Miller Goodall
Environmental Services

3 2014 0618P

NOISE ASSESSMENT

on behalf of

JJ HOMES NORTH WEST LIMITED

for the site at

LAND OFF CHATBURN OLD ROAD, CHATBURN, CLITHEROE

REPORT DATE: **23RD MAY 2014**

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Miller Goodall Environmental Services Ltd
214 Turton Road
Bradshaw
Bolton
Lancashire
BL2 3EE

Tel: 01204 596166

www.millergoodall.co.uk

Company registration number 5201673

Summary

A noise assessment was undertaken to predict the potential impact of a proposed residential development at Land off Chatburn Old Road, Chatburn, Clitheroe. This was requested by the Local Authority to support a revised planning application for the development. The proposed development site is in proximity to Lanehead Quarry and industrial works related to the quarry.

The previous layout of the development at this site was granted planning permission at appeal with a recommendation for any noise mitigation to be addressed at detailed application stage. The proposed layout of the residential development has changed slightly from the previous proposal and 3 houses are now closer to the quarry than previously. This report updates the previous noise impact assessment based on this revised layout.

Additional environmental noise measurements were undertaken to update the previous assessment. Noise measurements were made at the location of the nearest residential dwellings on the proposed site to identify the existing ambient and background noise levels with and without the quarry in operation. This data was subsequently used to predict the potential impact of noise from activities associated with the quarry and to assess whether any noise mitigation measures are required to the proposed development. A noise model has been assembled for the proposed development site, the results from which are provided within this report.

Vibration measurements and an assessment was undertaken as part of the previous planning application. This data has been reviewed and previous vibration monitoring is discussed. Additional vibration monitoring was not felt necessary and vibration mitigation has not been recommended.

With the implementation of these recommendations, it is considered that a suitable and commensurate level of protection against noise and vibration will be provided to the occupants of the proposed accommodation

Prepared By	Joanne Miller MIOA	Reviewed By	Lesley Goodall MIOA
Signed	J Miller	Signed	L Goodall
Date	23rd May 2014	Date	23rd May 2014

Record of changes

Version	Date	Change	Initials
1	23/05/14	Initial issue	JLM

Contents

1 Introduction

1.1 Miller Goodall Environmental Services Ltd (MGES) has, on behalf of JJ Homes North West Limited of Low Park Barn, Aveland Way, Haslakby, Sleaford, NJ34 0HF, undertaken a noise assessment in respect of the impact to a residential development of noise and vibration from Lanehead Quarry and additional industrial works, including an asphalt plant related to the quarry.

1.2 The new development is located on land off Chatburn Old Road. Planning permission was refused for ten dwellings on the land in 2012 (Appn. 3/2011/0025) due to the proximity of the development to adjacent mineral reserves and impact upon sterilisation of these reserves. This application was subsequently allowed at Appeal (Appeal Ref: APP/T2350/A/12/2176828).

1.3 Since the planning approval was granted the developer has revised the scheme and this results in three of the ten proposed dwellings being closer to the quarry than under the approved scheme. This noise assessment is in relation to a revised scheme for the site.

2 Site Description

2.1 The site is located towards the end of Chatburn Old Road, Clitheroe within the administrative boundary of Ribble Valley Borough Council (RVBC). It lies approximately 60 – 65 m from the edge of the Lanehead Quarry site and approximately 200 m from the workings at the base of the quarry. The application site covers an area of approximately 2.39 hectares and located in a hollow in the land and is accessed from Chatburn Old Road.

2.2 The site may be affected by the noise from the quarry and associated activities and as a result the local authority have requested a noise assessment to ascertain the impact and determine the need for further mitigation.

2.3 Figure 1 shows the location of the site along with the noise monitoring positions selected to assess the noise.

Figure 1: Measurement locations

3 Proposed Development

3.1 The revised site layout is provided in Appendix 1. The proposal is to revise the original plan and build 10 detached properties in a cul-de-sac arrangement off Chatburn Old Road. Three of the properties are located closer to the quarry than in the approved scheme.

3.2 The properties are to be constructed using traditional stone construction with dense internal blocks in the internal wall and faced with stone. The foundations are concrete strip foundations built directly off the bedrock, no piling is required.

4 Local Authority Requirements

4.1 A response from Ribble Valley Environmental Health to a pre-application application for noise stated:

The most recent proposal results in the development being closer to the quarry than that which was previously submitted and allowed at Appeal. On this basis, and considering previous concerns regarding the proximity of the quarry I stressed at our meeting that a current noise and vibration assessment/Environmental Appraisal is carried out and submitted as part of any subsequent *application. The results of which will be a material consideration in the determination of the application.*

4.2 MGES submitted a methodology request to James Russell, Head of Environmental Health Services, his response stated:

Your suggested approach appears appropriate, However, I confirm my suggestion that some supplementary noise monitoring may be advisable as both Hanson Cement and Tarmac are experiencing a recovery and Hanson in particular are working at more typical production levels, which was not the case 3 years ago when they were working alternate months.

I applaud and support your intended approach to model as 'worst case scenario' as this will very much be in both the interests of your client and eventual future occupiers of the properties. It will be appropriate to compare with WHO standards both internally & externally with a view to meeting the best category;

Noise attenuation be further considered in relation to achieve internal noise levels resulting from external noise exposure to at least meet the BS 8233 noise level criteria of 'Good'. (Equiv to NEC Cat A)

Outdoor amenity areas as suggested should be placed on the far side of buildings away from noise sources in addition, heavy duty close boarded acoustic fences should be used on those most at risk to reduce noise levels below 50dB in these areas;

Include mitigation for potential vibration from blasts to minimise intrusion and potential damage.

A Noise Management Plan should be provided before commencement of construction and suggestions were made of information to be included.

4.3 The previous application approved on appeal had only one condition applicable to noise as detailed below, there was no condition applied in relation to vibration.

Condition 7

Any application for the approval of reserved matters shall include details of noise attenuation measures to be incorporated into the design of the development. The measures so submitted and approved shall then be fully implemented prior to first occupation of the dwellings and thereafter retained in perpetuity.

5 Policy Context

5.1 Noise Policy Statement for England

5.1.1 The Noise Policy Statement for England (NPSE1), published in March 2010, sets out the long-term vision of Government noise policy. The Noise Policy aims, as presented in this document, are:

"Through the effective management and control of environmental, neighbour and neighbourhood noise within the context of Government policy on sustainable development:

- avoid significant adverse effects on health and quality of life;
- mitigate and minimise adverse effects on health and quality of life; and
- where possible, contribute to the improvement of health and quality of life."

5.1.2 The NPSE makes reference to the concepts of NOEL (No Observed Effect Level) and LOAEL (Lowest Observed Adverse Effect Level) as used in toxicology but applied to noise impacts. It also introduces the concept of SOAEL (Significant Observed Adverse Effect Level) which is described as the level above which significant adverse effects on health and the quality of life occur.

