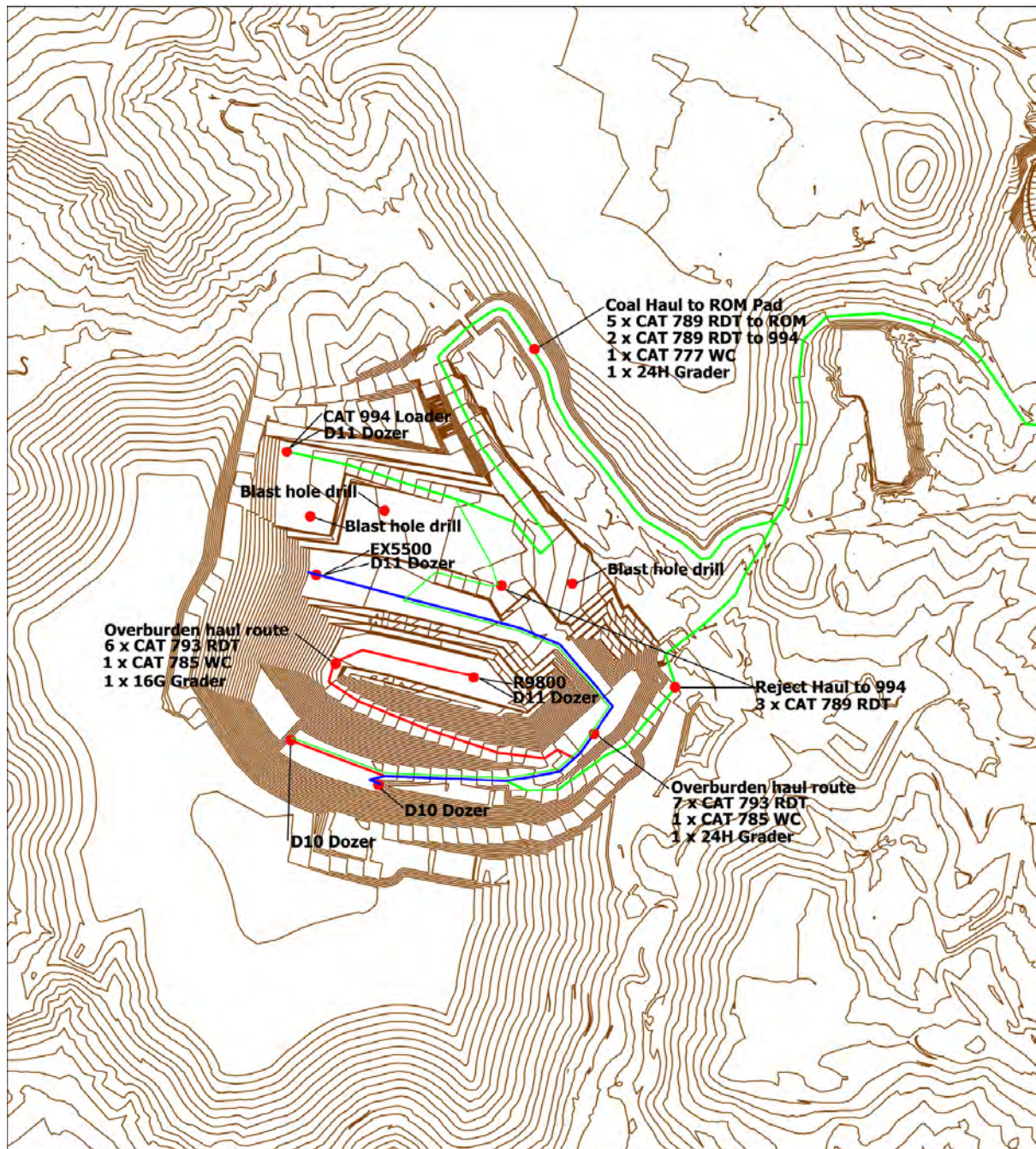


Figure B-8 Modelled Source Locations - 2026 Evening/Night Period Scenario

