8.0 NOISE AND VIBRATION

8.1 Introduction

This section of the rEIAR was prepared by ITPEnergised, to assess the potential noise and vibration impacts associated with the operation of the Windmillhill quarry ('the quarry').

The Substitute Consent application area is currently comprised of an area of ca. 46.14 hectares. The development includes an aggregate processing plant comprising a primary crusher, secondary and tertiary crushing units, a weighbridge, wheel wash, an asphalt manufacturing plant, car parking, offices/canteen/toilets, and storage maintenance sheds.

8.1.1 Site location and Setting

The quarry is situated approximately 1 km south-west of Rathcoole and 10 km east of Naas. The N7 national road which connects Dublin with Naas passes in an east-west direction just off the site.

Vehicular access to the quarry is from the N7 via a 170 m long access track that provides access to the quarry and surrounding lands. The site is surrounded by agricultural fields and there are other industrial sites 200 m to the east. The area immediately around the site is sparsely populated, with a few houses to the south of the quarry and to the north west. A series of third class roads run around the lands, serving a number of dwellings and farms.

8.2 Description of Site Operations

The subject development is an authorised quarry (Planning Reg. Ref. SDQU05A/4) at which rock was extracted by blasting and excavation, transferred to mobile crushing units by excavator, and further processed by mobile and stationary screening units which further grade the aggregates which are then loaded onto trucks for export off site. On-site ancillary activities also include an asphalt manufacturing plant. These activities shall continue should the quarry be operated in the future.

Site infrastructure includes security fencing, access roads, weighbridges, wheel wash, car parking, offices/canteen/toilets, and storage maintenance sheds. It is intended that these activities shall continue to occur as the quarry is operated into the future.

As required in Condition 4 of Planning Reg. Ref. SDQU05A/4 as granted by South Dublin County Council, a programme of noise monitoring has been conducted in the vicinity of the existing site boundaries and at the closest residential receptor to the site to assess the impact that all site activities have had on local ambient noise levels, the results of which are detailed in this report to describe the historic impacts, if any, that the subject site has had on local ambient noise levels.

8.3 Study Area and Noise Sensitive Receptors

The study area considered in this assessment comprises a buffer extending approximately 600 metres beyond the quarry redline boundary. This area includes the receptors anticipated to be impacted by quarry operations. The closest receptors are located approximately 200 metres south of the quarry boundary.

Representative Noise Sensitive Receptors (NSRs) considered within this assessment are shown in Figure 8.1 and are listed in Table 8.1.

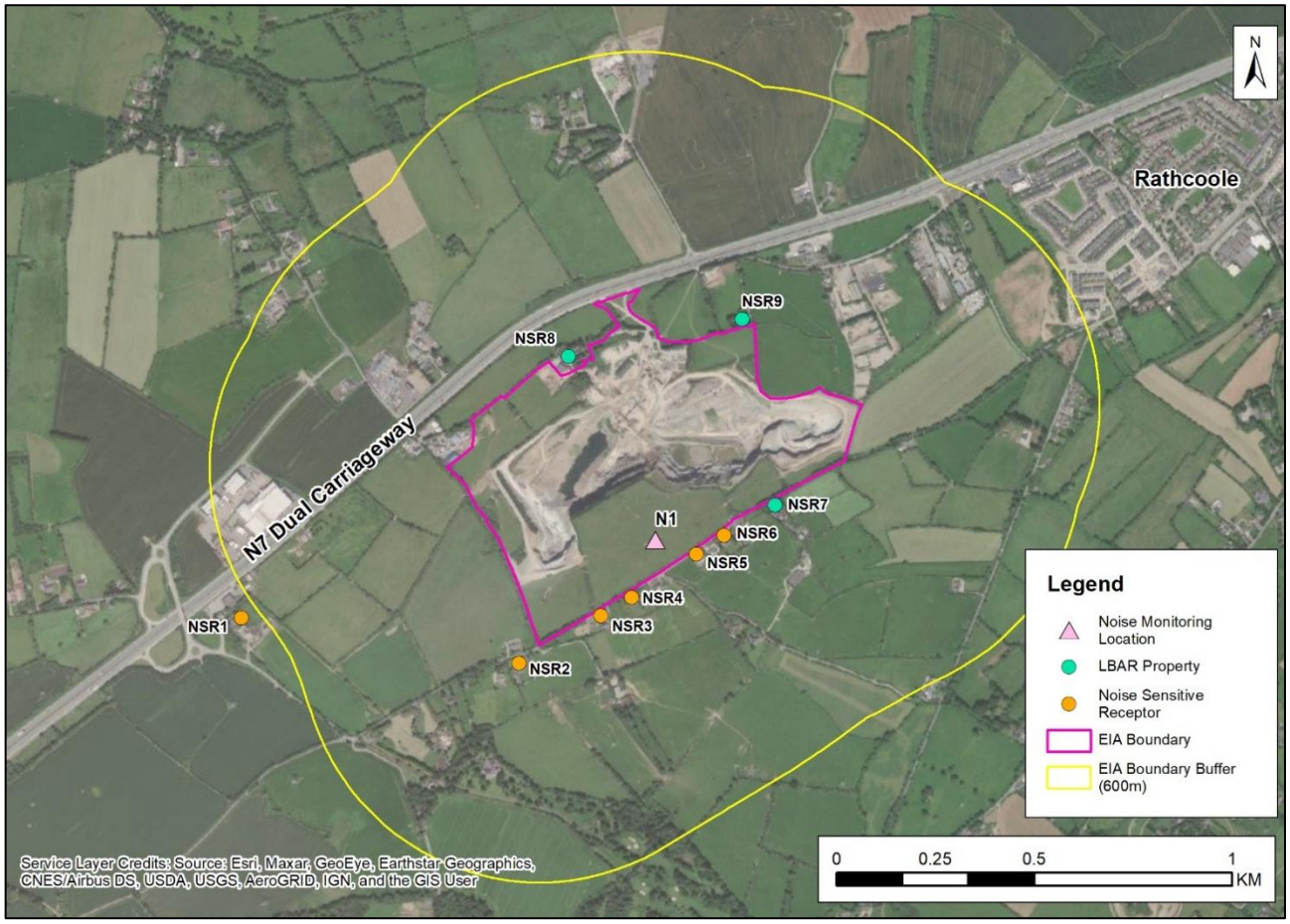

Figure 8.1: Noise monitoring location and noise sensitive receptors.

Table 8.1: Identified representative NSRs

Receptor	Representative of	X	Y
NSR1	Property to the west of the quarry.	698868.42	725304.74
NSR2	Property to the south of the quarry.	699570.14	725189.66
NSR3	Property to the south of the quarry.	699776.63	725309.03
NSR4	Property to the south of the quarry.	699855.63	725355.8
NSR5	Property to the south of the quarry.	700018.14	725465.51
NSR6	Property to the south of the quarry.	700088.31	725513.1
NSR7	Applicant owned property to the south of the quarry.	700217.36	725588.92
NSR8	Applicant owned property immediately to the north of the quarry	700134.44	726057.95
NSR9	Applicant owned property to the east of the quarry	699696.1	725965.18

Residential properties were also identified to the north of the quarry, on the far side of the N7 motorway. Observations of the noise environment at these potential NSRs confirmed that road traffic noise from the N7 was of such prominence that noise from quarry operations would not be audible. These potential NSRs were therefore scoped out of this assessment. Similarly, residential properties were identified approximately 600 metres east of the quarry, however noise from quarry operations was inaudible here against the residual road traffic noise.

This assessment therefore focuses on potential noise and vibration impacts at the closest NSRs in the quietest environments, where such impacts would be greatest. Noise and vibration impacts associated with quarry activities at more distant NSRs in noisier environments have been assumed to be lesser.

8.4 Statement of Competence

This section of the rEIAR has been prepared by Gregor Massie MSc BEng AMIOA. Gregor is a consultant at ITPEnergised and has over two years' experience in acoustics. Gregor holds the IOA Diploma in Acoustics and Noise Control and the Institute of Acoustics (IOA) Certificate of Competence in Environmental Noise Measurement.

This section of the rEIAR has been reviewed by Simon Waddell BSc. (Hons) MIOA. Simon is Principal Consultant at ITPEnergised and has over 10 years of experience in environmental acoustics. Simon has completed the Institute of Acoustics' (IOA) Diploma in Acoustics and Noise Control, and also holds the Certificate of Competence in Environmental Noise Measurement.

ITPEnergised have considerable experience in the assessment of noise impacts and have compiled EIA studies ranging from quarries, mines, retail development, housing developments and wind farms.

8.5 Relevant Guidance and Legislation

The following relevant guidance and legislation have been used and applied in this assessment:

8.5.1 Guidance Note for Noise: Licence Applications, Surveys and Assessments in Relation to Scheduled Activities (NG4) (Jan 2016)

With regards to noise, the most recent Irish guidance was published in 2016 by the Environmental Protection Agency (EPA), Office of Environmental Enforcement (OEE), entitled 'Guidance Note for Noise: Licence Applications, Surveys and Assessments in Relation to Scheduled Activities (NG4)'.

NG4 sets methods for addressing noise from operations that fall under IPPC and Waste Licensing functions of the Environmental Protection Agency Office of Environmental Enforcement (OEE). NG4 provides detailed consideration of a range of noise related issues including basic background to noise issues, various noise assessment criteria and procedures, noise reduction measures, Best Available Techniques (BAT) and the detailed requirements for noise surveys. NG4 identifies typical limit values for noise from licensed sites as: Daytime (07:00 to 19:00hrs) – 55dB $L_{Ar,T}$; Evening (19:00 to 23:00hrs) – 50dB $L_{Ar,T}$; and, Night-time (23:00 to 07:00hrs) – 45dB $L_{Aeq,\ T}$.

NG4 identifies the following guidance as potentially appropriate for assessing noise, subject to the use of the methodology being considered and justified by a competent person:

- BS 4142: 2014: Methods for rating and assessing industrial and commercial sound – evaluation of industrial and commercial noise sources at residential properties;
- BS 8233: 2014 Guidance on sound insulation and noise reduction for buildings – outline guidance on noise matters and deals specifically with noise within buildings; and
- BS 5228-1: 2009 + A1: 2014 Code of practice for noise and vibration control on construction and open sites – Part 1: Noise – outline guidance on prediction and control of noise from construction and open sites.

