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Mawsons

Mawsons - Blue Hills Greenfield Quarry- Noise Impact Assessment

Noise Impact Assessment

30T-22-0395-TRP-44833-0

13 March 2023

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Executive Summary

Vipac Engineers and Scientists Ltd was engaged by Mawsons to prepare a noise impact assessment to support a Work Authority application to develop the Blue Hills Quarry approximately 10km northwest of Maldon in the Mount Alexander Shire Council local government area. The proposed extraction area has an extraction capability of approximately 65 million tonnes of hornfels, and the site location was chosen due to the localised presence of this resource.

Future potential noise levels of the Quarry were predicted at the nearest noise sensitive receivers using the SoundPLAN noise modelling software, using measurements obtained from the equipment currently operating at the Lake Cooper Quarry, with operational noise levels predicted to comply in both neutral and worst-case weather conditions.

Ground vibration and air blast over pressure impacts have been calculated for the proposed blasting plans with the results displaying impacts can be adequately managed with appropriate MIC quantities and blast monitoring programs.

A range of noise mitigation and management strategies have been outlined and are provided as ancillary advice should it be desired. It is expected that noise and vibration emissions from the Quarry during the proposed operation hours can be adequately managed at the nearest noise sensitive receptors.

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1 Introduction

Vipac Engineers and Scientists Ltd was engaged by Mawsons to prepare a noise impact assessment to support a Work Authority application for the proposed Blue Hills Quarry located 10km northwest of Maldon in the Mount Alexander Shire Council local government area. The Work Authority area will occupy approximately 50ha of land within a 560ha property owned by Mawsons. The proposed extraction area has an extraction capability of approximately 65 million tonnes of hornfels, and the site location was chosen due to the localised presence of this resource.

2 Project Description

2.1 Blue Hills Quarry Activities

The Blue Hills Quarry is located 10km northwest of Maldon in the Mount Alexander Shjre Council local government area. Access to the quarry is via Bells Lane, west of the proposed site. There are several sensitive receptors (shown in Figure 2-1) which consist of long term land holders and more recent lifestyle block owners

Mawsons proposes for the extraction of hard rock to be undertaken using conventional drill and blasting techniques. Shot rock will be loaded from benches using front end loaders or excavators and subsequently hauled by dump truck to the fixed plant on site for processing. Blasting is expected to occur up to 12 times per year.

Fixed on site equipment consists of conventional hard rock processing equipment including a double toggle primary crusher, primary scalping screen, secondary and tertiary crushers. Product from this fixed plant will be directly discharged into trucks from overhead bins, proceeding to on-site stockpiles or directly despatched off site.

It is anticipated that at its peak, approximately 500tpa of product will be produced with approximately 14,705 truck movements occurring on an annual basis with an average of 60 loads per day along the proposed haul route shown in Figure 2-1.

Proposed operational hours will be from 7am to 6pm Monday to Friday, and 7am-1pm on Saturdays.

Details of the plant and equipment proposed for use at Blue Hills have been based off current equipment operating at an existing Mawsons Quarry in Central Victoria (i.e. Lake Cooper Quarry) and are provided in Table 2-1.

Table 2-1: LCQ Plant and Equipment

Description	No. of Units
Komatsu WA600 wheel loader (pit loader)	1
Caterpillar 773G dump truck	1
Komatsu HD405 Dump truck	2
Caterpillar 980 sales loaders	3
Komatsu HD325 watercart	1
Kenworth ridged tipper (bin truck) tertiary	1
Sterling ridged tipper (bin truck) ballast	1
Komatsu WA600 wheel loader (pit loader)	1
Caterpillar 773G dump truck	1

2.2 Surrounding Environment

The proposed quarry is located on a roughly east to west trending ridge that rises to about RL 320 m (relative to Australian Height Datum) on the eastern side of the pit, while the Bridgewater-Maldon Road to the west is at an approximate elevation of RL220 m. The western slopes are typically gently sloping and approximately planar before the terrain becomes generally flat, near to the main road.

There are eight sensitive receptors located within an approximately 2 km radius as shown in Figure 2-1. The nearest resident is accessed via Lakeys road and is approximately 1.3km north of the closest point of the proposed quarry footprint.

The locations of the nearest potentially affected noise sensitive receivers to LCQ are provided below in Table 2-2.

Table 2-2 - Noise Sensitive Receivers

Noise Sensitive Receiver	Modelled Coordinates		Observation
R01	55234045	5911724	Approx. 1.3km north of the Quarry
R02	55234038	5912261	Approx. 1.9km north of the Quarry
R02	55235054	5912376	Approx. 2.1km north of the Quarry
R03	55235728	5912360	Approx. 2.3km north east of the Quarry
R05*	55233489	5908368	Approx. 1.7km south of the Quarry
R06	55233786	5908187	Approx. 1.8km south of the Quarry
R07	55233832	5908163	Approx. 1.8km south of the Quarry
R08	55231546	5909924	Approx. 2km west of the Quarry