5.1.3 The first aim of the NPSE is to avoid significant adverse effects, taking into account the guiding principles of sustainable development (as referenced in Section 1.8 of the Statement). The second aim seeks to provide guidance on the situation that exists when the potential noise impact falls between the LOAEL and the SOAEL, in which case:

"...all reasonable steps should be taken to mitigate and minimise adverse effects on health and quality of life while also taking into account the guiding principles of sustainable development".

5.1.4 Importantly, the NPSE goes on to state:

"This does not mean that such adverse effects cannot occur".

5.1.5 The Statement does not provide a noise-based measure to define SOAEL, acknowledging that the SOAEL is likely to vary depending on the noise source, the receptor and the time in question. NPSE advises that:

"Not having specific SOAEL values in the NPSE provides the necessary policy flexibility until further evidence and suitable guidance is available"

5.1.6 It is therefore likely that other guidance will need to be referenced when applying objective standards for the assessment of noise, particularly in reference to the SOAEL, whilst also taking into account the specific circumstances of a proposed development.

[1] Noise Policy Statement for England, Defra, March 2010

5.2 National Planning Policy Framework

5.2.1 The National Planning Policy Framework (NPPF[2]) was published in March 2012. One of the documents that the NPPF replaces is Planning Policy Guidance Note 24 (PPG 24) "Planning and Noise"[3].

5.2.2 Paragraph 109 of the NPPF states that the planning system should contribute to and enhance the natural and local environment by, (amongst others) "preventing both new and existing development from contributing to or being put at unacceptable risk from, or being adversely affected by unacceptable levels of soil, water or noise pollution or land stability".

5.2.3 The NPPF goes on to state in Paragraph 123 "planning policies and decisions should aim to:

- Avoid noise from giving rise to significant adverse impacts on health and quality of life as a result of new development;
- Mitigate and reduce to a minimum other adverse impacts on health and quality of life arising from noise from new development, including thorough use of conditions;
- Recognise that development will often create some noise and existing businesses wanting to develop in continuance of their business should not have unreasonable restrictions put on them because of changes in nearby land use since they were established, and
- Identify and protect areas of tranquillity which have remained relatively undisturbed by noise and are prized for their recreational and amenity value".

5.2.4 The NPPF document does not refer to any other documents regarding noise other than NPSE.

5.3 Planning Practice Guidance – Minerals

5.3.1 Planning Policy Guidance for Minerals was issued in March 2014 and it advises that mineral planning authorities should take account of the prevailing acoustic environment and in doing so consider whether or not noise from the proposed operations would:

- give rise to a significant adverse effect;
- give rise to an adverse effect; and
- enable a good standard of amenity to be achieved.

5.3.2 In line with the Explanatory Note of the Noise Policy Statement for England, this would include identifying whether the overall effect of the noise exposure would be above or below the significant observed adverse effect level (SOAEL) and the lowest observed adverse effect level (LOAEL) for the given situation.

5.3.3 Appropriate noise standards for mineral operators for normal operations are described as follows within the PPG.

5.3.4 Subject to a maximum of 55dB(A)LAeq,1h (free field), mineral planning authorities should aim to establish a noise limit at the noise-sensitive property that does not exceed the background level by

[2] National Planning Policy Framework, DCLG, March 2012
[3] Planning Policy Guidance 24: Planning and Noise, DCLG, September 1994

more than 10dB(A). It is recognised, however, that in many circumstances it will be difficult to not exceed the background level by more than 10dB(A) without imposing unreasonable burdens on the mineral operator. In such cases, the limit set should be as near that level as practicable during normal working hours (0700-1900) and should not exceed 55dB(A) LAeq,1h (free field). Evening (1900-2200) limits should not exceed background level by more than 10dB (A) and night-time limits should not exceed 42dB(A) LAeq, 1h (free field) at noise-sensitive dwellings. Where tonal noise contributes significantly to the total site noise, it may be appropriate to set specific limits for this element. Peak or impulsive noise, which may include some reversing bleepers, may also require separate limits that are independent of background noise - e.g. Lmax in specific octave or third-octave bands - and should not be allowed to occur regularly at night.

5.3.5 All mineral operations will have some particularly noisy short-term activities that cannot meet the limits set for normal operations. Examples include soil-stripping, the construction and removal of baffle mounds, soil storage mounds and spoil heaps, construction of new permanent landforms and aspects of site road construction and maintenance. However, these activities can bring longer-term environmental benefits.

5.3.6 The PPG states that increased temporary daytime noise limits of up to 70dB(A) LAeq,1h (free field) for periods of up to 8 weeks in a year at specified noise-sensitive properties should be considered to facilitate essential site preparation and restoration work and construction of baffle mounds where it is clear that this will bring longer-term environmental benefits to the site or its environs. Where work is likely to take longer than 8 weeks, a lower limit over a longer period should be considered. In some wholly exceptional cases, where there is no viable alternative, a higher limit for a very limited period may be appropriate in order to attain the environmental benefits. Within this framework, the 70 dB(A) LAeq,1h (free field) limit referred to above should be regarded as the normal maximum.

6 Acoustic Standards and Guidance

6.1 Technical Guidance to the National Planning Policy Framework

6.1.1 The Technical Guidance to the National Planning Policy Framwork was published in 2012 when a number of planning guidance documents were replaced. The Technical Guide provides detailed advice on noise criteria for minerals workings in England. The document replaces the guidance on noise that was provided in Minerals Policy Statement 2: Annex 2, although the noise criteria are the same as those contained in MPS 2. The following criteria apply to quarries:

- Subject to a maximum of 55dB(A)$L_{Aeq,1h}$ (free field), mineral planning authorities should aim to establish a noise limit at the noise-sensitive property that does not exceed the background level by more than 10dB(A). It is recognised, however, that in many circumstances it will be difficult to not exceed the background level by more than 10dB(A) without imposing unreasonable burdens on the mineral operator. In such cases, the limit set should be as near that level as practicable during normal working hours (0700-1900) and should not exceed 55dB(A) $L_{Aeq,1h}$ (free field). Evening (1900-2200) limits should not exceed background level by more than 10dB (A) and night-time limits should not exceed 42dB(A) $L_{Aeq,\ 1h}$ (free field) at noise-sensitive dwellings. Where tonal noise contributes significantly to the total site noise, it may be appropriate to set specific limits for this element. Peak or impulsive noise, which may include some reversing bleepers, may also require separate limits that are independent of background noise - e.g. L_{max} in specific octave or third-octave bands - and should not be allowed to occur regularly at night.

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6.1.2 The NPPF document does not refer to any other documents regarding noise other than NPSE.

6.2 BS 8233:2014 Guidance on Sound Insulation and Noise Reduction for Buildings

6.2.1 BS 8233:1999[4] was superseded by BS 8233:2014[5], with the former code of practice replaced by a guidance document. The updated Standard provides recommended guideline values for internal noise levels within dwellings which are similar in scope to guideline values contained within the World Health Organisation (WHO) document, Guidelines for Community Noise (1999)[6]. These guideline noise levels are shown in Table 1, below.