8.5.2 BS5288: 2009+A1:2014 Code of Practice for noise and vibration control on open sites: Part 1 Noise and Part 2 Vibration

BS5228 (BSI, 2014) provides a procedure for the estimation of construction noise and vibration levels and for the assessment of the significance of the predicted effects at the nearest sensitive receptors. Annex D of the Standard includes measured typical noise levels for a range of construction plant and activities.

Part 1 of the Standard provides several methods for the evaluation of the significance of construction noise effects. The ABC method considers significance by comparison to the measured baseline $L_{Aeq,T}$ noise level, rounded to the nearest 5 dB. Three categories of threshold values are provided; A, B and C, in increasing 5 dB bands, for the periods “daytime and Saturdays”, “evenings and weekends” and “night time”. Where the measured baseline exceeds the highest category (C), a 3 dB increase over baseline is considered significant. The evaluation periods are defined as follows:

- Daytime: 07:00 – 19:00 on weekdays and 07:00 – 13:00 on Saturdays
- Evenings and weekends: 19:00 – 23:00 weekdays, 13:00 – 23:00 Saturdays and 07:00 – 23:00 Sundays; and
- Night-time: 23:00 - 07:00 (all days).

Part 2 of the Standard provides threshold levels at which vibration may be perceptible to people, through to becoming intolerable, and frequency-weighted thresholds at which vibration may cause cosmetic damage to structures.

The thresholds are dependent on frequency and the type of building, however, in the worst-case, residential, or light commercial structures may see the onset of damage at 15 mm/s PPV at 4 Hz, increasing to 20 mm/s PPV at 15 Hz and above.

8.5.3 BS7385:, Evaluation and Measurement for Vibration in Buildings, Part1 1990 Guide for measurement of vibrations and evaluation of their effects on buildings and Part 2 1993 Guide to damage levels arising from ground borne vibration

BS 7385 states that there should typically be no cosmetic damage if transient vibration does not exceed 15 mm/s at low frequencies rising to 20 mm/s at 15Hz and 50 mm/s at 40 Hz and above.

BS7385 also provides further context with regards to air overpressure:

“Windows are generally the weakest parts of a structure exposed to air overpressure. Research by the United States Bureau of Mines has shown that a poorly mounted window that is pre-stressed can crack at around 150 dB(lin), with most windows cracking at around 170 dB(lin). Structural damage would not be expected at air overpressure levels below 180 dB(lin). “

8.5.4 BS7445-1:2003 Description and Measurement of Environmental Noise. Guide to Quantities and Procedures

BS7445 provides guidance on appropriate environmental noise monitoring, including specification of equipment and appropriate calibration intervals, suitable weather conditions and observations to note regarding the nature of the noise environment.

8.5.5 ISO 9613-2, First Edition 1996-12-15. Acoustics-Attenuation of sound during propagation outdoors-Part 2: General Method of Calculations

ISO 9613 describes a method for calculating the attenuation of sound during propagation outdoors in order to predict the levels of environmental noise at a distance from a variety of sources. The method predicts the equivalent continuous A-weighted sound pressure level under meteorological conditions.

8.5.6 EPA, 2006, Environmental Management Guidelines-Environmental Management in Extractive Industry (Non Scheduled Minerals)

This guidance outlines primary sources of noise associated with quarrying and offers guidance in relation to the correct approach to be followed in respect of assessment and mitigation. Recommended noise limit values are 55dB $L_{Aeq,1hr}$ and 45dB $L_{Aeq,15mi}$n for daytime and night-time respectively.

8.5.7 Design Manual for Roads and Bridges (DMRB)

DMRB provides standards and advice regarding the assessment, design, and operation of roads in the UK and sets out screening criteria, by which percentage changes in traffic flow can be related to a predicted change in road traffic noise and vibration. The guidance also provides significance criteria, by which the percentage of people adversely affected by traffic noise can be related to the total noise or vibration level due to road traffic, or the increase over an existing level.

DMRB provides a method for predicting the Basic Noise Level (BNL), a measure of the source noise level of a road. The BNL is a function of the composition, flow and speed of traffic and the quality of the road surface. Changes in the BNL, arising from changes in traffic flow, may be used as a means of determining the significance of operational noise effects.

8.5.8 Other Guidance

Other guidance reviewed as part of the assessment process include:

- Department of the Environment, Heritage and Local Government (DEHLG) – Quarries and Ancillary Activities: Guidelines for Planning Authorities, 2004;
- Design Manual for Roads and Bridges (DMRB);
- BS 6472:1992 - The Evaluation of Human Exposure to vibration in buildings;
- Department of the Environment, Heritage and Local Government – Quarries and Ancillary Activities: Guidelines for Planning Authorities, 2004; and
- Environmental Code (2005) Irish Concrete Federation (ICF). EPA guidelines in relation to blasting activities outlining the methodology and limits to be used for vibration measurement.

8.6 Methodology

8.6.1 Characterisation of Historical Baseline Noise Levels

Historical baseline noise data at the closest residential receptor to the quarry has been characterised using monitoring data collected during quarry operations from 2007 – 2015. No monitoring was undertaken between 1990 and 2006 or between 2016 and 2019. A baseline noise survey at the nearest residential receptor was therefore undertaken in November 2020 to characterise noise levels during current operations. Subsequent monitoring was also carried out in February 2021. Noise measurements were also undertaken in 2021 to characterise noise emissions for different items of operational plant and machinery.

This document presents a comprehensive noise assessment based on the criteria specified in the EPA's *'Advice notes on Current Practice in the Preparation of Environmental Impacts Statements'* and the *'Guidelines on the Information to be contained in Environmental Impact Statements'* also published by the EPA and with reference to *'ISO 1996,2, 2007: Acoustics – Description, Measurement and Assessment of environmental noise'.*

Noise Measurement Indices

At the measurement position, the following noise level indices have been recorded:

- $L_{Aeq,T}$ – the A-weighted equivalent continuous sound pressure level over the measurement period T, effectively represents an “average” energy level of all the sampled levels. The ambient sound level is usually measured as an $L_{Aeq,T}$ and is made up of all the sound in the area from sources near and far;
- $L_{A90,T}$ – the A-weighted noise level exceeded for 90% of the measurement period, T. This parameter is often used to describe the” background” noise level, it gives a clear indication of the underlying noise level, or the level that is almost always there in between intermittent noisy events; and
- $L_{A10,T}$ – the A-weighted noise level exceeded for 10% of the measurement period, T. This parameter is often used to describe or identify road traffic noise.

8.6.1.1 Measurement Method

Golder attended the site in November 2020 and February 2021 to undertake further baseline noise monitoring. Monitoring was undertaken using a Norsonic 140 Class I integrating sound level meter (SLM). The SLM was within its two-year laboratory calibration period, and a calibration check was performed before and after each measurement, with no drift in calibration noted. The calibration certificates are provided in **Appendix 8.1**.

Monitoring was undertaken at monitoring position N1 for a duration of 1 hour. Multiple 1/3 octave and measurements were also undertaken at 10 m from various plant and equipment operating in the quarry.

The noise indices L_{Aeq}, L_{A90}, L_{A10} and L_{Amax} were recorded. An averaging period of 1 minutes was selected for all NMPs to provide sufficient data resolution to characterise the noise environment.

Weather conditions were in accordance with the requirements of BS7445 and BS4142 throughout the survey with low wind speeds, no rain, and dry roads. Details of observations made during monitoring are provided in **Appendix 8.2**.

8.6.2 Noise Impact Assessment

8.6.2.1 Evaluation Criteria

Appropriate criteria have been adopted for the derivation of impact magnitude and are provided in Table 9-2. The criteria have been adapted from DMRB. DMRB provides criteria for construction phases of developments, which are appropriate for this evaluation.

Table 8.2: Impact Magnitude Criteria

Exceedance of threshold value OR change in noise level, dBLAeq,T	Subjective reaction	Impact Magnitude
≥5	Clearly perceptible	High adverse
≥3, <5	Perceptible	Medium adverse
>0, <3	Barely perceptible	Low adverse
≤0	Inaudible	No change / none

The criteria in Table 8.2 have been used to determine the significance of noise effects for receptors of different sensitivities, as shown in Table 8.3

Table 8.3: Assumed sensitivity of representative NSRs

Magnitude	Level of significance, relative to sensitivity of receptor		
	Low	Medium	High
High	Moderate	Moderate/Large	Large
Medium	Slight	Moderate	Moderate
Low	Neutral	Slight	Slight
No change / none	Neutral	Neutral	Neutral

This assessment considers that effects of moderate and large significance are significant, and that effects of neutral and slight significance are not significant.

All NSRs considered in this assessment are assumed to be of 'High' sensitivity.

8.6.2.2 Target Noise Levels

The EPA has produced the Environmental Management Guidelines 2006. The document references to 'A Guidance Note for Noise in Relation to Scheduled Activities'. It deals with the approach to be taken in the measurement and control of noise and provides advice in relation to the setting of emission limits values and compliance monitoring.

In relation to quarry developments and ancillary activities, noise from the activities on site should not exceed the following noise limits at the nearest NSR:

- Daytime - 08:00 – 20:00. Target level - L_{Aeq1hr} = 55 dBA; and
- Night-time - 20:00 – 08:00. Target level - L_{Aeq1hr} = 45 dBA.

8.6.2.3 Method of Prediction

A 3D model of the quarry was constructed within noise prediction software CadnaA and noise levels were predicted at the representative NSRs. The software enables prediction of noise levels under atmospheric conditions using the method provided in BS5228.

Source noise terms from various plant on site were obtained by measurement during the recent baseline survey. All measurements of plant were undertaken at a distance of 10 m from the source. Appropriate source noise terms from BS5288 were applied to plant which could not be measured during the survey. **Table 8.4** presents the sound power data and sources included in the noise model.