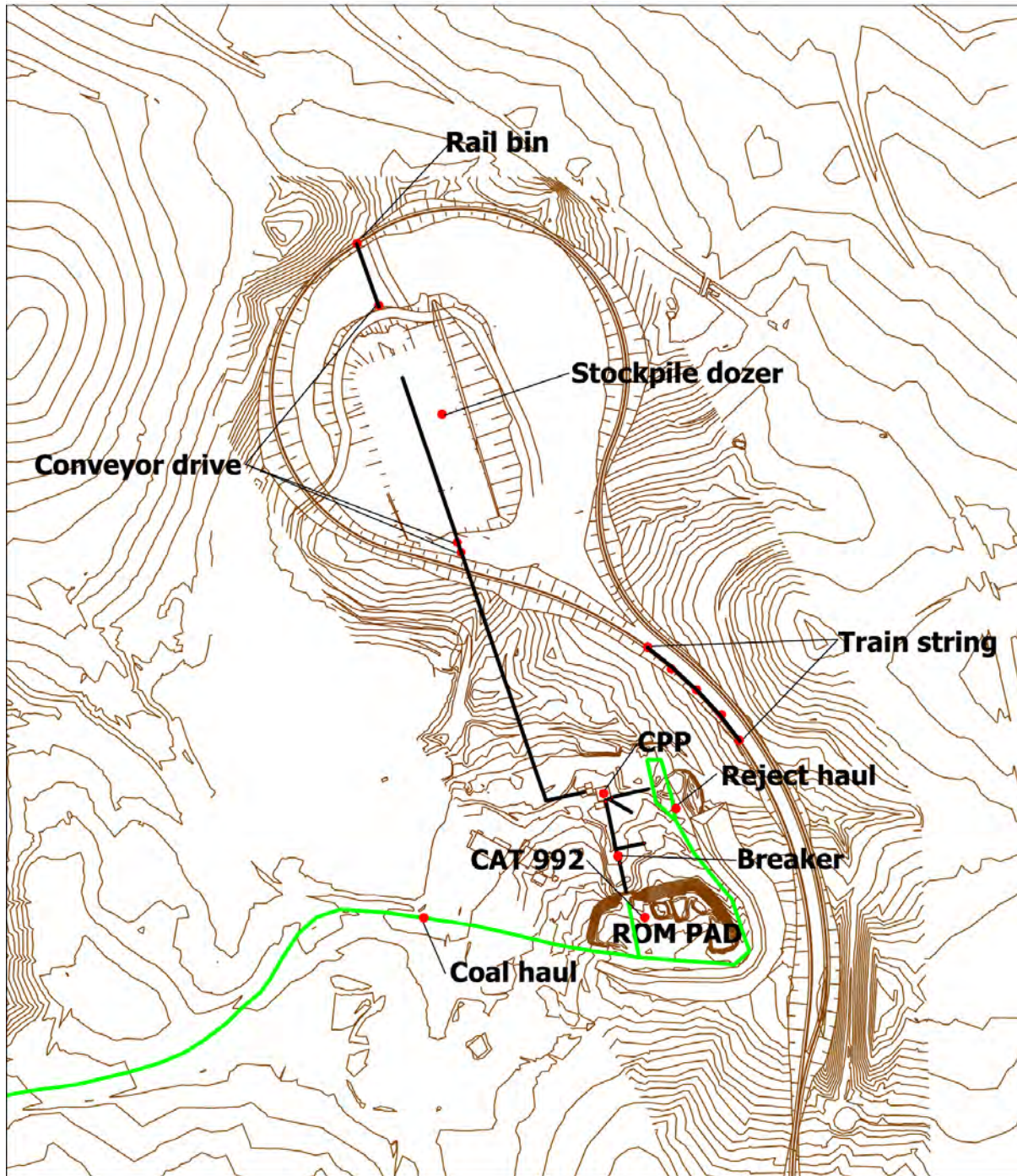


Figure B-9 Modelled Source Locations - CHPP and Rix's Rail Infrastructure All Stages