Table 1: BS 8233: 2014 guideline indoor ambient noise levels for dwellings

Location	Activity	07:00 to 23:00	23:00 to 07:00
Living Room	Resting	35 dB $L_{Aeq,16hr}$	-
Dining room/area	Dining	40 dB $L_{Aeq,16hr}$	-
Bedroom	Sleeping (daytime resting)	35 dB $L_{Aeq,16hr}$	30 dB $L_{Aeq,8hr}$

[4]BS 8233:1999 Sound Insulation and Noise Reduction for Buildings – Code of Practice
[5]BS 8233:2014 Guidance on Sound Insulation and Noise Reduction for Buildings
[6] World Health Organisation Guidelines for Community Noise, 1999

6.2.2 BS 8233:2014 no longer provides recommendations in relation to maximum noise levels in residential bedrooms at night from individual noise events such as vehicle pass-by or aircraft movements. Instead, it advises that:

> *"regular individual noise events...can cause sleep disturbance. A guideline value may be set in terms of SEL[7] or $L_{Amax,F}$ depending on the character and number of events per night. Sporadic noise events could require separate values".*

6.2.3 BS 8233:2014 adopts guideline external noise values provided in WHO for external amenity areas such as gardens and patios. The Standard states that it is "desirable" that the external noise does not exceed 50 dB $L_{Aeq,T}$ with an upper guideline value of 55 dB $L_{Aeq,T}$ whilst recognising that development in higher noise areas such as urban areas or those close to the transport network may require a compromise between elevated noise levels and other factors that determine if development in such areas is warranted. In such circumstances, the development should be designed to achieve the lowest practicable noise levels in external amenity areas.

6.3 BS 4142: 1997 'Rating industrial noise affecting mixed residential and industrial areas'

6.3.1 BS 4142: 1997[8] provides guidance on the assessment of the likelihood of complaints relating to noise from industrial sources.

6.3.2 The standard presents a method of rating noise levels by comparing the noise level of the new source (the Rating Level) with that of the existing background noise level at the nearest noise sensitive receiver in the absence of the source (the Background Noise Level).

6.3.3 The Specific Noise Level - the noise level produced by the source in question at the assessment location - is determined and a +5 dB correction applied for any unusual acoustic features such as discreet tones, whines, hisses or impulsive character. The corrected Specific Noise Level is referred to as the Rating Level.

6.3.4 The Background Noise Level is arithmetically subtracted from the Rating Level to provide the BS 4142 Rating. A Rating of +10 dB or more indicates that complaints about noise are likely. A Rating of +5 dB is said to be of marginal significance. If the Rating Level is more than 10 dB below the measured Background Noise Level it is a positive indication that complaints are unlikely

6.4 World Health Organisation (WHO) Guidelines for Community Noise 1999

6.4.1 The WHO Guidelines 1999 recommends that to avoid sleep disturbance, indoor night-time guideline noise values of 30 dB L_{Aeq} for continuous noise and 45 dB L_{AFmax} for individual noise events should be applicable. It is to be noted that the WHO Night Noise Guidelines for Europe 2009[9] makes reference to research that indicates sleep disturbance from noise events at indoor levels as low as 42 dB L_{AFmax}.

[7] Sound exposure level or L_{AE}
[8] BS 4142:1997 Method for rating industrial noise affecting mixed residential and industrial areas
[9] WHO Night Noise Guidelines for Europe 2009

6.4.2 The WHO document recommends that steady, continuous noise levels should not exceed 55 dB L_{Aeq} on balconies, terraces and outdoor living areas. It goes on to state that to protect the majority of individuals from moderate annoyance, external noise levels should not exceed 50 dB L_{Aeq}.

6.5 BS.6472:2008 Evaluation of human exposure to vibration in buildings. Blast-induced vibration.

6.5.1 BS 6472-2 is a guide to the evaluation of human exposure to blast vibration in buildings. Although it states that it is the responsibility of the Mineral Planning Authority to set the limits as conditions, it produces a table (Table 1) which uses the term "maximum satisfactory magnitudes of vibration". It suggests that during the day, vibration levels within a peak particle velocity (PPV) of up to 6mm/s would be satisfactory, occasionally rising to 10 mm/s in specific situations. Different levels are suggested for outside working hours, for structures other than residential, and for when there are more than three blasts in a day.

6.5.2 It is important to realise that these values do not represent absolute maximums. BS6472-2 uses the term "satisfactory level" to refer to a level of Peak Particle Velocity which is not exceeded by more than 10% of the blasts.

6.6 Possible LOAEL and SOAEL Noise Standards

6.6.1 It is acknowledged that the NPSE and the Planning Practice Guidance both advise caution when attempting to set objective standards in relation to LOAEL and SOAEL that may be applicable to a new development.

6.6.2 That said, the guideline values for noise within the WHO documents are set at the level of the lowest adverse health effect (the critical health effect) and as such, the values could form the basis of the LOAEL as referenced in the NPSE and PPG. Targeting the WHO guidelines levels as the LOAEL should, therefore, provide a robust basis for assessment. No levels are provided within the WHO guidance that may be directly applicable to the SOAEL and any such threshold levels will, as indicated in the above guidance, vary depending on the specific circumstances of the development and the noise climate in which it is located.

6.6.3 With reference to noise from industrial sources assessed using BS 4142: 1997, it is considered that a Rating Level of 10 dB or more below the existing background noise level would equate to No Observed Effect Level (NOEL). Since a Rating Level equivalent to +10 dB above the existing background noise level provides a subjective response equivalent to "complaints likely", this could equate to the SOAEL. The LOAEL would therefore fall somewhere between these two limits and it is proposed that a Rating Level of 0 dB above the existing background noise level would be appropriate in this regard.

7 Noise Survey

7.1 Measurements of Existing Noise Sources

7.1.1 Noise measurements were undertaken in 2012 for the purposes of the planning appeal and more recently in 2014 at a location consistent with the latest proposed development in accordance with BS 7445-1: 2003[10] by Colin Foster and Joanne Miller of Miller Goodall Environmental Services Ltd. The noise levels from the 2012 survey have not been presented in this report but are kept on file for future reference.

7.1.2 The calibration of the sound level meter was checked before and after measurements with negligible deviation (<0.1 dB).

7.1.3 Vibration measurements were undertaken previously for the purposes of the planning appeal at one location on the site in accordance with BS 6472 Part 2: Blast Induced Vibration, 2008 : by Joanne Miller of Miller Goodall Environmental Services Ltd. Additional vibration monitoring results are also available within this assessment undertaken by the quarry operator.

7.1.4 Details of all the equipment used are shown in Table 2, below.

Table 2: Noise and vibration monitoring equipment

Equipment Description	Type Number	Manufacturer	Serial No.	Date Calibrated	Calibration Certification Number
Class 1 Integrating Real Time 1/3 Octave Sound Analyser	Type 2260	Brüel&Kjær	2467009	03/09/13	U14377
Microphone	Type 4189	Brüel&Kjær	2508884	03/09/13	U14377
Calibrator	Type 4231	Brüel&Kjær	2478249	03/09/13	U14375
Seismograph – Tri-axle sensor	V901	Vibrock	1025	06.03.2012	03121025

7.1.5 Specific, background and ambient noise monitoring was undertaken at the dates and times specified in 3 at locations shown in Figure 3, below.