Table 8.4: Source Noise Terms

Item	Resultant sound power level, dBA	Data source	Modelled setting
Excavator	110.4	BS_5228_2009_C1_12	Point Source
Excavator Rock Breaking	121.0	BS_5228_2009_C9_11	Point Source
Screeners	110.3	Measured data	Point Source
Loader	103.5	BS_5228_2009_C6_34	Point Source
Drill Rig	119.0	BS_5228_2009_C9_3	Point Source
Crushers	115.5	Measured data	Point Source
Generator	88.1	BS_5228_2009_C4_77	Point Source
Asphalt Plant	98.6	Measured data	Point Source

Item	Resultant sound power level, dBA	Data source	Modelled setting
Dump Truck	105.1	BS_5228_2009_C6_25	Moving point source
Road HGV	101.4	BS_5228_2009_C11_4	Moving point source

The quarry operates (and has historically operated) to the following hours:

- The quarrying occurs 05:00 - 21:00 Monday to Friday, and 05:00 - 14:00 on Saturdays, with no working on Sundays or Bank Holidays;
- Excavation and mobile processing of material is carried out between 08:00 - 20:00, Monday to Friday and between 08:00 - 14:00 on Saturdays; and
- Outside the hours of 08:00 – 20:00 the activities are limited to loading and moving trucks.

Based on the above timing of activities, four scenarios have been modelled to establish baseline noise impacts and impacts from recent quarry operations:

- Scenario 1 – Baseline 1990 / 1991, excavation and mobile processing of material – to determine initial noise impacts;
- Scenario 2 – Baseline 1990 / 1991, loading and moving trucks;
- Scenario 3 – Current 2020 / 2021, excavation and mobile processing of material – to determine current noise impacts; and
- Scenario 4 – Current 2020 / 2021, loading and moving trucks.

In line with the operational hours of different activities, Scenario 1 and Scenario 3 have been evaluated against the daytime target level, and Scenario 2 and Scenario 4 have been evaluated against the night-time target level.

Scenario 1 – Baseline 1990 / 1991 - excavation and mobile processing of material

The predicted inputs for this scenario include the activities of the below fixed and mobile equipment. Equipment working in the pit void has been located at the extremity of the pit (Figure 8.2) at the closest working location from the NSRs.

Details of operations modelled in Scenario 1 are presented below:

- 2 x mobile crusher units operating in the pit;
- 1 x excavators feeding mobile crushers;
- 1 x excavator rock breaking at a recently blasted face in the southern corner of the pit closest to all three NSRs;
- 1 x haul truck serving the crushers, route from excavators, six loads per hour;
- 2 x haul trucks from excavator to crushers, four loads per hour;
- 4 x road HGVs outbound per hour;
- 1 x loader filling road trucks;
- 1 x JCB working in plant area; and
- 1 x screener operating.

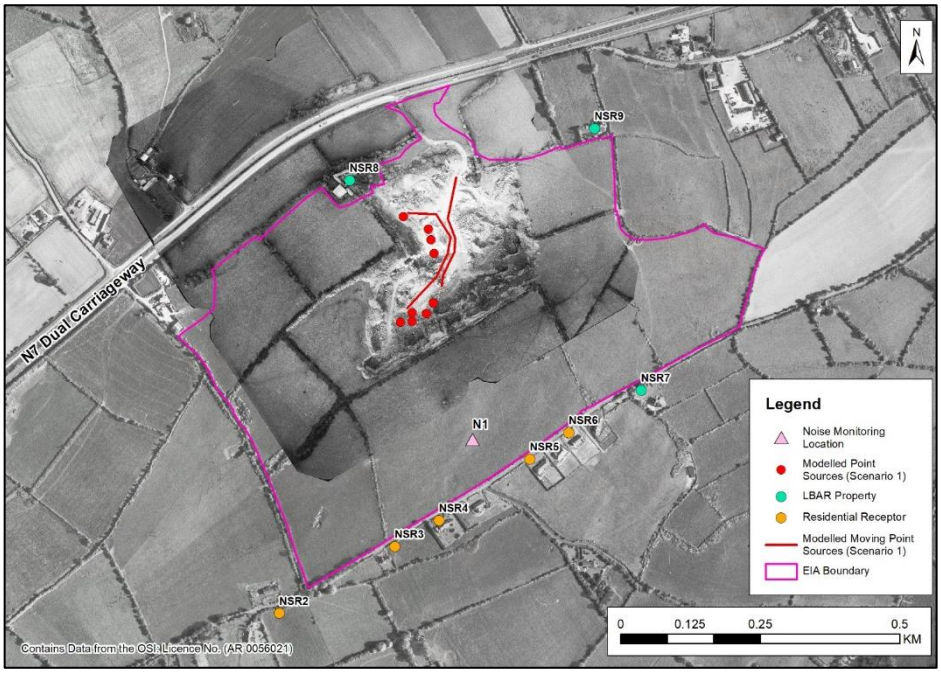

Figure 8.2: Noise Scenario 1 (Baseline 1990/1991, excavating and processing) predicted inputs.

Scenario 2 – Baseline 1990 / 1991 - loading and HGV movements

Scenario 2 includes for the loading and movement of HGVs in the quarry during the night-time period. The locations of the equipment are shown in Figure 8.3.

Details of operations modelled in Scenario 2 are presented below:

- 2 x road HGVs outbound per hour;
- 2 x haul trucks in operation, 4 loads per hours; and
- 1 x excavator loading haul trucks and HGVs.

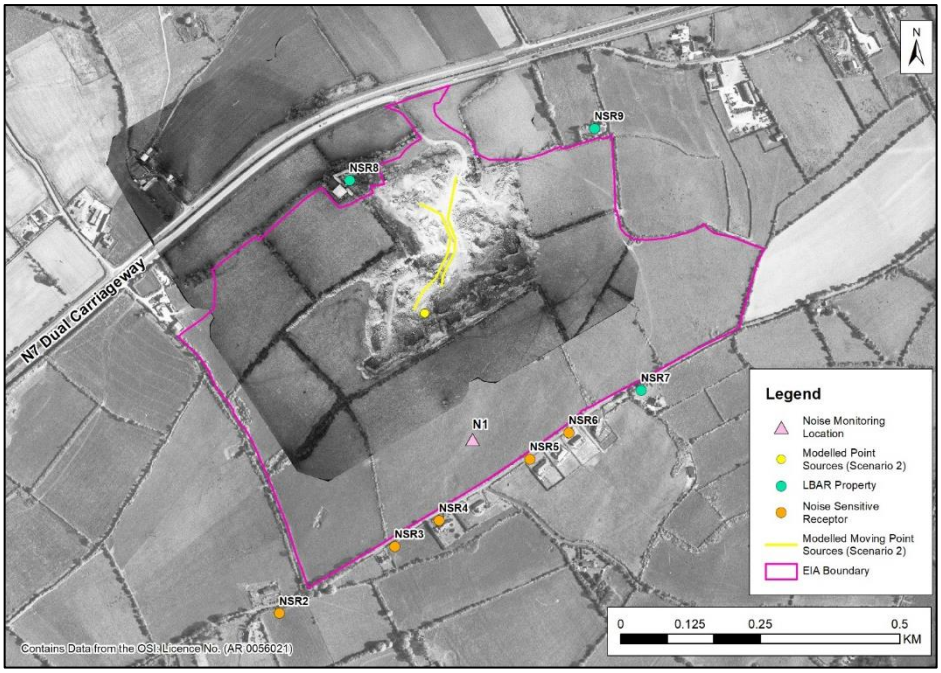

Figure 8.3: Noise Scenario 2 (Baseline 1990/1991, loading and HGV movements) predicted inputs.

Scenario 3 - Current 2020 / 2021 operations - excavation and mobile processing of material

The predicted inputs for this scenario include the activities of the below fixed and mobile equipment. Items of equipment have been located within the designated areas shown in Figure 8.4 so that they are at the closest working location to the NSRs. This predicted scenario is similar to Scenario 1 however, the working areas of the site have progressed to the south, west and east.

Details of operations modelled in Scenario 3 are presented below:

Area A – located at closest point to NSRs

- Jaw crusher;
- Cone crusher;
- Screener;
- Excavator (ca. 50t) feeding first jaw crusher; and
- Excavator (ca. 50t) rock breaking.

Area B

- Screen; and
- Loader loading road trucks.

Area C

- Screen;
- Excavator (ca. 50t) feeding screen; and
- Loader loading road trucks.

Area D

- Excavator conducting rock breaking and clearing ground; and
- Drill rig (Atlas Copco CM780D) preparing holes for blast.

Area E

- Jaw crusher;
- Excavator (ca. 50t) feeding crusher; and
- Loader loading road trucks.

Area F

- Excavator (ca. 50t) general tidying.

Area G

- Excavator (ca. 50t) loading haul trucks.

Other plant and equipment

- Dump Trucks - One dump truck moving from Area G to plant area (4 loads per hour); and
- Road HGV Trucks - 4 per hour, 10 % going to and from Area C, 45 % going to and from Area A & B and 45 % going to and from Area E.

Plant Area

- Screening Plant;
- Asphalt Plant;
- Water Recycling Unit;
- Loader working with stockpiles and loading; and
- JCB telehandler operating.

Figure 8.4: Noise Scenario 3 (Current 2020/2021, excavating and processing) predicted inputs.

Scenario 4 – Current 2020 / 2021 operations - loading and HGV movements.

Scenario 4 includes for the loading and movement of HGVs in the quarry during the night-time period. The locations of the equipment are shown in **Figure 8.5**.

Details of operations modelled in Scenario 4 are presented below:

- Dump Trucks - One dumper moving from Area G to plant area (4 loads per hour);
- Road HGV Trucks 4 per hour, 10 % going to and from Area C, 45 % going to and from Area A & B and 45 % going to and from Area E; and
- 2 x excavator loading haul trucks and HGVs.

Figure 8.5: Noise Scenario 4 (Current 2020/2021, loading and HGV movements) predicted inputs.

A robust approach has been applied in both model scenarios; modelling has assumed all mobile plant items operated at the area of the quarry closest to the identified NSRs. We note that these work practices would be very unlikely to occur in close proximity at such a location and this therefore represents a possible 'worst case', actual noise impacts are likely to have been lesser.