*Unoccupied dwelling

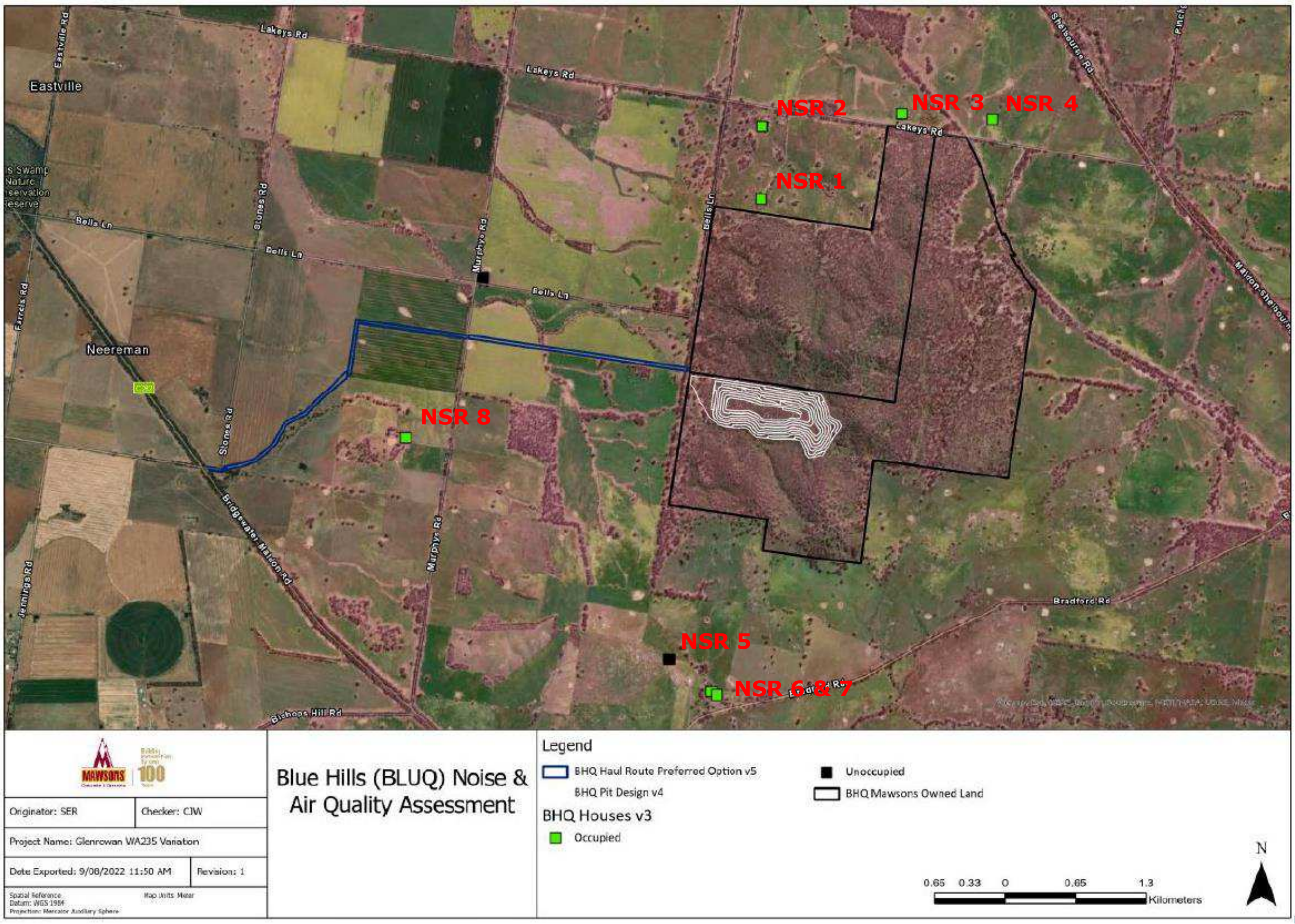


Figure 2-1: Site Location, Haul Route, and Nearest Sensitive Receptors

3 Existing Environment

Background noise monitoring for the project has not been conducted as the site is not expected to be exposed to higher levels of background noise for its locale. Therefore, given the surrounding zoning, and the lack of high noise generating areas within the surrounding environment, it is expected that the site is not classified as a background relevant area, and subsequently the background noise levels specified in the Noise Protocol apply.

3.1 Attended Quarry Measurements

The plant currently operating on the Lake Cooper quarry site was measured on the 21st of July, 2022 using the Bruel & Kjaer sound level meter, with the results detailed in Table 3-1 (along with calculated Sound Power Levels, L_{WAeq}).

Table 3-1: Measured Equipment Sound Power Levels

Index	Machinery	Approx. Measurement Distance(m)	L_{Aeq}	L_{WAeq}
1	Primary Crusher	11	87	116
2	Secondary Crusher	10	91	119
3	Tertiary Crusher	10	86	114
4	Crush Rock Plant	11	80	109
5	Caterpillar 773G (Unloading)	4	88	108
6	Caterpillar 773G (Uphill, Loaded)	7	85	109
7	Komatsu HD405 (Unloading)	4	86	106
8	Komatsu HD405 (Uphill, Loaded)	7	84	108
9	Caterpillar 980 Wheel Loader (Moving, Loaded)	9	77	104
10	Kenworth Bin Truck (Unloading)	5	80	102
11	Kenworth Bin Truck (Driving)	4	71	91
12	Komatsu WA600 Pit Loader (Face Loading)	8	83	109
13	Komatsu WA600 Pit Loader (Forward Travel)	6	84	108
14	Hitachi EX360 Rock Breaker	8	86	110
15	Sandvik DP1100i Drill Rig	7	98	122

It is anticipated that similar fixed and mobile equipment measured at Lake Cooper will be in operation at Blue Hills and have therefore been used to predict noise emissions from the quarry for this assessment.

4 Legislative Requirements

4.1 Noise Protocol

Noise criteria for noise generating uses in Victoria is determined in accordance with the Noise limit and assessment protocol for the control of noise from commercial, industrial and trade premises and entertainment venues' (Publication 1826.4, May 2021). The 'Noise Protocol' stipulates noise limits for 'earth resources' premises, such as quarries, in Section 2.7. Noise limits in rural areas for earth resources are determined as follows:

1. Where the noise sensitive area is in a Green Wedge A Zone (GWAZ), Rural Conservation Zone (RCZ) or Rural Living Zone (RLZ), the earth resources levels are –
   a. Day – 45dB(A)
   b. Evening – 38dB(A)
   c. Night – 33dB(A).
2. Where the noise sensitive area is in an Industrial 3 Zone (IN3Z) or Special Use Zone (SUZ) (only where accommodation, other than caretaker's house, is prohibited in the SUZ), the earth resources levels are –
   a. Day – 51dB(A)
   b. Evening – 46dB(A)
   c. Night – 41dB(A).
3. Where the noise sensitive area is in an Industrial 1 Zone (IN1Z), Industrial 2 Zone (IN2Z), Commercial 2 Zone (C2Z), the earth resources levels are –
   a. Day – 56dB(A)
   b. Evening – 51dB(A)
   c. Night – 41dB(A).
4. **In all other situations, the earth resources levels are –**
   a. Day – 46dB(A)
   b. Evening – 41dB(A)
   c. Night – 36dB(A).

No distance adjustment applies to these earth resources levels. The earth resources levels above are to be used as the distance-adjusted levels.

Figure 4-1 - Site and Surrounding Zoning

Considering all NSRs are within the Farming 1 Zone (FZ1), as per Figure 4-1 above, and the fact the site and NSRs are not considered to be in a background relevant area, the applicable noise limits are detailed in Table 4-1.