[10]BS 7445-1: 2003 Description and measurement of environmental noise - Part 1:Guide to quantities and procedures

Table 3: Dates, times and weather conditions during noise measurements

Measurement Locations	Date	Time	Weather conditions
MP1 – 3	07/02/13	11:17 – 12:52	Fine, mostly clear skies, no wind, 10C
MP4	14/05/14	06:00 – 08:30	Fine, clear skies, no wind, 10C

7.1.6 The 2012 measurements were taken at times considered to be representative of the periods during which the proposed residential accommodation would be subject to the highest levels of ambient noise. The 2014 measurements were taken in the early morning to obtain information on the environmental noise levels before and after the quarry began work (approximately 06:30). Measurements were made under free-field conditions at a height of 1.5 m above the ground.

7.1.7 During both surveys, a number of verifying monitoring (VP) positions were taken at varying distances from the edge of the quarry face working towards the appeal site boundary. The purpose of these measurements was to assist with validation of the CadnaA computer noise model.

7.1.8 The noise sources within the vicinity of the measurement locations are summarised in Table 4, below:

Table 4: Description of noise sources affecting the site

Measurement Locations	Date of Survey	Noise Sources
MP1	07/02/2013	Bird song, some distant low frequency noise from quarry, road traffic from Crow Trees Brow, work ongoing on property on Crow Trees Brow.
MP2	07/02/2013	Bird song, road traffic from Crow Trees Brow and Chatburn village, work ongoing on property on Crow Trees Brow.
MP3	07/02/2013	Bird song, some distant low frequency noise from quarry, road traffic from Crow Trees Brow.
MP4	14/05/2014	6:00 - 6:30 - Distant road traffic, birdsong very prominent, some constant low frequency noise from distant factory barely audible 6:30 -8:30 - Distant road traffic, birdsong very prominent, some low frequency noise from distant factory barely audible, noise from haul trucks and diggers at quarry.

7.2 Monitoring Results

7.2.1 A summary of the broadband measurement data is provided in Table 5 below with full data in Appendix 2. All data are sound pressure levels in dB re 20 μPa.

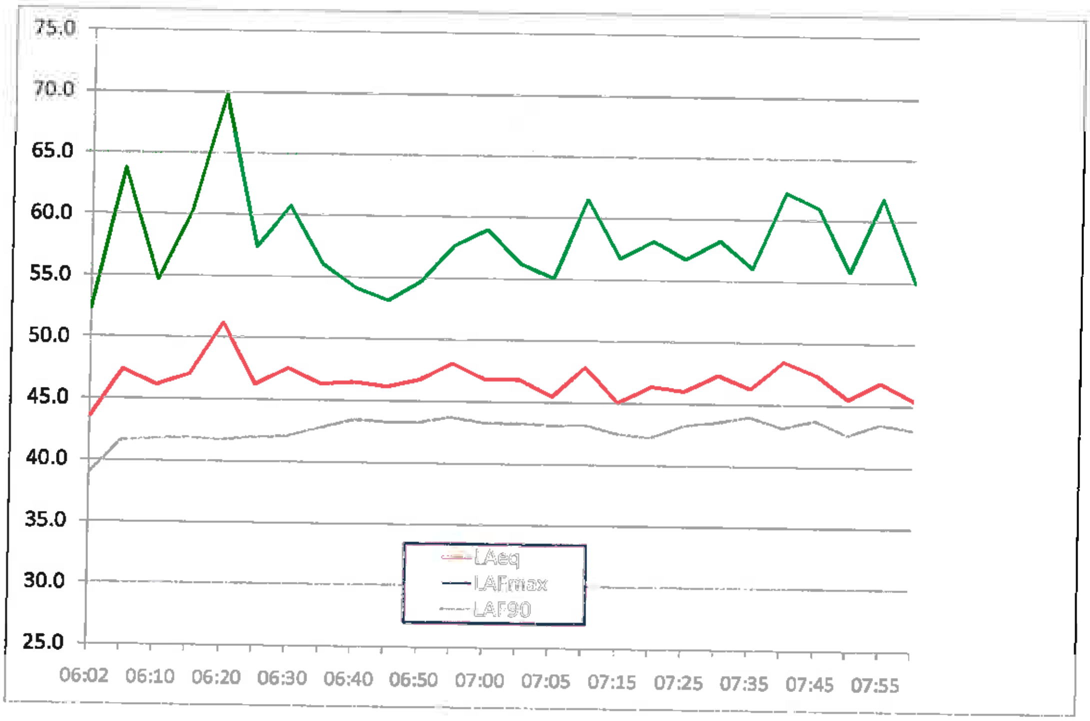
Table 5: Summary of noise measurements

Measurement Location	Date	Start Time	Elapsed Time (hr:min: sec)	Average $L_{Aeq,T}$ (dB)	Overall L_{AFmax} (dB)	Lowest $L_{AF90,T}$ (dB)
MP1	07/02/2013	11:17	2:00	42 (T=1min)	66	34 (T=1min)
MP2	07/02/2013	11:02	1:43	44 (T=1min)	71	36 (T=1min)
MP3	07/02/2013	12:52	1:00	44 (T=1min)	66	40 (T=1min)
MP4	14/05/2014	06:02	1:00	47 (T=5min)	70	42 (T=5min)
MP4	14/05/2014	07:03	1:00	47 (T=5min)	62	43 (T=5min)

7.2.2 The noise levels measured during both surveys are relatively low. It can be seen that the background and ambient noise levels measured at MP4 in 2014 are slightly higher than those measured at MP1, MP2 and MP3 in 2012 and it is considered that this is mostly due to reduced screening of quarry and distant traffic noise sources by the topography at MP4, where the ground is elevated in comparison to MP1, MP2 and MP3.

7.2.3 For the 2014 monitoring, each measurement period consisted of sequential 5 minute samples which therefore allowed the variation in noise level over time to be assessed. A time history of the 5 minute samples measured at MP4 during the 2014 survey is provided in Figure 2.

Figure 2: time history at location MP4 on 14th May 2014



7.2.4 In the period between 06:00 to 06:30 the only noise from the quarry works was a constant low frequency noise from the distant factory at very low levels, ocassionally audible above the low frequency traffic noise.

7.2.5 It was observed that a haul truck and digger commenced work in the quarry at around 06:30 and continued from this time until after the completion of the measurements at MP4 at around 08:00. Low frequency noise from the truck and digger were audible at the measurement position, albeit at a low noise level, from 06:30 onwards.

7.2.6 The dominant noise source throughout was considered to be birdsong at mid and high frequencies, and it is considered that this had the biggest influence on the broad-band L_{Aeq} noise levels, which were farily constant throughout. The slight rise in the L_{A90} at around 06:30 may be attributable to noise from the quarry workings which commenced around this time. However this difference is not significant and could also be a result of a general increase in distant road traffic noise during the early morning period.