The predicted noise levels assume a receptor height of 4 m above local ground level, (representative of a first-floor bedroom window). This is a robust approach, which minimises the attenuation due to ground absorption. Predicted levels at the height of a person standing at ground level, (e.g. effective receptor height of 1.5 – 1.8 m) will be lower.

A conservative 100% equipment 'on-time' has been applied in all predictions for all fixed and mobile plant throughout the working day. All equipment and plant has been modelled to run simultaneously. The resultant prediction conservatively overestimates the noise output as all plant is not usually in operation simultaneously for 100% of the day. This assessment therefore considers a 'worst-case' 1 hour period during a working day for each scenario when all on-site plant is in use simultaneously. Actual noise impacts are likely to have been lesser.

8.6.2.4 Model settings

A typical air temperature of 10^{o}C and relative humidity of 70% have been assumed within the model. Ground absorption within the quarry has been assumed to be G=0, representative of hard ground conditions. The ground absorption for the area surrounding the site has been modelled as G = 0.5 representative of mixed ground conditions.

Local topography has been included within the model for all scenarios, using detailed contour line data provided by Golder.

8.6.3 Vibration Impact Assessment

The most significant potential sources of ground borne vibrations generated during the operational phase of the development was the extraction of rock from the active face. Rock extraction requires the use of a pneumatic rock breaker and blasting techniques.

With respect to the proximity of the closest receptors to the site boundaries, it was deemed necessary to implement a programme of vibration monitoring to be conducted during blast events by a blasting contractor to ensure that the potential for cosmetic or structural damage occurring at any receptor structure was assessed.

In order to determine the potential for either cosmetic or structural damage to occur as a result of ground vibrations, vibration levels were monitored during historical blasting events. Previously-measured vibration levels have been assessed according to *British Standard BS 7385: Evaluation and measurement for vibration in buildings, Part1 1990 Guide for measurement of vibrations and evaluation of their effects on buildings and Part 2 1993 Guide to damage levels arising from ground borne vibration.*

Vibration Measurement Parameters

- Ground vibration at sensitive receptors is measured as Peak Particle Velocity (PPV) in mm/sec. The PPV is the maximum instantaneous velocity of a particle at a point during a given time interval; and
- Air blast (air overpressure) noise is measured in linear decibels dB(Lin). Air overpressure is energy transmitted from the blast site within the atmosphere in the form of pressure waves and is generally perceived as a loud bang.

8.6.3.1 Evaluation criteria

Table 1 in BS6472 (reproduced here as **Table 8.5**) provides magnitudes of vibration that are acceptable with respect to human response for up to three blast vibrations events per day.

Table 8.5: Maximum satisfactory magnitude of vibration with respect to human response for up to three blast vibration events per day

Place	Time	Satisfactory Magnitude, PPV (mm/s)
Residential	Day – 08:00 to 18:00 Mon-Fri, 08:00 to 13:00 Saturdays Night – 23:00 to 07:00 Other times	6.0 to 12.0 2.0 4.5
Offices	Any time	14.0
Workshops	Any time	14.0

The table recommends magnitudes of vibration below which the probability of adverse comments is low.

8.6.3.2 Vibration and air overpressure limits

Vibration limits from blasting are recommended in DEHLG (now DCCAE), EPA and ICF Environmental Guidelines. The vibration limit from blasting should not exceed a peak particle velocity of 12 mm/sec when measured in any three mutually orthogonal planes at a receiver location when blasting occurs at a frequency of once per week or less. Research has found that damage to windows occur at air overpressure levels of 150 dB(lin) and above. Structural damage would likely only occur at air overpressure levels greater than 180 dB(lin).

The acceptable vibration and air overpressure limits at sensitive receptors in Ireland is **12mm/sec** (PPV) and **125 dB(lin)** Air Overpressure (AOP) as defined in the EPA management guidelines.

8.6.4 Construction Phase

The construction noise levels associated with the previous activity were of relatively short term duration which served to minimise the noise impacts at local existing NSRs. The construction of the screening banks around

the site has provided more effective attenuation to noise generated by site activities. Noise levels associated with any future construction phase activities will be controlled in accordance with methods provided in BS5228.

Appropriate construction phase noise limits, which are presented in **Table 8.6** (NRA Guidelines, 2004) represent a reasonable compromise between the practical limitations in a construction project, and the need to ensure an acceptable noise level for the nearby residents. In addition to the standard workday criterion of 70 dB(A), the guidelines specify a reduced limit of 65 dB(A) for work on Saturdays, and 60 dB(A) for evening periods, and Sundays and Bank holidays.

Table 8.6: Construction Phase Noise Limit Values

Days	Times	Ambient level, dBLAeq1hr	Maximum level, dBLAmax
Monday to Friday	07:00 to 19:00	70	80
Monday to Friday	19:00 to 22:00	60	65
Saturday	08:00 to 16:30	65	75
Sundays and Bank Holidays	08:00 to 16:30	60	65

8.7 Historical Baseline

8.7.1 Noise baseline

8.7.1.1 Historical monitoring data

The results of the noise monitoring campaigns from 2007 – 2020 are presented in **Table 8.7**. No monitoring was undertaken during the years 1990 – 2006 or 2016 – 2019.

Table 8.7: Noise Survey Results 2007 – 2020 – Monitoring position N1

Date	LAeq,1hr	LA90,1hr	LA10,1hr
April 2007	53	47	61
June 2008	51	49	59
May 2009	51	48	53
Sept 2010	54	46	60
March 2011	53	50	56
Oct 2012	53	50	59
Feb 2013	51	43	52
Feb 2014	52	48	60
April 2014	54	47	57
July 2014	52	45	60
Oct 2014	54	50	63
Feb 2015	51	46	55
July 2015	53	48	65
Oct 2015	51	43	55
November 2020	54	48	57
February 2021	54	49	56

There are no exceedances of the 55 dB(A) $L_{Aeq,1hr}$ daytime target level throughout the historical noise monitoring.

Observations from monitoring in February 2013 stated that the noise environment at N1 was dominated by road traffic on the N7 motorway, with quarry site activities faintly audible.

During the October 2015 survey, the noise environment was also noted to be dominated by road traffic on the N7 motorway, with quarry site activities still only faintly audible.

During the November 2020 and February 2021 surveys, the noise environment at N1 was dominated by traffic noise from the N7 motorway. Operational noise from the quarry was sporadic and only faintly audible at N1. Further observations were noted at NSRs north, west and east of the site. At all of these properties noise from the quarry was inaudible, with the noise environment dominated by noise from the N7 motorway.

8.7.2 Vibration baseline

Humans beings are extremely sensitive to vibration, the threshold of perception is typically in the PPV range of 0.14 mm/s to 0.3mm/s. BS6472-2 sets out vibration levels from blasting activities at which minimal adverse comment is likely to be provoked (**Table 8.5**). If vibration levels from blasting exceed these values, then the chance of adverse comment increases significantly. Potential annoyance from blasting activities does not correlate to baseline vibration levels in 1990. This assessment therefore evaluates historical vibration levels from recently measured data against the limits set out in **Table 8.5**.

Measurements were undertaken at the eastern and western boundary of the site throughout 2019 and 2020. The full results of the vibration monitoring undertaken in 2019 and 2020 are presented in **Appendix 8.3**.

The maximum PPV recorded was 10.6 mm/sec, which complies with the vibration limit. The maximum air-overpressure recorded was 124.8 dB(lin) and therefore complies with the vibration limit Measured air-overpressure levels were below the values provided in BS6472 at which damage may be expected to windows.

8.8 Embedded Mitigation Considered

8.8.1.1 Noise mitigation measures

The quarry did not operate in the night-time period (with the exceptions identified for loading and moving HGVs) or on Sundays or Public Holidays. Potential impacts of quarrying activities on the noise climate in the vicinity of the site were therefore limited to the weekday daytime period, which limited potential impacts on local residential amenity during the more sensitive evening, weekend and night-time hours.

A historical programme of quarterly noise monitoring undertaken by the quarry operator established routine compliance with noise limits at the closest receptors.

The following noise control and mitigation techniques have historically been implemented at the quarry:

- Internal haul roads were designed so as to have as low a gradient as possible so as to minimise excessive revving of vehicle engines on-site;
- The use of vehicle horns was discouraged during the daytime period and was banned during the early morning periods before 10:00;
- Restriction of working hours to 05:00 - 21:00, Monday to Friday and to 05:00 - 14:00 on Saturdays with no works on Sundays and on public holidays;
- Out of hours activity (where permitted by the local authority) only included the loading of trucks from stockpiles and the operation of the asphalt plant, which were relatively low noise activities. Quarry operations such as blasting, excavation or crushing did not occur outside normal operating hours;

- Presence of screening bunds surrounding the site boundaries in proximity to residential noise sensitive receptors;
- 10 kmph speed limit on access road;
- All site plant, machinery and vehicles were shut down when not in use;
- All pneumatic rock breakers were fitted with dampeners;
- Pumps and mechanical static plant were housed in acoustic enclosures;
- Noise levels were routinely monitored on a quarterly basis;
- Drop heights for materials were minimised; and
- Low noise level reverse warning alarms consistent with site safety were utilised.

8.8.1.2 Blasting vibration mitigation measures

The blasts were designed such that vibration at off-site NSRs met the criteria, using the following techniques:

- Blast events were conducted by an approved blasting contractor in accordance with best practice in this field, and potential impacts associated with the activity were therefore minimised.
- The use of delayed blasting techniques whereby each blast event takes place in a series of timed small blasts rather than a single large blast assisted in the minimisation of vibrations in the rock body.
- All shot holes were drilled to exact specifications by specialist contractors. Any features encountered during drilling such as cavities or soft material were recorded by the drilling contractor and this information was subsequently passed on to the shot-firer so that the correct charge was used. This ensured safe and efficient blasting of the rock face.

In addition to implementing the necessary blast specifications, the quarry operator provided appropriate advance warning of blasts to neighbouring residents, undertook required environmental monitoring and recorded any complaints arising, as detailed below.