Table 4-1 - Project Specific Noise Limits

Time of day	Earth Resources Noise Limits, L_{Aeq}, dB(A)
Day	46
Evening	41
Night	36

4.2 Blast Noise and Vibration

The criteria for ground vibration and airblast noise is defined in the 'Ground vibration and airblast limits for mines and quarries' Environmental Guideline provided by Earth Resources Victoria, which are based on the Australian and New Zealand Environment Council's Technical Basis for Guidelines to Minimise Annoyance Due to Blasting Overpressure and Ground Vibration, September 1990 (ANZEC Guidelines 1990).

4.2.1 New Sites

The limits for mines and quarries that commenced operation on or after July 1st, 2001 are as follows:

- Ground vibration at sensitive sites **must not exceed 5mm/s (ppv) for 95% and 10mm/s (ppv) for 100% of all blasts.**
- Airblast at sensitive sites **must not exceed 115dB (Linear Peak) for 95% and 120dB (Linear Peak) for 100% of all blasts.**

Note: The ANZEC Guidelines 1990 state that experience has shown that for almost all sites a ppv of less than 1mm/sec is generally achieved. It is recognised that it is not practicable to achieve a ppv of this level at all sites and hence a recommended maximum level of 5mm/sec has been selected. However, it is recommended that a level of 2mm/sec (ppv) be considered as the long-term regulatory goal for the control of ground vibration.

5 Noise Modelling

Noise modelling has been undertaken using the SoundPLAN 8.2 computational noise modelling software package. The use of the SoundPLAN software and referenced modelling methodology is accepted for use in the Victoria by the EPA for environmental noise modelling purposes. Vipac have undertaken numerous noise modelling and impact assessments previously using SoundPLAN for a range of projects, including infrastructure development and industrial projects.

5.1 Geographical Data

Elevation data supplied by the client has been used to establish the topographical model of the site. The data was obtained by a fly over survey conducted by Eltirus on the 10th of October 2022.

5.2 Weather Conditions

Noise propagation over long distances can be significantly affected by the weather conditions, mainly source-to-receiver winds and temperature inversions, as both these conditions can increase noise levels at sensitive receptors.

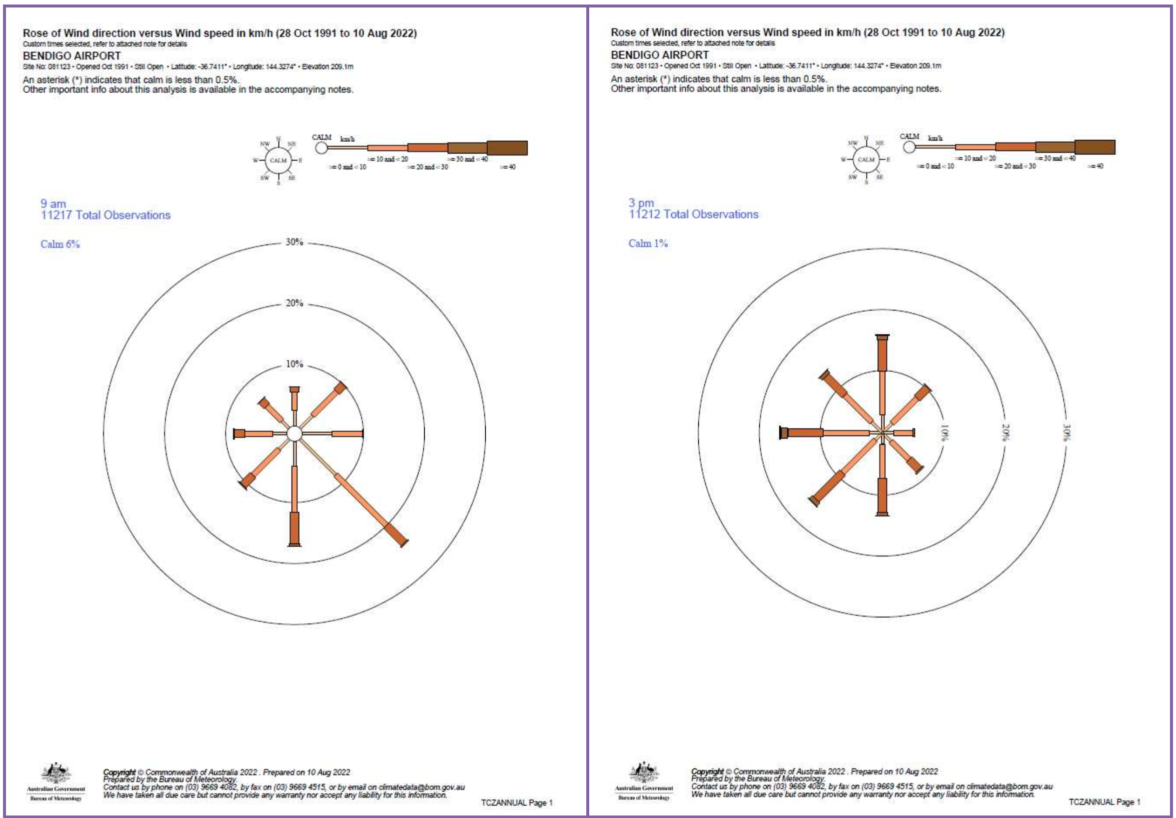
The CONCAWE methodology can predict to one of six meteorological categories (CAT). To determine which category is modelled, the Pasquill Stability Classes need to be determined for the Quarry. For this assessment the weather conditions, including stability class frequencies at the Quarry have been obtained from The Air Pollution Model (TAPM). TAPM is a three-dimensional prognostic model developed and verified by Commonwealth Scientific and Industrial Research Organisation (CSIRO). TAPM data was generated for the air quality assessment has been used for uniformity. The wind parameters were compared for the Bureau of Meteorology (BOM) and TAPM data and were found to be very similar.

Atmospheric stability refers to the tendency of the atmosphere to resist or enhance the motion of noise. The Pasquill-Gifford Stability Classes define the amount of turbulence in the air, of which the most widely used categories are Classes A-F. The TAPM generated meteorology determined the stability class for each hour of the year. The frequency of each stability class occurrence is shown in Table 5-1. Temperature inversions are defined as Class F. These conditions only occur with clear and calm conditions during the evening and night time periods. During temperature inversions noise emissions from distant sources can be amplified.