7.2.7 Spectral data for the 2014 measurements is also provided in Appendix 2 and this provides a useful indication of the change in the character of noise levels before and after the haul truck and digger started operating. Whereas the overall broadband L_{Aeq} values remain failry consistent regardless of quarry operations, it can be seen that there is an increase in the low frequency (63 Hz – 250 Hz) L_{eq} component after 06:30, when the quarry began operating. This is consistent with the subjective impression of the engineer who unertook the measurements.

7.2.8 The 2014 survey data was subsequently analysed to determine a 'typical' L_{AFmax} and L_{Aeq} noise level and octave band spectrum. This source data is provided in Table 6 below and was subsequently utilised within noise impact assessment calculations.

Table 6: Octave band free-field external noise level spectra

	Measurement Descriptor	Sound Pressure Level, dB in Octave Band Centre Frequency, Hz								dB(A)
		63	125	250	500	1k	2k	4k	8k	
Based on external noise level measured at 06:15 on 14/5/14 (no quarry noise)	$L_{eq,5min}$	50	43	37	34	40	43	40	31	47
	L_{max}	60	52	43	47	49	58	55	47	61
Based on external noise level measured at 07:55 on 14/5/14 (quarry operational)	$L_{eq,5min}$	56	54	45	37	38	39	42	31	47
	L_{max}	64	66	55	49	43	50	61	47	63

8 Impact of Existing Noise Sources on the Development

8.1 Computer Modelling

8.1.1 Predictions of existing noise levels on the site specifically from the quarry have been undertaken using the CadnaA noise modelling package. Specific model parameters were applied as follows:

- Propagation of noise using algorithms within ISO 9613: 1993 *Acoustics - Attenuation of sound during propagation outdoors.*
- Default ground absorption G = 0.2 (equivalent to hard rock and some soft ground cover on the appeal site, consistent with the dominant ground cover at the site).
- Ground attenuation: spectral all sources
- No adverse meteorological effects
- Two orders of reflection
- Topographical data for site was taken from a number of sources:
  - Topographical data for Lanehead Quarry, Hanson, August 2012.
  - NextMap Britain 2 m contours
  - Topographical survey provided for Chatburn Old Road appeal site dated 8th August 2000.

8.2 Validation of the Noise Model

8.2.1 Noise level receptor points were incorporated into the CadnaA model at the noise survey measurement locations to calibrate the model using the measured octave band L_{eq} and L_{Fmax} noise levels. The modelled results agreed with the measured results to within around ± 1 dBL_{Aeq} and around ± 2 dBL_{AFmax}.

8.3 Noise Model Predictions

8.3.1 Noise modelling was undertaken to show the predicted levels based on the work being undertaken during the survey on 14th May 2014 and also based on a worst case scenario of work being undertaken at the east end of the quarry. The information on noise sources used to populate the model was obtained from BS 5228–1 2009, Code of practice for noise and vibration control on construction and open sites – Part 1: Noise. This included:

- 2 off 7-9 tonne large tracked face shovel, probably either Volvo or Komatsu, with a bucket capacity of about 4-5 cu.m. (noise data taken from BS5228 Table C.10 No. 1 tracked face shovel 37 tonne, 184kw) Sound Pressure Level, 80 dB L_{Aeq} at 10 m.

- 2 off rigid body dump trucks of probably 60 - 80 tonnes capacity. (Levels taken from Table C.9 No.23 of BS5228 – Rigid dump truck 60 tonnes). Sound Pressure Level, 85 dB LAeq at 10 m.

8.3.2 Screen shots from the CadnaA noise model are provided in Appendix 3 which clearly show the reduction in noise from the site as a result of the quarry face, being approximately 100 m below the height of the appeal site, providing a significant noise barrier.

8.3.3 A number of model runs were undertaken to identify the location within the quarry where works would result in the highest level of noise at the site. The modelling has shown that the worst case scenario in terms of working on site is work being undertaken at the east end of the quarry.

8.3.4 It can be seen that the noise levels at the proposed development are of a similar magnitude for both modelled situations (as observed on 14th May and at eastern end of the quarry) considered to the be the worst case for noise. It can therefore be stated that the noise levels measured during the 2014 survey are similar in level to a worst case scenario (excluding short term noise from blasting operations or other temporary intermittent work))

8.3.5 The screen shots also give an indication of the distribution of the noise across the whole of the development site and the screening effect which new houses would have on certain areas.

8.4 Minerals Policy Statement Assessment.

8.4.1 The MPS states that mineral planning authorities should aim to establish a noise limit at the noise-sensitive property that does not exceed the background level by more than 10dB(A). The assessment below shows the comparison between measured levels and the background level.

Measured noise level (including specific noise), taken as average L_{Aeq} of readings when quarry in operation	47
Background noise (L_{A90}) taken before 06:30 at MP1	42
Difference between Measured Noise and Background Noise Level:	**+5**

8.4.2 This assessment shows that even with a worst case scenario of the lowest background noise level plant and equipment working at the end of Chatburn Old Road, the level of noise (L_{Aeq}) is not 10 dB over the background noise.

8.5 Predicted Internal Noise Levels Assessed to BS 8233 Criteria

8.5.1 It is proposed that noise associated with the quarry operations is controlled to 30 dB L_{Aeq} in bedrooms at night (23:00 to 07:00) and 35 dB L_{Aeq} in habitable rooms during the day, in line with the internal noise criteria set down in BS 8233:2014. This criterion also corresponds to the 'good' levels advised in the superseded BS 8233:1999 (referred to by the Local Authority) for night-time noise and 'good' to 'reasonable' levels for daytime noise.

8.5.2 Based on the guidance set down in BS8233:1999 the proposed upper limit for individual noise events is an indoor level of 45 dB L_{AFmax}. This applies during the night time with respect to potential sleep disturbance.

8.5.3 The generally accepted rule of thumb is that a window left open for ventilation provides 10 - 15 dB attenuation from external noise sources with the WHO Guidelines for Community Noise suggesting 15 dB. The DEFRA report NANR116: Open/Closed Window Research[11] suggests the figure to be between 12 and 18 dB for road and rail traffic. Where external noise levels are more than around 15 dB higher than the internal noise targets, openable windows should not be relied upon as the sole means of ventilation and some form of acoustically attenuated ventilation may be required. This equates to an external noise level of 45 dB L_{Aeq} or higher during the night. The noise levels measured at the proposed development site on the morning of 14th May 2014 were typically between 45 and 50 dB L_{Aeq}.

8.5.4 In order to assess the potential glazing and ventilation requirements for the most affected of the proposed dwellings, noise ingress calculations were undertaken based on the methodology in BS EN 12354-3[12]. The following assumptions were made regarding the internal rooms:

- Assessed within rooms with an internal volume of 30 m^3
- 'Normal' internal surface finishes e.g. carpeted with curtains etc.
- Noise ingress through the roof and ceiling structure is at least 10dB less than that through the facade

8.5.5 The external noise levels used in the calculations have been taken from the actual levels measured 1.5 m above the ground during the 2014 survey, as given in Table 8. Modelling has identified that the noise levels associated with the quarry operations are of a very similar level at ground and first floor levels and consequently, it has been assumed that the levels measured during the survey are the same as would be experienced at first floor level of the proposed houses.