The following blast warnings were provided by the quarry:

- A red warning flag was posted at the site entrance on the day of each blast and was immediately removed following each blast;
- Written notice was given to adjacent houses at least 24 hours prior to each blast;
- Warning sirens were sounded which were audible inside each adjacent house 10 minutes prior to each blast;
- A warning siren was sounded exactly 30 seconds prior to each blast; and
- A final siren was sounded after each blast by the Blast Operator under Garda supervision.

Blasting occurred between 09:00 to 18:00 Monday to Friday. Blasting did occur on Saturdays (mornings only).

Vibration monitoring records were maintained by the Quarry Manager and were available for display to local residents that may have been affected by site operations.

The quarry manager maintained a written complaints log in which all complaints made by local residents were detailed. This ensured that the concerns of local residents who may have been affected by site activities were considered during the management of activities at the quarry site.

8.9 Evaluation of Impacts

8.9.1 Noise Impacts

Recorded baseline noise levels (see section 8.7.1) include noise from all sources, including road traffic from the N1 and operational noise from the quarry. Noise modelling has predicted noise from quarry activities only to determine the likely worst-case contribution of quarry operations to the noise environment. The predicted noise levels for Scenario 1 are presented in Table 8.8. The magnitude of impact and significance of effect have been determined with reference to criteria provided in Table 8.2 and Table 8.3 respectively.

Table 8.8: Evaluation of Predicted worst-case levels for Scenario 1 against daytime target level

Noise Sensitive Receptor	Predicted Noise Level dB(A)	Predicted level minus target level, 55 dB(A) LAeq,1hour	Magnitude of Impact	Significance of effect
NSR1	34.6	-20.4	No change	Neutral
NSR2	31.0	-24.0	No change	Neutral
NSR3	33.6	-21.4	No change	Neutral
NSR4	34.7	-20.3	No change	Neutral
NSR5	36.6	-18.4	No change	Neutral
NSR6	36.9	-18.1	No change	Neutral
NSR7– applicant property	35.5	-19.5	No change	Neutral
NSR8 – applicant property	58.8	3.8	Medium Adverse	Moderate
NSR9 – applicant property	51.1	-3.9	No change	Neutral

Predicted noise levels at all third party receptors are substantially below the daytime target level (55 dB(A) L_{Aeq}) during this conservatively predicted scenario for operations at the quarry in 1990 / 1991. The highest predicted levels were at NSR6, with predicted levels 18.1 dB below the daytime target level.

Predicted noise levels at NSR8 which is owned by the applicant exceed the target level by 3.8 dB. Noise effects at NSR8 have been evaluated as being of moderate significance and are therefore ‘significant’. Despite the exceedance in target levels, any significant noise effects experienced would likely have been of short duration as the topography of the quarry changed significantly post 1991 such that the quarry wall would have provided greater screening. The noise model has also made a number of conservative assumptions (see Section 8.6.2.3), and actual noise levels from quarry operations were likely lower.

Noise effects at all third-party NSRs for Scenario 1 associated with quarry operations during the daytime period have been evaluated as being of ‘neutral’ significance and are therefore ‘not significant’.

The predicted noise levels for Scenario 2 are presented in Table 8.9. The magnitude of impact and significance of effect have been determined with reference to criteria provided in Table 8.2 and Table 8.3 respectively.

Table 8.9: Evaluation of Predicted worst-case levels for Scenario 2 against night-time target level

Noise Sensitive Receptor	Predicted Noise Level dB(A)	Predicted level minus target level, 45 dB(A) LAeq,1hour	Magnitude of Impact	Significance of effect
NSR1	23.9	-21.1	No change	Neutral
NSR2	19	-26	No change	Neutral
NSR3	22.5	-22.5	No change	Neutral
NSR4	23.7	-21.3	No change	Neutral
NSR5	25.2	-19.8	No change	Neutral
NSR6	24.9	-20.1	No change	Neutral
NSR7 – applicant property	23.0	-22.0	No change	Neutral
NSR8 – applicant property	36.5	-8.9	No change	Neutral
NSR9 – applicant property	36.1	-8.5	No change	Neutral

Predicted noise levels at all NSRs are below the night-time target level (45 dBL_{Aeq}) at all NSRs during this conservatively predicted scenario for baseline operations at the quarry. Predicted noise levels are higher at the applicant owned properties (NSR8 & NSR9) due to their closer proximity to the quarry. However, for this scenario, predicted noise levels at NSR8 are still 8.5 dB(A) below the target level during the night-time operations.

Noise effects for Scenario 2 associated with quarry operations during the night-time period have been evaluated as being of 'neutral' significance and are therefore 'not significant'.

The predicted noise levels for Scenario 3 are presented in **Table 8.10**. The magnitude of impact and significance of effect have been determined with reference to criteria provided in **Table 8.2** and Table 8.3 respectively.

Table 8.10: Evaluation of Predicted worst-case levels for Scenario 3 against daytime target level

Noise Sensitive Receptor	Noise Level	Predicted level minus target level, 55 dB(A) LAeq,1hour	Magnitude of Impact	Significance of effect
NSR1	29.7	-25.3	No change	Neutral
NSR2	38.6	-16.4	No change	Neutral
NSR3	49.4	-5.6	No change	Neutral
NSR4	45.2	-9.8	No change	Neutral
NSR5	41.9	-13.1	No change	Neutral
NSR6	40.6	-14.4	No change	Neutral
NSR7 – applicant property	40.8	-14.2	No change	Neutral
NSR8 – applicant property	49.0	-6.0	No change	Neutral

Noise Sensitive Receptor	Noise Level	Predicted level minus target level, 55 dB(A) LAeq,1hour	Magnitude of Impact	Significance of effect
NSR9 – applicant property	44.4	-10.6	No change	Neutral

Predicted noise levels at all NSRs are below the daytime target level (55 dBL_{Aeq}) during this conservatively predicted scenario for current operations at the quarry. Predicted noise levels are higher at the properties south of the site (NSR3 to NSR7) due to the extension of quarry operations in the south of the quarry. However, for this conservative operational scenario, predicted noise levels at NSR3 are still 5.6 dB(A) below the target level during the daytime operations.

In comparison to Scenario 1, where there were exceedances in target level at NSR8, there were no exceedances in Scenario 3. The bulk of quarry operations moved further away from this NSR, and the quarry pit became deeper, which provided more screening to operational noise.

Noise effects for Scenario 3 associated with quarry operations during the daytime period have been evaluated as being of 'neutral' significance and are therefore 'not significant'.

The predicted noise levels for Scenario 4 are presented in **Table 8.11**. The magnitude of impact and significance of effect have been determined with reference to criteria provided in **Table 8.2** and Table 8.3 respectively.

Table 8.11- Evaluation of Predicted worst-case levels for Scenario 4 against night-time target level

Noise Sensitive Receptor	Predicted Noise Level dB(A)	Predicted level minus target level, 45 dB(A) LAeq,1hour	Magnitude of Impact	Significance of effect
NSR1	25.7	-19.3	No change	Neutral
NSR2	26.0	-19.0	No change	Neutral
NSR3	29.1	-15.9	No change	Neutral
NSR4	28.8	-16.2	No change	Neutral
NSR5	29.2	-15.8	No change	Neutral
NSR6	34.1	-10.9	No change	Neutral
NSR7 – applicant property	35.1	-9.9	No change	Neutral
NSR8 – applicant property	35.0	-10.0	No change	Neutral
NSR9 – applicant property	31.0	-14.0	No change	Neutral

Predicted noise levels at all NSRs are below the night-time target level (45 dBL_{Aeq}) during this conservatively predicted scenario for current operations at the quarry. Predicted noise levels are higher at the properties south of the site (NSR6 & NSR7) due to the extension of quarry operations in the south of the quarry. However, for

this conservative operational scenario, predicted noise levels at NSR7 are still 9.9 dB(A) below the target level during the night-time operations.

8.9.2 Vibration and Air-Overpressure Impacts

The maximum PPV recorded during vibration monitoring was 10.6 mm/sec; 1.4mm/sec below the 12 mm/sec PPV limit. On average PPV values were 2.9 mm/sec. With reference to Table 8.5, the probability of adverse comments due to blasting activities at representative NSRs is low.

The maximum air-overpressure value recorded was 124.8 dB(lin); marginally below the 125 dB(lin) limit. The average air-overpressure recorded was 111 dB(lin). Measured air overpressure levels were substantially below the level which would see structural damage to windows occur (180 dB(lin)).

It should be noted that vibration monitoring was undertaken at the eastern and western boundary of the quarry, close to blasting activities. Actual vibration levels at NSRs will be lower.

8.10 Mitigation measures

8.10.1 Remedial Measures Proposed

The following remedial measures are proposed:

- The noise monitoring programme will be undertaken consistently every six months at the monitoring location N1 for a period of 60 minutes while the quarry is operating normally;
- Vibration blast monitoring will be undertaken during blast activities at the closest NSRs to blasting locations, and not at the eastern and western boundary of the quarry; and
- Monitoring of vibration levels at local residences will be conducted in agreement and with the consent of local residents. The quarry manager will give at least 24-hours' notice to the residents at whose homes vibration monitoring will occur.

8.11 Conclusion

This assessment considers historical noise and vibration impacts from the quarry as it was in 1990 up to current operations in 2020.

Noise monitoring was undertaken by the quarry from 2007, excluding a pause from 2016 to 2019. The noise environment at the closest NSR to the quarry was noted to be dominated by road traffic noise from the N/M7 dual carriageway at the time of the most recent noise survey. Operational noise from the quarry was only sporadically audible at the monitoring position and was inaudible at properties to the north, east and west of the quarry.

Operational noise from the quarry has been predicted for four historical operational scenarios, 1990 / 1991 daytime & night-time operations, and 2020 / 2021 daytime and night-time operations. All modelled scenarios followed a highly conservative approach to determine the likely 'worst-case' noise levels at NSRs. Despite this approach the predicted historical noise levels are well within the daytime and night-time levels recommended by the EPA Environmental Management Guidelines – Environmental Management in Extractive Industry. The one exception was an exceedance at the applicant-owned property NSR8, occurring in Scenario 2 – baseline 1990 night-time operations. Any significant noise effects under this scenario would likely have been of short duration as the topography of the quarry changed substantially post-1991, resulting in much greater topographic screening by the operational face. Predicted operational noise levels at NSR8 in Scenario 4 – current night-time operations meet the noise limits. Predicted noise levels from quarry operations for all modelled scenarios have been found to be 'not significant'.