Table 5-1: Annual Stability Class Distribution Predicted [TAPM, 2014]

Stability Class	Description	Frequency of Occurrence (%)	Average Wind Speed (m/s)
A	Very unstable low wind, clear skies, hot daytime conditions	2.6	2.1
B	Unstable clear skies, daytime conditions	6.6	3.1
C	Moderately unstable moderate wind, slightly overcast daytime	17.4	4.2
D	Neutral high winds or cloudy days and nights	38.1	4.1
E	Stable moderate wind, slightly overcast night-time conditions	16.4	3.7
F	Very stable low winds, clear skies, cold night-time conditions	18.9	2.5

The long term wind roses recorded at the Bendigo Airport at 9am and 3pm are provided in Figure 5-1. Winds are shown to be more common from the south and south east at 9am. In addition, winds from the south, west and north directions dominate at 3pm. Stronger winds occur more frequently in the afternoon



Location: Bendigo Airport BoM Station	**Data Period:** 1991 - 2022	**Data Type:** Measured Data

Figure 5-1: Wind Roses for Bendigo Airport Weather Station (9am and 3pm)

5.2.1 Modelled Weather Scenarios

For the purposes of providing a worst case assessment, source to receptor winds have been applied to all receivers surrounding the Quarry.

Stability classes A, B, and C are associated with an unstable atmosphere and are generally unfavourable for noise propagation. Condition D is a neutral condition for noise propagation while conditions E and F are unfavourable as stable conditions further facilitate noise propagation.

Taking into consideration the time of day the Quarry currently operates and is proposing to operate, the following weather scenarios have been assessed:

Average/Neutral Climatic Conditions:

- Class D (average/neutral) conditions occur for more than 38% of the time. Class D has been modelled for the average climatic condition scenarios for day, with 0m/s wind speeds.

Worst Case Climatic Conditions:

- Worst case climatic conditions during the day period have been assessed as per Class D, but with 3m/s wind speeds.

5.3 Modelled Operational Scenarios

The 7am to 6pm operational scenario representing maximum hourly activities for the Quarry has been modelled for this assessment during neutral/average and worst case weather conditions.

5.4 Noise Sources

Details of the plant and equipment that will be used and their indicative sound power levels are listed in Table 5-2.

Table 5-2 - Modelled Noise Sources, Heights and Modelled Scenarios

Plant/Equipment	SWL	Approximate Source Heights (m)	Sound Power Reference Source
Primary Crusher Plant	116	9	Table 3-1, Index 1
Secondary Crusher Plant	119	9	Table 3-1, Index 2
Tertiary Crusher Plant	114	16	Table 3-1, Index 3
Crush Rock Plant	109	10	Table 3-1, Index 4
Caterpillar 773G Dump Truck	109	3	Table 3-1, Index 5-6
Komatsu HD405 Dump Truck (x2)	108	3	Table 3-1, Index 7-8
Caterpillar 980 Sales Loader (x3)	104	2.5	Table 3-1, Index 9
Kenworth Ridged Tipper (Bin Truck)	102	2.5	Table 3-1, Index 10-11
Komatsu WA600 Pit Loader	109	3	Table 3-1, Index 12-13
Hitachi EX360 Rock Breaker	110	1	Table 3-1, Index 14
Sandvik DP1100i Drill Rig	122	1	Table 3-1, Index 15
Sterling Ridged Tipper (Bin Truck)	102	2.5	Table 3-1, Index 10-11
Komatsu HD325 Watercart	102	3	Table 3-1, Index 11

*Measurements of the watercart were unable to be conducted as the watercart was not in operation during the site visit. It is anticipated that the watercart shares similar characteristics and overall noise levels with the bin trucks.

5.4.1 Modelling Assumptions

Details on most plant operational has been provided by Mawsons which is based on the existing operation at the Lake Cooper Quarry and is shown in Table 5-3. Where information was not available, Vipac have made conservative assumptions for the purposes of a conservative assessment.

Table 5-3 - Operational Frequency/Number of Events

Plant/Equipment	Frequency/Number of Events
Primary Crusher Plant	100%
Secondary Crusher Plant	100%
Tertiary Crusher Plant	100%
Crush Rock Plant	100%
Caterpillar 773G Dump Truck	52%[3]
Komatsu HD405 Dump Truck	52%[3]
Caterpillar 980 Sales Loaders	50%[2]
Kenworth Ridged Tipper (Internal)	32%[4]

Kenworth Ridged Tipper (External Haul)	91%[1]
Komatsu WA600 Pit Loaders	100%
Hitachi EX360 Rock Breaker	50%[2]
Sandvik DP1100i Drill Rig	50%[2]
Sterling Ridged Tipper (Internal)	32%[4]
Sterling Ridged Tipper (External Haul)	91%[1]
Komatsu HD325 Watercart	50%[2]

[1]Based on approximately 120 truck movements per day travelling at approximately 50km/hr along the 4000m Bells lane long haul route to Bridgewater-Maldon Road between the hours of 7am to 6pm.

[2]No information available – a conservative 50% assumption has been assumed.

[3]Based on approximately 208 loads per day from the pit to the primary crusher travelling at approximately 10km/hr.

[4]Based on approximately 168 movements per day from the tertiary crusher and crushed rock plant when on Ballast or FGM60, travelling at approximately 10km/hr.

Predicted octave band results (shown in Appendix C) show no appreciable tonality at any receptor. Additionally, no intermittency or impulsivity characteristics were observed when conducting the attended measurements of the Quarry plant and equipment on site. As a result, noise from the Quarry:

- Does not exhibit any prominent (tonal) sound frequency that would have the potential to result in greater annoyance;
- Does not exhibit any notable, intermittent fluctuations (i.e. does not increase rapidly by 5-10dB, depending on time of day, on at least two occasions during a 30 minute period, then maintaining that noise level for at least 60 seconds) that would have the potential to result in greater annoyance; and
- Does not exhibit any impulsive characteristics that would have the potential to result in greater annoyance.

Therefore, corrections for noise characteristics are not required to be applied in accordance with the Noise Protocol.

5.4.2 Noise Source Locations

Figure 5-2 details the indicative noise source locations for all scenarios based on the preliminary quarry footprint and design levels provided by Mawsons.