8.5.6 As discussed previously, noise from the quarry is low frequency in character and is not dominant at the measurement location. The measured levels include significant contributions from other noise sources, in particular birdsong and distant low levels of road traffic noise

8.5.7 The calculations consider two scenarios. The first is where opening windows provide all ventilation (window opening measuring 1 m x 0.1 m). The second scenario is where windows are closed and ventilation is provided by two standard non-acoustic trickle vents.

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[11] NANR116: 'Open/closed window research' Sound Insulation through ventilated open windows, Defra April 2007

[12] BS EN 12354-3:2000 Building acoustics. Estimation of acoustic performance in buildings from the performance of elements - Airborne sound insulation against outdoor sound

8.5.8 The results have been compared against the night-time criteria as the standards are more onerous than for daytime periods. Based on our understanding of operations, work begins at the quarry before 07:00 and therefore falls within a small part of the night time period.

8.5.9 A summary of the results is shown in Table 7, below. Full details of the noise ingress calculations, including the frequency data are provided in Appendix 2:

Table 7: Predicted internal noise levels

Description	External Noise Levels		Predicted Internal Noise Levels; Open Windows		Predicted Internal Noise Levels; Trickle vents and closed windows		BS 8233:1999 Criteria Night time	
	dB $L_{Aeq,5minr}$	dB L_{AFmax}	dB $L_{Aeq,5min}$	dB L_{AFmax}	dB $L_{Aeq,5min}$	dB L_{AFmax}	dB $L_{Aeq,8hr}$	dB L_{AFmax}
Based on external noise level measured at 06:15 on 14/5/14 (no quarry noise)	47	61	30	44	23	37	30	45
Based on external noise level measured at 07:55 on 14/5/14 (quarry operational)	47	63	30	46	23	36	30	45

8.5.10 The predicted internal noise levels summarised above include contributions from a number of sources (e.g. birdsong, distant traffic, and quarry) and are not solely attributable to noise associated with the quarry operations. It can be seen that the overall A-Weighted predicted internal noise levels are effectively the same before and after 06:30 when the haul truck and digger began operating. Notwithstanding this, inspection of the detailed calculation results given in Appendix 2 indicate that the low frequency component of the internal noise does increase when the quarry operations commence, even if the overall A-Weighted value does not.

8.5.11 It can be seen from inspection of the results that the internal noise levels are predicted to be at or marginally above the night time criteria in the situation where open windows are used as the only means of ventilation. If noise from the quarry were to increase above the levels measured, then the night time criteria is likely to be exceeded in bedrooms when the windows were open for ventilation, for the short period of the night-time when the quarry is in operation.

8.5.12 The calculations indicate that when trickle ventilators used and all windows are closed, then the internal noise levels are predicted to easily satisfy the most onerous night time criteria. The criteria are still likely to be met even if the noise from the quarry were to increase by 6 dB, which is considered an unlikely situation, particularly when the quarry noise levels are averaged over an 8 hr period between 23:00 to 07:00.

8.5.13 It is recommended that standard, non-acoustic trickle ventilators (with a minimum element normalised sound level difference of at least 29 dB $D_{ne,w}$ + C_{tr}) are provided to the most affected facades of the proposed development. This will allow background ventilation to be provided without having to rely on open windows which may cause internal noise levels to be marginally exceeded during the night time period.

8.5.14 For dwellings with habitable rooms facing away from the quarry or where shielding from other buildings is provided, opening windows may be feasible as the means of ventilation.

8.6 External Noise Levels

8.6.1 The predicted daytime noise levels across the open site are currently below 50 dB L_{Aeq} and as such would achieve the Local Authority's daytime noise criteria in external amenity spaces. Therefore no additional screening or noise barriers for gardens is necessary for acoustic reasons.

8.7 BS 4142: 1997 Assessment

8.7.1 The assessment set down in BS4142 is appropriate for determining, at the outside of a building, noise levels from industrial premises, or fixed installations and the background noise level. It also describes a method for assessing whether the noise in question is likely to give rise to complaints from persons living in the vicinity. The use of this guidance for moving plant as with the quarry is not generally accespted, however it is worth considering it for this assessment, since it provides a quantitative assessment for noise. Caution however must be stated on the value of this assessment for the moving machinery on the quarry site.

8.7.2 During the noise measurements it was clear that there was no difference between when the industrial processes at the quarry were in operation compared to no industrial activity, it was therefore not possible to measure the specific noise of the industrial site, and it was therefore not possible to undertake a full BS 4142 assessment from the measured results. Therefore rather than assessing the measured noise level from the quarry activity, which is the equivalent to the residual noise, consideration should be given to the predicted noise from the quarry, which at the closest location to the quarry is L_{Aeq} 40 dB.

Table 8: BS 4142 assessment for predicted noise from the quarry.

Description	Assessment at Position P1
Measured Background Noise Level (dB $L_{AF90,1hr}$)	42
Predicted Specific Noise Level	40
Acoustic feature correction*	+5
Rating Level	45
Excess of Rating Level over Background Noise Level	+3
Likelihood of complaints (to BS 4142)	"Complaints marginal"

* Acoustic feature correction applied due to low frequency nature and possible impact noise from loading trucks.

8.7.3 The assessment in Table 9 shows that there is a marginal likelihood of complaints, although it must be stated that this is a comparison with the quietest time of the day and the worst-case activity on the quarry.

9 Vibration

9.1 Introduction

9.1.1 When an explosion detonates it leads to borehole stress waves, leading to localised distortion and cracking. However outside the immediate vicinity of the blasting point permanent distortion does not occur, the blast leads to rapidly decaying stress waves causing the ground to move temporarily, this movement attenuates as a result of distance. The technology of blasting has resulted in accurate predictions being able to be made by site operators to ensure planning targets are not exceeded.

9.1.2 Human response to blast induced ground vibration is a relatively complex phenomenon and is dependent upon a range of factors, of which the magnitude of the blast is only one part. The human body is very sensitive to the onset of vibration and although this varies between individuals, a person will generally become aware of blast induced vibration at levels of around 1.5 mms^{-1} peak particle velocity (PPV) or even as low as 0.5 mm^{-1}, however there is clear evidence that this level of vibration is experienced daily within households as a result of everyday activity.

9.1.3 This level of perception of vibration is very much lower than the onset of even cosmetic damage such as plaster cracking which BS 7385-2:1993[13] states can typically occur at <12 mms^{-1} PPV.

9.1.4 Improvements in blasting techniques over recent years have assisted in reducing the significance of blasts. The "8 millisecond rule" has been applied for many years, on the assumption that adjacent holes which are detonated less than 8 ms apart could be considered as occurring simultaneously, thus increasing the actual Maximum Instantaneous Charge and therefore raising vibration levels. The levels of vibration will also depend on the blast design, the nature of the rock between blast and receptor, and the ground at the monitoring location. Improvements in software technology also allows for the prediction of PPV values of blasts taking into account the distance, previous monitored results and the maximum instantaneous charge.