Vibration monitoring undertaken throughout 2019 and 2020 at the eastern and western boundary of the quarry resulted in no exceedances in the specified vibration limits. The probability of adverse comments due to blasting activities was low, and measured air overpressure levels were substantially lower than the levels which would see structural damage to windows.

No significant noise or vibration impacts have been identified throughout the operation of the quarry from 1990 to 2021.

8.12 References

Guidance Note for Noise: Licence Applications, Surveys and Assessments in Relation to Scheduled Activities (NG4) (Jan 2016).

BS5288: 2009+A1:2014 Code of practice for noise and vibration control on open sites: Part 1 Noise and Part 2 Vibration.

BS 7385:, Evaluation and measurement for vibration in buildings, Part1 1990 Guide for measurement of vibrations and evaluation of their effects on buildings and Part 2 1993 Guide to damage levels arising from ground borne vibration.

BS7445-1:2003 Description and Measurement of Environmental Noise. Guide to Quantities and Procedures.

ISO 9613-2, First Edition 1996-12-15. Acoustics-Attenuation of sound during propagation outdoors-Part 2: General method of calculations.

EPA, 2006, Environmental Management Guidelines-Environmental Management in Extractive Industry (Non Scheduled Minerals).

Department of the Environment, Heritage and Local Government (DEHLG) – Quarries and Ancillary Activities: Guidelines for Planning Authorities, 2004.

Design Manual for Roads and Bridges (DMRB).

BS 6472:1992 - The Evaluation of Human Exposure to vibration in buildings.

Department of the Environment, Heritage and Local Government – Quarries and Ancillary Activities: Guidelines for Planning Authorities, 2004.

Environmental Code (2005) Irish Concrete Federation. EPA guidelines in relation to blasting activities outlining the methodology and limits to be used for vibration measurement.

APPENDIX 8.1

Calibration Certificates

CAMPBELL ASSOCIATES
SOUND & VIBRATION SOLUTIONS

Sonitus House, 5b Chelmsford Road Industrial Estate
Great Dunmow, Essex, CM6 1HD

Sales Tel: 01371 871033 Hire Tel: 01371 871037
Admin Tel: 01371 871030 Fax Tel: 01371 879106
E-Mail: info@campbell-associates.co.uk
Website: www.campbell-associates.co.uk

Technical Report

Customer: Golder Associates (Scotland)

Contact: Kevin McGillycuddy

Order No: To be advised

Comments: Calibrator Requires UKAS Calibration

Technical log No: 20900

Report Date: 28 April 2020

Internal ref: 24705/GOL300A

Service Req'd: Calibration

Equipment ID:- NOR-1251.33002

Service Request:- Requires UKAS Calibration

Report: UKAS calibration complete.

Certificate number: U34661

Accessories supplied: C/W Black Leather case & type 1443 adapter

Important

Please note, our calibration and/or repair process may involve changing several parameters in your equipment. We endeavour to restore the original setting wherever possible, however, we cannot guarantee the equipment has been returned with your original settings. On receipt, please ensure that the settings meet your requirements prior to use.

Technician:

Campbell Associates Ltd
5b Chelmsford Road Industrial Estate
GREAT DUNMOW, CM6 1HD, England
www.campbell-associates.co.uk
info@campbell-associates.co.uk
Phone 01371 871030 Facsimile 01371879106

CALIBRATION

0789

Certificate number: U34661

Certificate of Calibration and Conformance

Test object:	**Sound Calibrator**
Manufacturer:	**Norsonic**
Type:	**1251**
Serial no:	**33002**
Customer:	Golder Associates (UK) Ltd
Address:	Attenborough House, Browns Lane Business Park, Stanton on the Wolds, Nottinghamshire. NG12 5BL.
Contact Person:	Kevin McGillycuddy.

Measurement Results:	Level	Level Stability	Frequency	Frequency Stability	Distortion
1:	114.08 dB	0.06 dB	1000.63 Hz	0.00 %	0.35 %
2:	114.07 dB	0.05 dB	1000.63 Hz	0.00 %	0.35 %
3:	114.08 dB	0.06 dB	1000.63 Hz	0.00 %	0.35 %
Result (Average):	**114.08 dB**	**0.06 dB**	**1000.63 Hz**	**0.00 %**	**0.35 %**
Expanded Uncertainty:	0.10 dB	0.02 dB	1.00 Hz	0.01 %	0.10 %
Degree of Freedom:	>100	>100	>100	>100	>100
Coverage Factor:	2.00	2.00	2.00	2.00	2.00

The stated level is relative to 20µPa. The level is traceable to National Standards.
The stated level is valid at reference conditions. The following correction factors have been applied during the measurement: Pressure: 0.0005 dB/kPa Temperature: 0.003 dB/°C Relative humidity: 0.000 dB/%RH Load volume : 0.0003 dB/mm3
The reported expanded uncertainty of measurements is based on a standard uncertainty multiplied by the coverage factor of k=2, providing a level of confidence of approximately 95%. Where the degrees of freedom are insufficient to maintain this confidence level, the coverage factor is increased to maintain this confidence level. The uncertainty has been determined in accordance with UKAS requirements.
Records: K:\C A\Calibration\Nor-1504\Nor-1018 CalCal\2020\NOR1251_33002_M1.nmf

Environmental conditions:	Pressure:	Temperature:	Relative humidity:
Reference conditions:	101.325 kPa	23.0 °C	50 %RH
Measurement conditions:	99.841 ± 0.042 kPa	24.2 ± 0.1 °C	33.8 ± 1.0 %RH

Date received for calibration:	24/04/2020
Date of calibration:	28/04/2020
Date of issue:	28/04/2020
Engineer	Michael Tickner
Supervisor	Darren Batten TechIOA

Certificate number: U34661

Preconditioning
The equipment was preconditioned for more than 4 hours in the specified calibration environment.

Measurements
The calibrator has been tested as described in the following annexes to BS EN IEC60942:2003 Sound Calibrators; B3.4 for sound pressure level, B3.5 for frequency, B3.6 for total distortion and A4.4 for short term stability of the pressure level.

Method
Calibration has been performed as set out in the current version of CA Technical procedure TP01

Instruments and program
A complete list of equipment, hardware and software that has been used in this calibration is available from the calibration laboratory on request.

Traceability
The measured values are traceable to an accredited national physical laboratory within the EU or EFTA.

Comment
Calibrated as received, no adjustments made.

Statement of conformance
As public evidence was available[1], from a testing organisation responsible for approving the results of pattern evaluation tests, to demonstrate that the model of sound calibrator fully conformed to the requirements for pattern evaluation described in annex A of BS EN IEC 60942:2003, the sound calibrator tested is considered to conform to all the class 1 requirements of that BS EN IEC 60942:2003.

[1] This evidence is held on file at the calibration laboratory.

Notes:
The sound pressure level generated by the calibrator in its ½ inch configuration was measured five times and averaged by a WS2P working standard microphone for class 1 or 2 devices or a LS2P reference microphone for class 0 or LS devices as specified in the International Standard BS EN 61094-4. The results of three replications and the mean of the measurements obtained are given in the measurement results table of this certificate. The frequency and distortion were measured in a similar manner. The figures in **BOLD** are the final results; a small correction factor may need to be added to the sound pressure level quoted here if the device is used to calibrate a sound level meter that is fitted with a free field response microphone. See manufacturer's handbooks for full details of this and other corrections that may be applicable.

Sonitus House, 5b Chelmsford Road Industrial Estate, Great Dunmow, GB-CM6 1HD
Tel (+44) 01371 871030 Fax (+44) 01371 879106
email calibration@campbell-associates.co.uk

Campbell Associates Ltd
5b Chelmsford Road Industrial Estate
GREAT DUNMOW, Essex, GB-CM6 1HD
www.campbell-associates.co.uk
Phone 01371 871030 Facsimile 01371879106

CALIBRATION 0789

Certificate of Calibration and Conformance

Certificate No.: U31392

Test object:	**Sound Level Meter, BS EN IEC 61672-1:2003 Class 1 (Precision)**
Manufacturer:	**Norsonic**
Type:	**140**
Serial no:	**1402742**
Customer:	**Golder Associates**
Address:	**Sirius Building, The Clocktower, Flassches Yard, South Gyle Crescent, Edinburgh. EH12 9LB.**
Contact Person:	**Karen Campbell.**

Method :
Calibration has been performed as set out in CA Technical Procedures TP01 & 02 as appropriate. These are based on the procedures for periodic verification set out in BS EN IEC 61672-3:2006. Results and conformance statement are overleaf and detailed results are in the attached Test Report.

	Producer:	Type:	Serial No:	Certificate number
Microphone	Norsonic	1225	72926	31391
Calibrator*	Norsonic	1251	33002	U31390
Preamplifier	Norsonic	1209	12131	Included

Additional items that also have been submitted for verification

Wind shield	Norsonic	Nor1451
Attenuator	None	
Extension cable	None	

These items have been taken into account wherever appropriate.

	Pressure:	Temperature:	Relative humidity:
Environmental conditions:			
Reference conditions:	101.325 kPa	23.0 °C	50 %RH
Measurement conditions:	102.88 ±0.01kPa	22.9 ±0.2°C	35.2 ±2%RH

Date received : 20/03/2019
Date of calibration: 28/03/2019
Date of issue: 28/03/2019

Engineer

Michael Tickner

Supervisor

Darren Batten TechIOA

Certificate of Calibration and Conformance

UKAS Laboratory Number 0789

Certificate No.: U31392

Conformance

From markings on the sound level meter or by reference to the manufacturer's published literature it has been determined that the instrument submitted for verification was originally manufactured to BS EN IEC 61672-1:2002 and similarly that the associated sound calibrator conforms to BS EN IEC 60942.