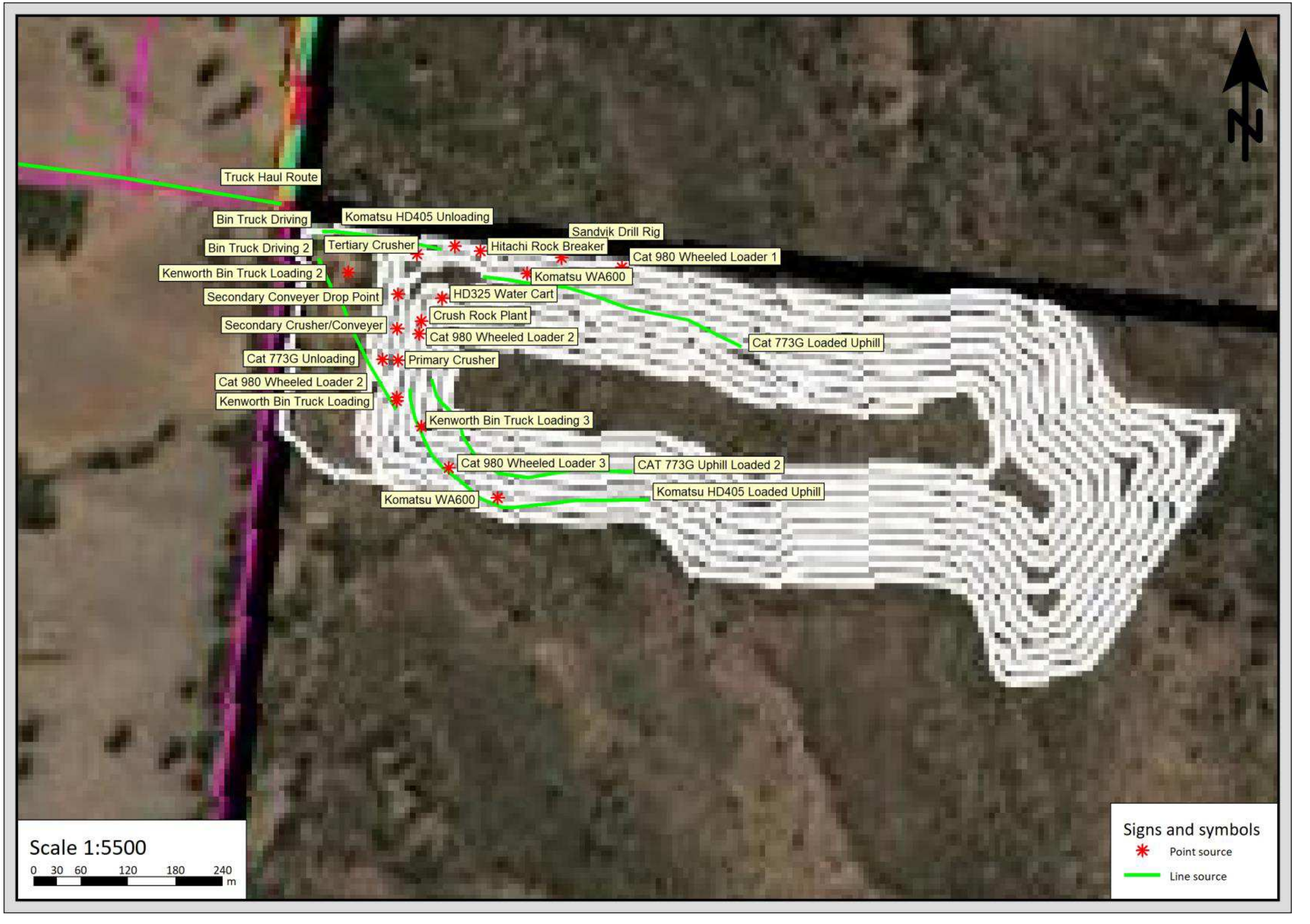


Figure 5-2 - Source Locations

6 Modelling Results

6.1 Predicted Operational Noise Levels 7am-6pm

Noise predictions have been conducted to assess the potential impact associated with the proposed operations at the nearest noise sensitive receivers during neutral and worst case climatic conditions. Graphical representation of these results are shown in Appendix A.

Table 6-1 - Predicted Noise Levels Scenario 1

Receiver	Neutral Weather Conditions	Worst Case Weather Conditions
NSR 1	23	28
NSR 2	32	37
NSR 3	11	16
NSR 4	9	14
NSR 5	32	37
NSR 6	17	22
NSR 7	16	21
NSR 8	32	37
Criteria	**46**	

Noise levels of the proposed operations are predicted to comply with the daytime criteria at all receptors during neutral and worst case weather conditions.

Suggestions for general noise management measures and recommendations are detailed in Section 7.

6.2 Blasting Noise and Vibration

6.2.1 Ground Vibration

Ground vibration from blasting operations can be predicted according to the propagation relationship from AS2187.2 shown below:

$$PPV = K\left(\frac{Dist}{\sqrt{Wt}}\right)^{-n}$$

where *PPV* is the peak particle vibration level (vector sum, measured in mm/s),

Dist is the distance between the monitoring point and the nearest blasthole and

Wt is the maximum weight of explosive per blasthole, or Maximum Instantaneous Charge (kg).

The site constants, *K* and *n*, vary from site to site and may be approximated by the values 3000 and 1.6 for average conditions and is considered to be a suitable assumption for the prediction of the 95th percentile relationship when assessing blast impact criteria.

6.2.2 Airblast Overpressure

Airblast overpressure (OP) from quarry blasts can be predicted according to the propagation relationship from AS2187.2 as shown in logarithmic form below:

$$OP_{dBL} = dBL - \beta \times Log\left(\frac{Dist}{\sqrt[3]{Wt}}\right)$$

Here, *dBL* = log Ks, where Ks is the site constant, and *β* =log *a,* where *a* is the site exponent. The 95th percentile relationship for the overpressure data can be conservatively represented by the parameter values of *dBL* = 172 and *β* =24 when assessing blast impact criteria. These values have been implemented for this assessment.

6.3 Predictions at Noise Sensitive Receptors

Table 6-2 shows the separation distances between blast locations and the nearest receptors.

Table 6-2: Separation Distances for Blasting Assessment

Receptor ID	Distance and direction
R1	Approx. 1.3km north of the Quarry
R2	Approx. 1.9km north of the Quarry
R3	Approx. 2.1km north of the Quarry
R4	Approx. 2.3km north east of the Quarry
R5	Approx. 1.7km south of the Quarry
R6	Approx. 1.8km south of the Quarry
R7	Approx. 1.8km south of the Quarry
R8	Approx. 2km west of the Quarry

The nearest residential receiver (R1) is located approximately 1.3km from the closest Quarry footprint, adjacent to where blasting activities will occur. For purposes of a conservative assessment, the nearest distance from the quarry footprint have been used in the calculation, with the assumption the receptors is 'behind' the face for ground vibration, and 'in front' of the face for air blast over pressure.