9.2 Vibration Planning Condition

9.2.1 The Lanehead Quarry has planning permission with a vibration blasting level attached to it. Conditions 32 to 34 control the vibration levels, including details of the location and timing of monitoring and the vibration limit for all blasts, which is detailed in conditions 33 and 34 detailed below:

- The vibration from 95% of all blasts in any calendar month shall not exceed 6 mm/sec peak particle velocity in any plane at the properties identified in condition 32, measured at a point closest to the blast shotholes.
- Notwithstanding condition 33, the vibrations from blasting shall not exceed 9 mm/sec peak particle velocity in any plane.

[13] BS 7385-2:1993 Evaluation and measurement for vibration in buildings Part 2- Guide to damage levels from groundborne vibration

9.3 Vibration Monitoring

9.3.1 No additional measurements of blasting have been undertaken as a result of moving the site closer to the quarry because extensive blasting information has been previously analysed at the site for the worst case blasts, i.e. those at the closest point to the quarry.

9.3.2 Measurements of vibration were undertaken on 5th February 2013 at 1353 hours, in accordance with guidance provided in the Association of Noise Consultants (ANC) Guidelines "Measurement and Assessment of Groundborne Noise and Vibration" BS 6472-2[14]. Information was provided from the quarry of the date and time of the blast. No air overpressure measurements were taken.

9.3.3 Monitoring was undertaken simultaneously with Peter Clayton from Vibrock and Hanson Quarry. MGES undertook monitoring of the blast on the application site and monitoring was undertaken by Vibrock at a point in line with the MGES monitoring location at a point along Chatburn Old Road. Hanson was also monitoring the blast at the closest residential property on Chatburn Old Road.

9.3.4 The equipment used by MGES was a Vibrock V901, Serial No. 1025; Calibration is valid until 14th March 2013. Table 10 provides the details of the monitoring points and organisation undertaking the monitoring. The weather conditions were cold light easterly breeze 3 ms-1, snowing, temperature 00C.

9.3.5 Details of the blast were provided by Hanson Quarry and are provided in Table 9 and 10.

[14] BS 6472-2: 2008 Guide to evaluation of human exposure to vibration in Buildings – Part 2: Blast-induced vibration.

Table 9: Details of Blast on 5th February 2013

Date	5/02/3013
Time	13:53
No. of holes	37
Depth	10.5
Burden	4.5
Maximum Instantaneous Explosive Charge Weight	124kg
Total Explosive Charge Weight	3963

Table 10: Vibration monitoring locations 5th February 2013

	Monitoring point	Person Undertaking Monitoring	Grid reference
1	Monitoring on Development site	MGES – Joanne Miller and Matt Hopley	53°53'29.71"N 2°21'29.38"W
2	Monitoring on Chatburn Road Old in line with development site	Vibrock – Peter Clayton	53°53'31.85"N 2°21'30.22"W
3	Front garden of 9 Chatburn Old Road on patio.	Hanson's - Peter Owen	53°53'31.84"N 2°21'25.20"W

9.1 Results of Vibration Monitoring – 5th February 2013

9.1.1 Table 11 provides details of the monitoring results, a chart showing the results from the 3 axes is provided in Appendix 5.

Table 11: Vibration monitoring results for 5th February 2013

Monitoring point	Measurement Axis	Peak Particle Velocity (PPV) (mm^{-1})
1	Longitudinal	2.1
	Vertical	1.1
	Transverse	1.35
2	Longitudinal	2.02
	Vertical	1.37
	Transverse	1.85
3	Longitudinal	0.625
	Vertical	0.675
	Transverse	0.925

9.1.2 The results of the blasting at the appeal site on 5th February at 1353 showed a maximum PPV of 2.1 and 2.02 mms^{-1}. This result is well within the permitted limit of the quarry's planning condition of 95% of all blasts in any calendar month shall not exceed 6 mms^{-1} peak particle velocity in any plane. The development site monitoring location is approximately 190 m which is effectively the worst case scenario for vibration impacts on the site. The blast was located at approximately 90 m from the end of Chatburn Old Road, which demonstrates almost the worst case scenario for the site.

9.2 Results of previous blasting

9.2.1 Results of earlier vibration monitoring exercises are included in Appendix 6 and 7.

9.2.2 Some details have been provided of blasting monitoring undertaken on 27th November 2012 at 13:41 hours by the quarry operator. It appears from the results that the only test results which could have been taken along Chatburn Old Road, near the development site are those located between 290 and 340 m from the blast. These results show levels of between 0.5 and 1.2 mms^{-1}. As shown on Appendix 6 these levels are well below the limits within the planning condition limits and on the borders of perceptibility.

9.2.3 Appendix 7 shows a summary of blasting monitored in 2005 and shows a range of tests along Chatburn Old Road. Historical data shown in Appendix 7 shows levels in 2005 ranged from 1.2 to 2.0 mms^{-1} for Chatburn Old Road. As can be seen from the test results, the only measured result along Chatburn Old Road was measured at 2 mms^{-1}.

9.2.4 If a comparison is made between the results from the 5th February 2013 and 27th November 2012 for the results at 190 m from the blast site it can be seen that the results are 2.1 mms^{-1} and 1.5 mms^{-1} respectively. These results are fairly comparable, within 0.6 mms^{-1}.

9.2.5 It is clear that the level of vibration required for damage to occur is significantly higher than the human perception level, consequently when setting planning conditions MPAs often set levels below which damage will occur. However they may still be at a level where complaints could be received. For example in this case where the limit is 95% of all blasts not to exceed 6 mms-1. The critical level for complaints is likely to be lower than this.

9.2.6 Compliance with planning condition limits does mean that structural damage is very unlikely and, although cosmetic damage is possible, the significant issue is on the likelihood of complaints. Evidence has shown that complaints are likely to be received when vibrations reach 1.5 - 3 mm/s[15] and that people are more concerned about a few high level vibration events than a greater number of low vibrations[16].

9.2.7 The issue of vibration complaints was discussed in length at the planning appeal and in the past 6 years there have been 2 complaints of vibration, the details of the complainants location is unknown.

9.2.8 It would be difficult to justify nuisance complaints based on levels which are only just perceptible, which in this case they are. The measured results for vibration which were produced on the 27th November 2012 and on 5th February 2013 are well within the planning condition limit and on the borders of perceptibility. These levels would not lead to a sterilisation of future mining on the site, since the measurements are taken when the blasts are closest to the appeal site and consequently the worst case.

9.2.9 Bringing the site approximately 26 m closer to the quarry will effectively bring the closest house directly between the 240 and 290 m measurement positions shown in appendix 6, these show PPV levels between 1.3 and 2.5 mms^{-1} respectively. The properties are to be built with traditional dense block and stone off concrete strip foundations. The monitoring results show that moving the site this distance closer will make a significant difference to the level of vibration experienced by the properties and therefore we do not feel additional monitoring or vibration mitigation is required within the proposed dwellings. This issue was raised at appeal and no conditions for anti-vibration measures within the construction were required at this time.