Statement of conformance

The sound level meter submitted for testing has successfully completed the class 1 periodic tests of BS EN IEC 61672-3:2006, for the environmental conditions under which the tests were performed. As public evidence was available[1], from an independent testing organisation responsible for approving the results of pattern evaluation tests performed in accordance with BS EN IEC 61672-2:2003, to demonstrate that the model of sound level meter fully conformed to the requirements in BS EN IEC 61672-1:2002, and that the sound level meter submitted for testing conforms to the class 1 requirements of BS EN IEC 61672-1:2003.

[1] This evidence is held on file at the calibration laboratory

Measurement Results:

Indication at the calibration check frequency - IEC61672-3 Ed.1 #9	Passed
Self-generated noise - IEC 61672-3 Ed.1 #10	Passed
Acoustical signal tests of a frequency weighting - IEC 61672-3 Ed.1 #11	Passed
Frequency weightings: A Network - IEC 61672-3 Ed.1 #12.3	Passed
Frequency weightings: C Network - IEC 61672-3 Ed.1 #12.3	Passed
Frequency weightings: Z Network - IEC 61672-3 Ed.1 #12.3	Passed
Frequency and time weightings at 1 kHz IEC 61672-3 Ed.1 #13	Passed
Level linearity on the reference level range - IEC 61672-3 Ed.1 #14	Passed
Toneburst response - IEC 61672-3 Ed.1 #16	Passed
Peak C sound level - IEC 61672-3 Ed.1 #17	Passed
Overload indication - IEC 61672-3 Ed.1 #18	Passed
Electrical signal tests of frequency weightings - IEC 61672-3 Ed.1 #12	Passed

Comment

Correct level with associated calibrator is 113.9dB(A).

Observations

The details of the uncertainty for each measurement is available from the Calibration Laboratory on request and is based on the standard uncertainty multiplied by a coverage factor K=2, providing a level of confidence of approximately 95%. The uncertainty evaluation has been carried out in accordance with UKAS requirements. Details on the sources of corrections and their associated uncertainties that relate to this verification are contained the detailed test report accompanying this certificate.

APPENDIX 8.2

Noise Monitoring Data and Notes

Project Title: L Behan Aggregates		**Project Number: 20137776**	
Monitoring Location No.	N1	**Time & Date** (start of measurement):	06/11/2020 15:20
GPS Coordinates:		**Time & Date** (end of measurement):	06/11/2020 16:26
Calibration check (pre-measurement):	114.1 LAeq	**Calibration check** (post-measurement):	
Weather conditions (at commissioning & decommissioning & any evidence of throughout measurement)			
Wind (light/med/strong/km/h):	Light	Temperature (°C):	11°C
Rain:	None	Cloud (% cover):	20%
Ambient Noise Environment			
Dominant noise source(s):	N7 dual Carriageway to the North		
Other audible noise sources: Tonality, frequency of occurrence, description of noise (e.g. drone/whistle/hum/banging)	Local traffic passing on nearby Kilteel Rd.		
	Birdsong, activity in ajdacent dwellings (builders working on a house)		
	Dogs barking to South, aircraft overhead		
	Presumed quarry activity (pop) heard at 15:24.		
	Cow mooing to South.		
SLM file number (s):	#2		
Photographs:			

Project Title: L Behan Aggregates		**Project Number: 20137776**	
Monitoring Location No.	N1	**Time & Date** (start of measurement):	18/02/2021 12:21
GPS Coordinates:		**Time & Date** (end of measurement):	18/02/2021 13:26
Calibration check (pre-measurement):	114.3 LAeq	**Calibration check** (post-measurement):	
Weather conditions (at commissioning & decommissioning & any evidence of throughout measurement)			
Wind (light/med/strong/km/h):	Medium – remained below 5m/s.	Temperature (°C):	5°C
Rain:	Light drizzle after reading	Cloud (% cover):	100%
Ambient Noise Environment			
Dominant noise source(s):	N7 dual Carriageway to the North		
Other audible noise sources: Tonality, frequency of occurrence, description of noise (e.g. drone/whistle/hum/banging)	Excavator breaking rock on site heard at low levels due to North Westerly wind		
	Local traffic passing on nearby Kilteel Rd.		
	Birdsong, rustling hedges from light gusts of wind		
	Dogs barking to South, horse neigh to south		
	Activity in nearby dwellings to the south.		
SLM file number (s):	#2		
Photographs:			

APPENDIX 8.3

Vibration Monitoring Data

Date	Time	Location of Seismograph	Company	Air Overpressure dB(L)	Peak Particle Velocity (mm/sec)		
					Tran	Vert	Long
01/11/2019	09:56	East Boundary	Instantel	112.8	0.571	0.44	0.635
30/01/2019	11:23	East Boundary	Instantel	119.8	1.429	1.095	1.524
30/01/2019	11:23	West Boundary	Instantel	107	0.524	0.508	0.714
07/02/2019	11:51	East Boundary	Instantel	112.8	2.984	1.921	3.365
07/02/2019	11:51	West Boundary	Instantel	115.7	4.921	4.953	7.445
04/03/2019	10:45	East Boundary	Instantel	111.2	1.524	1.111	2.048
04/03/2019	10:44	West Boundary	Instantel	113.8	3.286	3.445	3.969
27/03/2019	11:19	East Boundary	Instantel	114	6.525	2.619	3.429
27/03/2019	11:19	West Boundary	Instantel	101	1.111	1.429	1.111
02/04/2019	11:43	East Boundary	Instantel	116.1	2.762	1.873	2.556
02/04/2019	11:43	West Boundary	Instantel	118.1	4.191	6.223	9.049
10/04/2019	09:21	East Boundary	Instantel	113.8	1.302	0.587	1.302
10/04/2019	11:11	East Boundary	Instantel	117.4	3.397	1.318	1.683
10/04/2019	09:21	West Boundary	Instantel	123.6	3.508	1.619	3.683
18/04/2019	10:38	East Boundary	Instantel	109.2	2.048	2.873	2.127
18/04/2019	10:38	West Boundary	Instantel	114.2	5.842	7.144	7.826
26/04/2019	10:31	East Boundary	Instantel	94	3.286	1.492	3
26/04/2019	10:31	West Boundary	Instantel	104.2	0.524	0.492	0.635
30/04/2019	10:45	East Boundary	Instantel	109.2	2.191	2.302	2.254
30/04/2019	10:45	West Boundary	Instantel	114.8	7.842	5.461	10.62
03/05/2019	09:15	East Boundary	Instantel	114.2	5.667	1.699	4.588
03/05/2019	09:15	West Boundary	Instantel	101	0.857	0.413	0.73
14/05/2019	10:36	East Boundary	Instantel	111.2	2.048	1.254	2
14/05/2019	10:36	West Boundary	Instantel	115	6.223	5.826	7.064
22/05/2019	09:38	East Boundary	Instantel	109.9	1.873	0.825	1.302
22/05/2019	09:38	West Boundary	Instantel	114	3.953	2.619	5.636
28/05/2019	10:58	East Boundary	Instantel	116.3	5.397	2.508	4.635
28/05/2019	10:58	West Boundary	Instantel	104.2	0.841	0.841	1.333
31/05/2019	12:46	East Boundary	Instantel	109.5	1.667	0.952	2
31/05/2019	12:46	West Boundary	Instantel	113.1	5.239	4.381	8.89
07/06/2019	10:07	East Boundary	Instantel	106.5	1.794	1.429	1.413
07/06/2019	10:06	West Boundary	Instantel	109.9	3.588	4.826	6.461
13/06/2019	10:12	East Boundary	Instantel	114.2	4.794	1.937	3.604
13/06/2019	10:12	West Boundary	Instantel	102.8	0.571	0.476	0.635

Date	Time	Location of Seismograph	Company	Air Overpressure dB(L)	Peak Particle Velocity (mm/sec)		
					Tran	Vert	Long
18/06/2019	12:54	East Boundary	Instantel	104.9	2.302	1.857	2.429
18/06/2019	12:54	West Boundary	Instantel	116.4	6.271	6.413	7.668
26/06/2019	10:16	East Boundary	Instantel	107.5	2.318	1.46	2.826
26/06/2019	12:04	East Boundary	Instantel	115.4	4.794	1.968	3.937
26/06/2019	10:16	West Boundary	Instantel	118.5	4.905	7.239	6.683
26/06/2019	12:04	West Boundary	Instantel	108.4	0.921	0.762	1.476
02/07/2019	10:44	East Boundary	Instantel	109.2	2.222	1.397	2.445
02/07/2019	10:43	West Boundary	Instantel	97.5	0.683	0.381	0.619
09/07/2019	12:17	East Boundary	Instantel	116.7	5.318	2.159	4.953
09/07/2019	12:16	West Boundary	Instantel	107.5	1.413	0.984	2.222
16/07/2019	10:48	East Boundary	Instantel	114.4	2.175	0.937	2.048
16/07/2019	10:48	West Boundary	Instantel	115.6	6.652	2.826	4.381
07/08/2019	13:27	East Boundary	Instantel	114.2	8.398	2.921	6.62
07/08/2019	13:27	West Boundary	Instantel	120	4.223	3.302	4.635
20/08/2019	12:00	East Boundary	Instantel	110.6	4.016	1.857	3.731
20/08/2019	11:59	West Boundary	Instantel	102.8	0.825	0.73	0.968
11/09/2019	12:03	East Boundary	Instantel	114.6	5.048	3.159	4.318
11/09/2019	12:04	East Boundary	Instantel	116.4	2.603	0.667	1.635
11/09/2019	12:03	West Boundary	Instantel	105.5	0.984	0.794	1.492
11/09/2019	12:03	West Boundary	Instantel	118.5	5.699	2.222	4.794
13/09/2019	10:12	East Boundary	Instantel	114.2	4.27	1.508	3.159
20/09/2019	12:27	West Boundary	Instantel	106.5	1.048	1	1.572
26/09/2019	11:50	East Boundary	Instantel	108.4	6.334	2.175	2.905
26/09/2019	11:50	West Boundary	Instantel	98.8	0.698	0.651	1.365
02/10/2019	11:20	East Boundary	Instantel	111.8	0.873	0.46	1.254
02/10/2019	11:20	West Boundary	Instantel	119	2.699	1.095	2.191
07/10/2019	14:40	East Boundary	Instantel	114	6.382	2.397	4.572
07/10/2019	14:40	West Boundary	Instantel	102.8	0.857	1.159	1.365
15/10/2019	13:18	East Boundary	Instantel	110.9	6.858	2.746	2.397
15/10/2019	13:17	West Boundary	Instantel	115.2	5.731	4.318	5.62
22/10/2019	12:28	East Boundary	Instantel	113.8	1.302	0.746	1.222
22/10/2019	10:28	West Boundary	Instantel	116.9	3.921	1.73	3.064
25/10/2019	11:55	East Boundary	Instantel	113.8	6.81	3.873	4.35
25/10/2019	11:52	West Boundary	Instantel	104.2	0.794	0.905	0.952