Control of ground vibration is highly dependent on the charge mass per delay (or Maximum Instantaneous Charge, MIC), blasting control measures, and local ground properties. Blasting parameters for the Project provided by Mawsons are shown in Table 6-3.

Table 6-3: Blasting Parameters

Blast Parameter	Value
Blast hole diameter	89mm
Blast hole depth	15m
Explosive	Orica Centra Gold (1.25 density)
MIC	~160kg
Explosive weight per blasthole	~7kg/m

The assessment has included predictions of varying explosive quantities alongside MIC detailed in Table 8-2.

Estimations of potential blasting vibration and airblast overpressure levels have been made using equations outlined in Australian Standard AS2187.2-2006 Explosives – Storage and use Part 2: Use of explosives.

Table 6-4 presents the predicted ground vibration and airblast overpressure levels at the nearest sensitive receiver for each of the designated MICs.

Table 6-4 - Predicted Blasting Emissions

Receiver	MIC (kg)	PPV (mm/s)	Complies with PPV Criteria? (5mm/s)	Overpressure (dB)	Complies with OP Criteria? (115dB)
NSR1	40	0.6	✓	110	✓
	50	0.7	✓	111	✓
	60	0.8	✓	111	✓
	105 (7kg per 15m hole)	1.3	✓	113	✓
	160	1.8	✓	115	✓

Blasting vibration and airblast overpressure emissions are predicted to be manageable at NSR1 to ensure compliance with the criteria for the assumed blasting parameters with appropriate stemming providing MIC quantities remain at or below

160kg. The current predictions are expected to be conservative in nature and blast noise and vibration monitoring will be recommended to determine if compliance can be achieved with larger MIC should it be necessary.

Blast control measures are to be refined for local conditions by the blasting contractor, with blast monitoring to be conducted in order to provide feedback on blast control measures.

7 Recommendations

7.1 Blast Monitoring

Blast noise and vibration monitoring is recommended at the most exposed receptors to capture actual ground vibration and air blast overpressure levels to determine if the proposed blasting methodology is appropriate. It is recommended the measured results be reviewed by Vipac prior to confirmation of blasting operation amendments. In general, the following is recommended:

- Implementation of a blast management plan to include, but not limited to:
    - Proposed hours of blasting;
    - Reference to AS2187 criteria;
    - Blasting to adhere to below maximum allowable MIC quantities to ensure compliance at closest receptors, noting MIC is subject to change pending results of regular blast monitoring;
    - Blasting activities to account for the direction the wind is blowing to reduce the risk of potential airblast ovepressure impacts at sensitive receptors;
    - Real time monitoring to be undertaken at closest sensitive receptors;
    - Outlines of exclusion zone establishment for each blast;
    - Notification to closest sensitive receptors of when blasting is to occur;
    - Consultation with closest sensitive receptors to develop and improve on protocols for notifications of blasting activities.

7.2 General Noise Management Measures

Predicted noise levels from the proposed Quarry are compliant with the applicable criteria, and acoustic mitigation measures are not required to be implemented, however, as a guide, the following potential mitigation and management measures are worth consideration for the purposes of operating best practice methods.

7.2.1 Control of the Noise Source

The primary, secondary, tertiary, and crushed rock plant equipment are predicted to be the dominating noise sources at the Quarry. If required, control noise from these sources should begin by investigation into the following:

- Selection of new, quieter plant;
- Relocation of plant further away from the most exposed receivers;
- Installation of shielding to crushing equipment, construction of enclosures/semi-enclosure around the noisiest parts of the equipment;
- Installation of high density rubber matting to the feeding section of the crushing equipment to reduce noise generated by the dumping of rock product into the crushing equipment; and/or;
- A combination of the above.

Confirmation with a suitably qualified acoustic engineer should be sought prior to finalisation of an appropriate mitigation method(s) should it be desired.

7.2.2 Control of the Noise Path

Controlling the noise along the noise path is dependent on the elevation relationship between the source and receptor. Given the elevation of the noise sources are indicative at this stage, and likely subject to change, it is not clear whether control of the noise path will be viable as a mitigation option should it ever be necessary. Notwithstanding, the following indicative measures are recommended in principal:

- Increasing heights of current earth mounds on the eastern boundary of the quarry footprint to extend above the height of the crushing equipment and restrict line of sight between the equipment and the nearest receptors;
- Relocation of stockpile locations if they are to be of a suitable height to provide attenuation between the crushing equipment and the nearest receptors;

- Construction of acoustic barriers between the source and receptor (i.e. on the quarry footprint boundary or at the boundaries of the nearest receptors).

7.2.3 Control at the Receiver

Managing adverse noise impacts at the nearest receptors can include the following:

- Increase the acoustic performance of dwellings by:
  - Mechanical ventilation/air conditioning so that windows may be closed during times of adverse noise impacts;
  - Installation of thicker glazing/double glazing with new frames and seals;
  - Installation of thicker, denser insulation in ceiling cavities, wall cavities, etc; and/or
  - A combination of the above.
- Implementation of negotiated agreements between the Quarry and the nearest affected receptors that acknowledge and accept the potential noise impacts in each operation scenario; or
- Property purchasing/land acquisition.

7.2.4 Operational Management Measures

General noise management measures that can be implemented into daily noise management plans can include:

- Constant community engagement and consultation to inform the nearest receptors of anticipated adverse impacts (i.e. community consultation days, monthly meetings, letter box drops, door knocking, information bulletins, etc)
- Consideration of reduction in operation frequency of the crushing equipment;
- Reduction in operation time and frequency of the crushing equipment and/or less crushing equipment operating simultaneously;
- Installation of permanent noise monitoring devices at select NSRs to monitor noise impacts in real time, with the inclusion of alert exceedances in the form of email/SMS alerts to be received by the Quarry operators;
- Temporary noise monitoring at the nearest receptors in response to valid, unresolved complaints.

8 Conclusion

A noise impact assessment has been carried out in support of a Work Authority application to develop the Blue Hills Quarry approximately 10km northwest of Maldon in the Mount Alexander Shire Council local government area.

Future potential noise levels were predicted using SoundPLAN modelling software for the proposed operation in neutral and worst case climatic conditions, with noise levels predicted to comply in both cases.

Ground vibration and air blast over pressure impacts have been calculated for the proposed blasting plans with the results displaying impacts can be adequately managed with appropriate MIC quantities and blast monitoring programs.