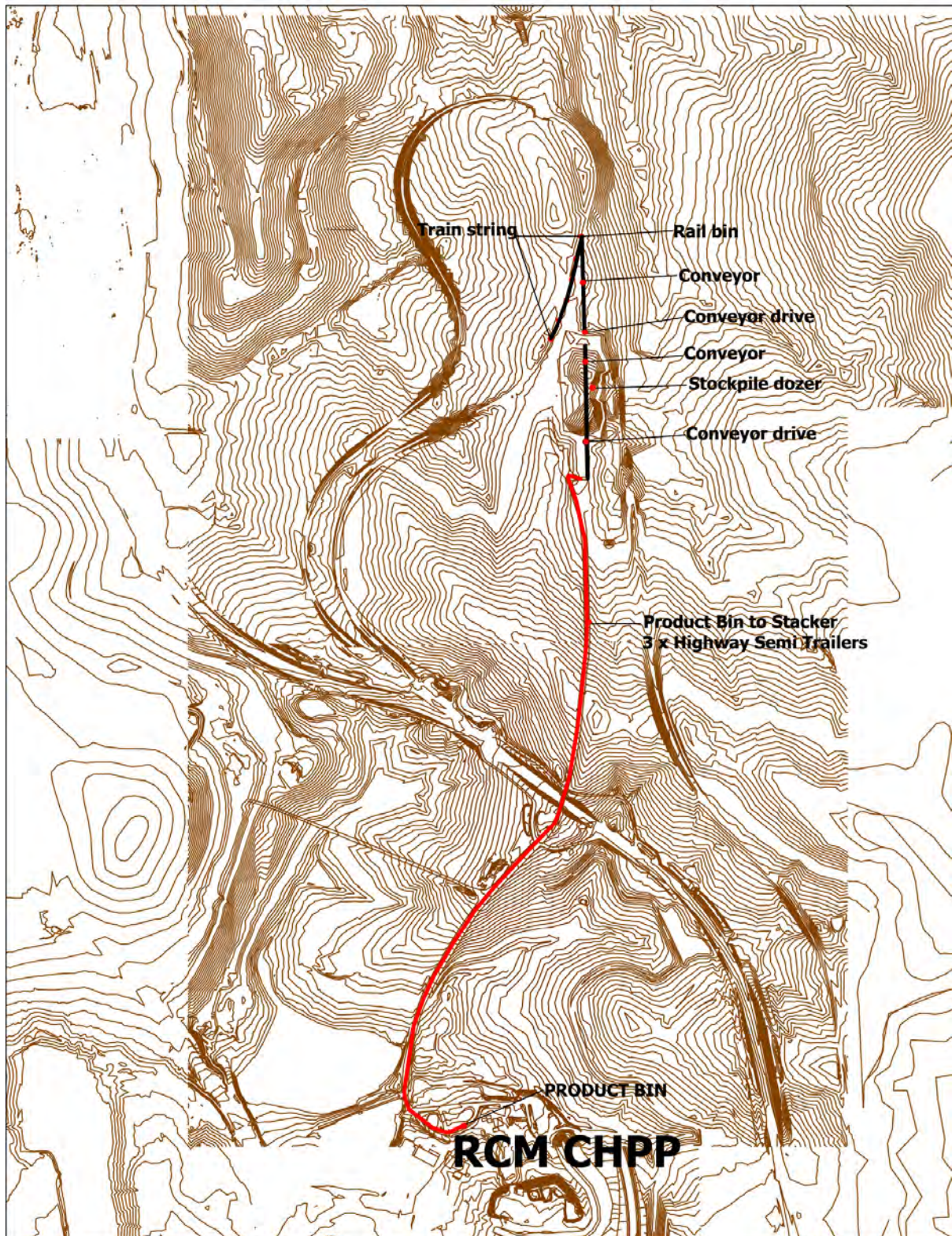


Figure B-10 Modelled Source Locations - Integra Rail Infrastructure All Stages