Date	Time	Location of Seismograph	Company	Air Overpressure dB(L)	Peak Particle Velocity (mm/sec)		
					Tran	Vert	Long
01/11/2019	09:56	West Boundary	Instantel	116.6	1.254	0.952	1.095
04/11/2019	11:03	West Boundary	Instantel	103.5	0.413	0.524	0.698
05/11/2019	12:03	East Boundary	Instantel	113.5	5.35	1.81	3.286
05/11/2019	12:03	West Boundary	Instantel	104.9	0.571	0.778	0.667
13/11/2019	10:11	West Boundary	Instantel	100	0.365	0.365	0.667
14/11/2019	11:04	East Boundary	Instantel	112.8	6.382	1.953	4.715
19/11/2019	10:21	East Boundary	Instantel	109.9	0.873	0.492	1.175
19/11/2019	10:21	West Boundary	Instantel	114.6	1.683	1.191	1.968
22/11/2019	12:36	East Boundary	Instantel	114.6	5.731	2.857	3.016
22/11/2019	12:36	West Boundary	Instantel	106	0.794	0.762	0.873
03/12/2019	13:21	East Boundary	Instantel	118.6	3.985	2.318	3.445
03/12/2019	13:20	West Boundary	Instantel	102.8	0.825	0.937	0.714
11/12/2019	12:12	East Boundary	Instantel	115	2.207	1.413	2.556
11/12/2019	12:12	West Boundary	Instantel	114.4	7.604	5.636	6.461
19/12/2019	11:37	East Boundary	Instantel	111.5	5.255	3.175	5.001
07/01/2020	13:34	East Boundary	Instantel	120.9	8.033	2.873	4.81
07/01/2020	13:33	West Boundary	Instantel	118.7	2.492	2.635	5.429
14/01/2020	13:06	East Boundary	Instantel	114.2	1.794	1.445	2.397
14/01/2020	13:06	West Boundary	Instantel	119.2	7.445	3.81	3.477
17/01/2020	12:14	East Boundary	Instantel	113.8	6.636	2.937	6.017
17/01/2020	12:14	West Boundary	Instantel	101.9	1.016	0.841	1
22/01/2020	10:40	East Boundary	Instantel	113.3	0.873	0.587	1.095
22/01/2020	10:40	West Boundary	Instantel	119.8	1.191	1.016	1.079
31/01/2020	11:45	East Boundary	Instantel	108	3.286	1.079	2.889
31/01/2020	07:59	West Boundary	Instantel	No events recorded			
07/02/2020	10:48	East Boundary	Instantel	108.4	2.016	1.095	1.635
07/02/2020	10:47	West Boundary	Instantel	112.8	2.794	2.413	3.048
12/02/2020	12:07	East Boundary	Instantel	114.8	4.588	1.651	3.254
12/02/2020	08:45	West Boundary	Instantel	No events recorded			
12/02/2020	08:45	West Boundary	Instantel	No events recorded			
18/02/2020	09:16	West Boundary	Instantel	No events recorded			
18/02/2020	09:16	West Boundary	Instantel	No events recorded			
20/02/2020	11:48	East Boundary	Instantel	119.3	5.747	1.699	4.286
20/02/2020	11:47	West Boundary	Instantel	111.5	0.889	0.635	1.016

Date	Time	Location of Seismograph	Company	Air Overpressure dB(L)	Peak Particle Velocity (mm/sec)		
					Tran	Vert	Long
25/02/2020	11:46	East Boundary	Instantel	114.2	1.206	1.238	1.953
25/02/2020	11:46	West Boundary	Instantel	117.6	2.667	2.54	3.429
28/02/2020	12:31	East Boundary	Instantel	118.1	4.334	1.476	2.683
05/03/2020	10:08	East Boundary	Instantel	109.9	0.698	0.492	1.032
05/03/2020	10:08	West Boundary	Instantel	111.5	2.159	0.889	1.651
11/03/2020	11:35	East Boundary	Instantel	108.4	3.794	1.699	3.048
11/03/2020	11:34	West Boundary	Instantel	98.8	0.635	0.635	1.143
19/03/2020	10:01	East Boundary	Instantel	112	1.667	1.048	1.746
19/03/2020	10:01	West Boundary	Instantel	124.8	3.683	1.651	4.953
23/03/2020	09:40	East Boundary	Instantel	116.7	2.064	1.397	2.937
23/03/2020	09:40	West Boundary	Instantel	101.9	0.889	0.635	0.889
10/04/2020	11:11	West Boundary	Instantel	108.8	0.619	0.571	0.667
03/06/2020	09:50	West Boundary	Instantel	121.1	2.41	1.78	6.6
11/06/2020	10:29	West Boundary	Instantel	116.6	1.65	0.889	1.9
17/06/2020	10:36	West Boundary	Instantel	88	2.54	2.03	3.05
23/06/2020	10:06	West Boundary	Instantel	114.6	2.03	1.78	2.67
26/06/2020	12:06	East Boundary	Instantel	97.5	1.476	0.952	1.524
26/06/2020	12:06	West Boundary	Instantel	119	3.937	1.778	3.937
03/07/2020	10:32	East Boundary	Instantel	98.8	1.937	0.746	1.159
03/07/2020	10:32	West Boundary	Instantel	121.6	6.477	3.429	5.842
08/07/2020	09:28	East Boundary	Instantel	91.5	0.762	0.683	1.333
08/07/2020	09:28	West Boundary	Instantel	111.8	1.651	1.016	1.905
13/07/2020	09:43	East Boundary	Instantel	103.5	1.524	0.714	1.254
13/07/2020	09:43	West Boundary	Instantel	116.9	1.778	1.397	2.286
16/07/2020	10:16	East Boundary	Instantel	94	1.778	1.079	1.889
16/07/2020	10:15	West Boundary	Instantel	114.2	1.905	1.524	2.667
22/07/2020	10:50	East Boundary	Instantel	113.5	1.508	0.635	0.873
22/07/2020	10:50	West Boundary	Instantel	117.1	1.143	1.27	2.54
28/07/2020	09:25	East Boundary	Instantel	115	1.175	0.714	1.143
28/07/2020	09:24	West Boundary	Instantel	120.1	1.397	1.778	2.286
04/08/2020	12:49	East Boundary	Instantel	111.8	0.556	0.381	0.429
04/08/2020	12:49	West Boundary	Instantel	111.8	0.762	0.508	0.635
10/08/2020	10:30	East Boundary	Instantel	106	1.302	0.46	1.143
10/08/2020	10:30	West Boundary	Instantel	113.3	2.159	1.27	2.413

Date	Time	Location of Seismograph	Company	Air Overpressure dB(L)	Peak Particle Velocity (mm/sec)		
					Tran	Vert	Long
18/08/2020	10:40	East Boundary	Instantel	118.3	2	1.556	2.969
18/08/2020	10:40	West Boundary	Instantel	107	0.635	0.508	0.762
25/08/2020	09:37	East Boundary	Instantel	115.9	1	0.381	0.81
25/08/2020	09:36	West Boundary	Instantel	113.8	1.397	1.143	1.778
02/09/2020	10:57	East Boundary	Instantel	112.8	0.651	0.476	0.698
02/09/2020	10:56	West Boundary	Instantel	112.8	1.143	1.016	1.143
08/09/2020	09:58	East Boundary	Instantel	104.9	2.222	1.603	2.826
08/09/2020	09:58	West Boundary	Instantel	104.2	2.667	2.667	2.286
16/09/2020	09:44	West Boundary	Instantel	103.5	0.762	1.016	0.889
19/09/2020	09:45	East Boundary	Instantel	114.6	2.302	1.46	2.349
20/09/2020	12:27	East Boundary	Instantel	115.4	4.985	2.349	4.985
22/09/2020	09:45	East Boundary	Instantel	109.2	0.81	0.317	0.571
22/09/2020	09:45	West Boundary	Instantel	117.2	1.397	0.762	1.778
29/09/2020	11:30	East Boundary	Instantel	107	3.477	1.603	3.572
29/09/2020	11:30	West Boundary	Instantel	115.2	3.302	3.81	5.334
04/10/2020	11:52	West Boundary	Instantel	108.8	3.683	4.318	5.08
05/10/2020	11:29	East Boundary	Instantel	109.5	1.46	0.794	1.349
05/10/2020	11:20	West Boundary	Instantel	113.3	3.175	3.302	6.477
14/10/2020	11:52	East Boundary	Instantel	105.5	2.3	2.3	3.6
16/10/2020	10:58	East Boundary	Instantel	109.5	1.2	1.0	1.7
16/10/2020	10:58	West Boundary	Instantel	114.8	4.2	3.8	4.6
20/10/2020	10:04	East Boundary	Instantel	105.5	1.9	1.2	2.4
20/10/2020	10:04	West Boundary	Instantel	115.9	5.1	5.3	7.4
27/10/2020	13:10	East Boundary	Instantel	107.5	1.8	1.3	2.3
27/10/2020	13:10	West Boundary	Instantel	110.9	2.8	5.1	3.9
03/11/2020	11:23	East Boundary	Instantel	108.8	2.9	1.8	3.0
03/11/2020	11:23	West Boundary	Instantel	116.6	6.5	6.7	8.3
Maximum Recorded				**124.8**	**8.4**	**7.2**	**10.6**
Average Recorded				**111.3**	**2.8**	**1.9**	**2.9**