A range of noise mitigation and management strategies have been outlined and are provided as ancillary advice should it be desired. It is expected that noise emissions from the Quarry during the proposed operation hours can be adequately managed at the nearest noise sensitive receptors.

Appendix A Noise Contour Maps

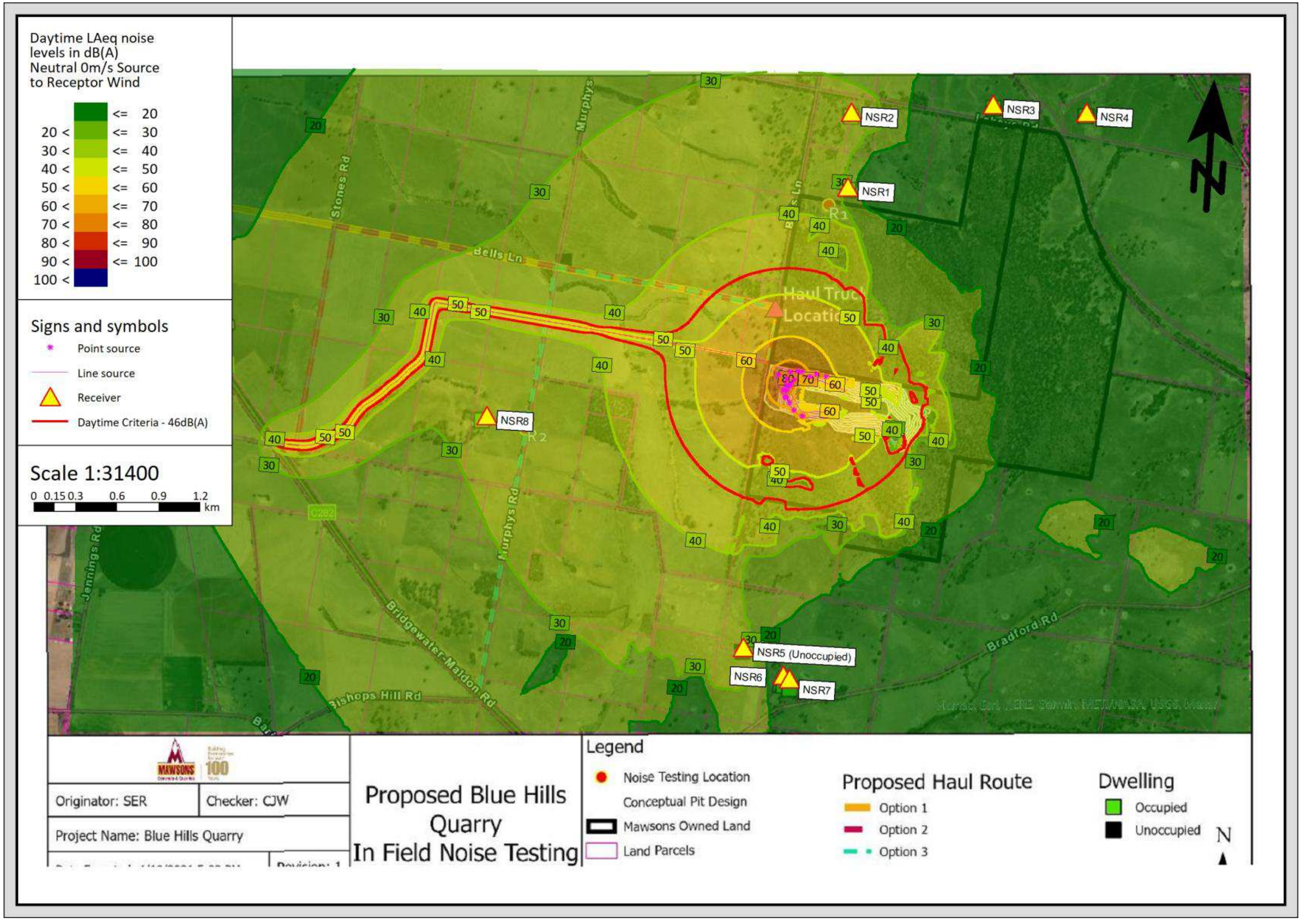


Figure A 1 - Proposed Operation Noise Contour Map - Neutral Weather Conditions

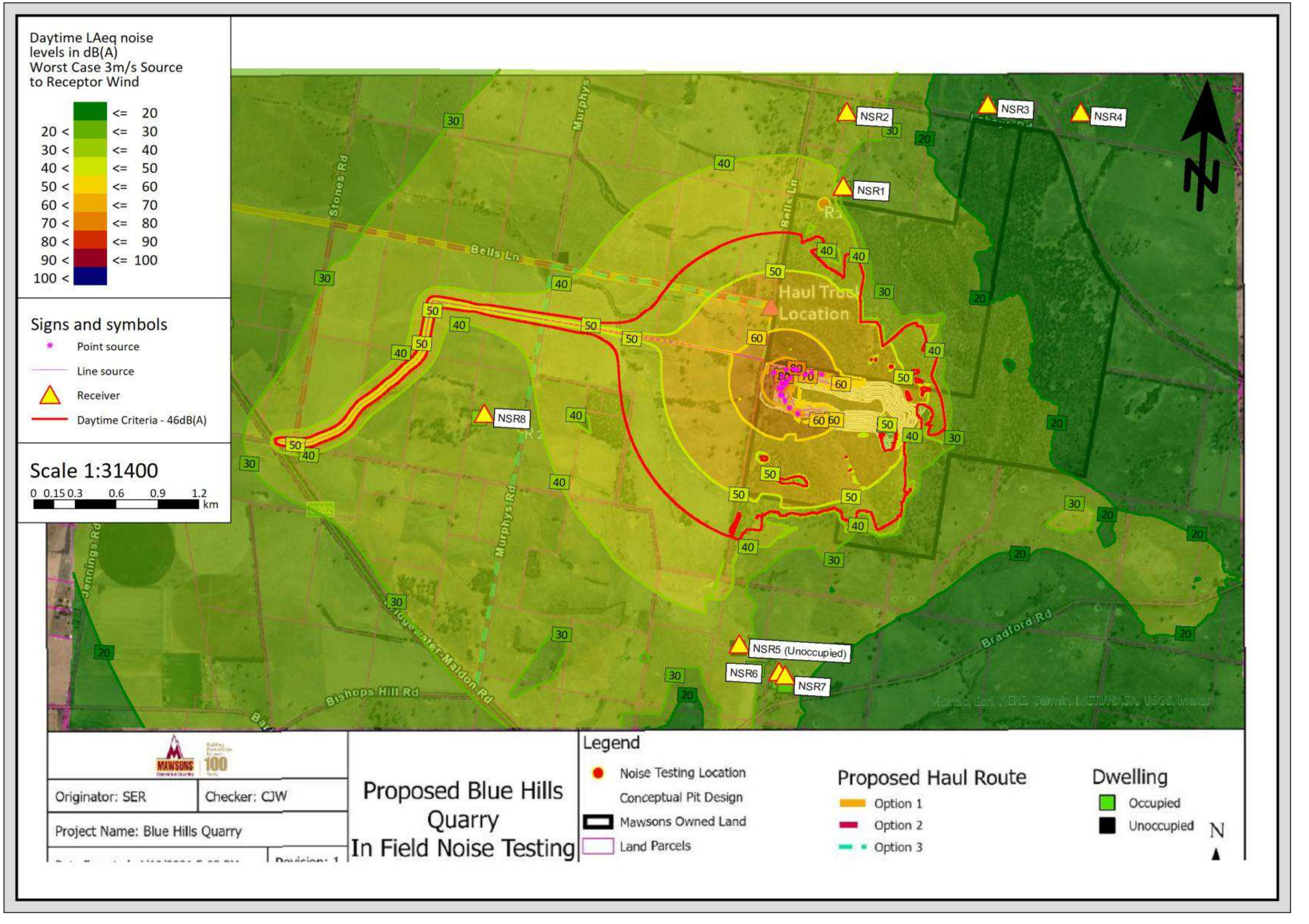


Figure A 2 – Proposed Operation Noise Contour Map – Worst Case Weather Conditions

Appendix B Noise Source Contribution at NSR 8 Sample

Blue Hills Quarry
Contribution level - Proposed Daytime Levels Worst

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Source	Ld dB(A)	
Receiver NSR8 Ld 37.1 dB(A)		
Secondary Crusher/Conveyer	32.5	
Sandvik Drill Rig	29.5	
Primary Crusher	27.5	
Truck Haul Route	26.5	
Hitachi Rock Breaker	26.1	
Tertiary Crusher	25.9	
Komatsu HD405 Unloading	22.2	
Crush Rock Plant	21.1	
Cat 773G Unloading	20.5	
Cat 980 Wheeled Loader 2	19.3	
Cat 980 Wheeled Loader 1	17.2	
Kenworth Bin Truck Loading 2	14.5	
Secondary Conveyer Drop Point	14.1	
HD325 Water Cart	11.7	
Cat 980 Wheeled Loader 2	9.2	
Cat 980 Wheeled Loader 3	6.0	
Komatsu WA600	5.3	
Komatsu WA600	4.5	
Kenworth Bin Truck Loading	0.1	
Bin Truck Driving 2	-0.3	
Bin Truck Driving	-0.6	
Kenworth Bin Truck Loading 3	-1.1	
Komatsu HD405 Loaded Uphill	-7.6	
CAT 773G Uphill Loaded 2	-11.7	
Cat 773G Loaded Uphill	-16.1	

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Appendix C 1/3 Octave Result –Worst Climatic

Blue Hills Quarry
Assessed receiver spectra in dB(A) - Proposed Daytime Levels Worst

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Time slice	50Hz dB(A)	63Hz dB(A)	80Hz dB(A)	100Hz dB(A)	125Hz dB(A)	160Hz dB(A)	200Hz dB(A)	250Hz dB(A)	315Hz dB(A)	400Hz dB(A)	500Hz dB(A)	630Hz dB(A)	800Hz dB(A)	1kHz dB(A)	1.25kHz dB(A)	1.6kHz dB(A)	2kHz dB(A)	2.5kHz dB(A)	3.15kHz dB(A)	4kHz dB(A)	5kHz dB(A)	6.3kHz dB(A)	8kHz dB(A)	10kHz dB(A)
Receiver NSR1 Ld 27.8 dB(A)																								
Ld	2.8	10.8	16.7	10.0	12.2	12.1	11.6	14.2	14.6	19.4	19.4	17.8	18.5	18.1	16.3	12.2	6.5	-0.5	-7.9	-20.7	-31.6	-55.3	-86.7	
Receiver NSR2 Ld 36.7 dB(A)																								
Ld	4.6	13.0	19.3	14.4	17.2	17.7	17.7	20.8	21.9	28.4	29.0	27.8	28.6	28.7	26.3	21.3	14.4	4.3	-8.3	-27.8	-43.2	-76.3		
Receiver NSR3 Ld 15.9 dB(A)																								
Ld	-8.5	-0.5	5.1	-1.2	0.5	0.3	-0.8	1.0	1.3	7.5	7.7	6.2	6.9	6.3	4.1	-2.1	-9.7	-20.4	-34.5	-56.2	-73.7	-112.3		
Receiver NSR4 Ld 13.6 dB(A)																								
Ld	-12.5	-4.2	2.1	-4.3	-4.6	-4.4	-4.8	-3.3	-3.1	4.7	5.6	4.3	5.9	4.7	3.1	-4.0	-12.3	-24.0	-40.4	-65.4	-85.4			
Receiver NSR5 (Unoccupied) Ld 36.9 dB(A)																								
Ld	3.1	11.0	17.0	13.7	17.2	17.7	17.7	21.0	22.2	28.5	29.0	27.9	28.7	29.3	26.3	21.4	14.9	4.8	-7.5	-26.4	-41.6	-74.4	-119.1	
Receiver NSR6 Ld 21.7 dB(A)																								
Ld	-2.7	4.1	9.8	5.1	6.5	6.2	5.6	7.7	8.0	13.9	13.9	12.1	12.5	11.5	9.4	3.3	-3.7	-13.4	-26.4	-46.7	-63.1	-99.2		
Receiver NSR7 Ld 21.3 dB(A)																								
Ld	-3.1	3.7	9.4	4.7	6.0	5.8	5.1	7.2	7.5	13.4	13.4	11.7	12.0	11.0	8.9	2.9	-4.1	-13.9	-27.0	-47.6	-64.1	-100.6		
Receiver NSR8 Ld 37.1 dB(A)																								
Ld	5.0	11.9	18.2	14.7	16.5	17.3	17.5	20.0	21.3	28.0	29.0	28.2	29.5	29.2	27.5	22.1	16.6	8.3	2.4	-9.0	-15.9	-32.0	-52.5	-80.0

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