[15] Rock, G.A. (1989) "The Environmental Noise Impact of a Large Quarry Extension", Proc. Inst. of Acoustics Meeting, "Noise from Drilling, Mining and Quarrying Operations", Bournemouth, April, 1989.
[16] Rawlinson, R.D. et al. (1986) "Noise from Surface Mineral Workings", Mine & Quarry, April 1986, pp26-28

10 Construction Noise and Dust

10.1 The Local Authority Environmental Health have requested that noise and dust from the construction be considered as part of the planning submission, as a result a Construction Phase Environmental Plan has been produced as is provided in Appendix 8.

11 Mitigation Measures

11.1 Building Envelope - Glazing and Ventilation

11.1.1 Table 12 below provides suggested glazing and ventilation specifications to be utilised within the development.

Table 12: Suggested glazing and ventilation specifications

Elevation	Minimum Required dB R_w+ C_{tr} of Glazing	Suggested Glazing Specification	Recommended Ventilation Solution
Habitable rooms facing the quarry on the closest elevation to the quarry (Plots 6 and 7)	27	4/12/4 lam double glazed unit	Acoustic trickle vents with min. rating of 29 dB $D_{ne,w}$
All other rooms, elevations and plots	43	Standard thermal double glazing	Not required

12 Conclusions

12.1 A noise and vibration assessment has been undertaken. The assessment shows that levels of noise are well within nationally recognised criteria usually used for assessing noise impacts for proposed residential dwellings. These criteria are well below the limit imposed in the planning condition of 55dB L_{Aeq}. The assessment also shows that the 'good' criteria for BS 8233 can also be achieved.

12.2 Our assessment is based on working at the closest location to the appeal site and therefore a worst case scenario. I am therefore confident that the quarry would not be sterilised for future working as a result of the development site, which is acoustically protected by virtue of the quarry face and natural topography the location.

12.3 The levels of vibration monitored on the site are just within the levels of perceptibility. The levels are well below the planning criteria of 6 mms^{-1} and consequently would not lead me to believe that the quarry would be sterilised from further development or that future residents will be impacted by the levels of vibration.

12.4 Mitigation measures with regards to glazing and ventilation for noise have been recommended, along with a noise and dust construction management plan. With the implementation of these recommendations, it is considered that a suitable and commensurate level of protection against noise and vibration will be provided to the occupants of the proposed accommodation.

Glossary of Terms

Decibel (dB) The unit used to quantify sound pressure levels; it is derived from the logarithm of the ratio between the value of a quantity and a reference value. It is used to describe the level of many different quantities. For sound pressure level the reference quantity is 20 μPa, the threshold of normal hearing is in the region of 0 dB, and 140 dB is the threshold of pain. A change of 1 dB is usually only perceptible under controlled conditions.

dBL_A Decibels measured on a sound level meter incorporating a frequency weighting (A weighting) which differentiates between sounds of different frequency (pitch) in a similar way to the human ear. Measurements in dB L_A broadly agree with an individual's assessment of loudness. A change of 3 dB L_A is the minimum perceptible under normal conditions, and a change of 10 dBL_A corresponds roughly to halving or doubling the loudness of a sound. The background noise level in a living room may be about 30 dBL_A; normal conversation about 60 dBL_A at 1 meter; heavy road traffic about 80 dBL_A at 10 meters; the level near a pneumatic drill about 100 dBL_A.

$L_{A90,T}$ The A weighted noise level exceeded for 90% of the specified measurement period (*T*). In BS 4142: 1997 it is used to define background noise level.

$L_{Aeq,T}$ The equivalent continuous sound level. The sound level of a notionally steady sound having the same energy as a fluctuating sound over a specified measurement period (*T*). $L_{Aeq,T}$ is used to describe many types of noise and can be measured directly with an integrating sound level meter.

L_{Amax} The highest A weighted noise level recorded during the time period. It is usually used to describe the highest noise level that occurred during the event.

NOEL No observed effect level: the level of noise exposure below which no effect at all on health or quality of life can be detected.

LOAEL Lowest observed adverse effect level: the level of noise exposure above which adverse effects on health or quality of life can be detected.

SOAEL Significant observed adverse effect level: the level of noise exposure above which significant adverse effects on health or quality of life can be detected.

R_w Single number rating used to describe the sound insulation of building elements and is defined in BSEN ISO 140-3: 1995. It is derived by measurement under laboratory conditions and does not take into account the effects of flanking transmissions.

$D_{nT,w}$ The weighted standardized level difference is a single figure rating used to describe the sound insulation of a construction separating two rooms, for example a wall or floor, and is defined in BSEN ISO 140-4: 1998. It is derived by measurement of an in-situ construction and therefore takes into account the effects of flanking transmissions, workmanship etc.

$D_{ne,w}$ The weighted element-normalized level difference is a single figure rating used to describe the sound insulation of small elements within a larger construction and is defined in BSEN ISO 140-10: 1991. It is most often used to rate the sound insulation performance of ventilator units e.g. trickle vents.

C_{tr} A spectrum adaptation term used to characterise the sound insulation rating with respect to urban traffic.

Appendix 1: Site Plan

Appendix 2:Measurement Data

Table A1: Environmental Noise Measurements at MP1, 7 Feb 2012

Description	Start Time	Elapsed Time (min:sec)	L_{Aeq} (dB)	L_{AFmax} (dB)	L_{AF90} (dB)
Position MP1 7 Feb 2012	11:17:34	0:02:26	41.3	51.4	37.9
	11:20:00	0:05:00	40.0	53.2	36.9
	11:25:00	0:05:00	37.6	50.0	33.7
	11:30:00	0:05:00	38.7	50.0	35.3
	11:35:00	0:05:00	41.2	56.6	35.7
	11:40:00	0:05:00	41.7	56.4	34.9
	11:45:00	0:05:00	40.8	55.3	35.2
	11:50:00	0:05:00	39.2	56.6	35.4
	11:55:00	0:05:00	38.4	51.7	35.2
	12:00:00	0:05:00	38.5	57.3	35.7
	12:05:00	0:05:00	49.5	65.5	34.8
	12:10:00	0:05:00	41.4	56.9	36.7
	12:15:00	0:02:34	39.5	51.1	34.8
	12:19:35	0:00:25	39.3	50.9	34.3
	12:20:00	0:05:00	48.1	65.8	36.2
	12:25:00	0:05:00	42.8	63.0	34.8
	12:30:00	0:05:00	38.5	54.3	34.2
	12:35:00	0:05:00	39.8	46.3	34.6
	12:40:00	0:05:00	38.1	50.0	35.8
	12:45:00	0:05:00	43.9	59.1	35.4
	12:50:00	0:05:00	43.6	58.4	36.1
	12:55:00	0:05:00	40.7	51.7	35.8
	13:00:00	0:05:00	40.7	58.6	35.4
	13:05:00	0:05:00	39.3	53.7	35.0
	13:10:00	0:05:00	42.5	55.9	35.6
	13:15:00	0:04:35	39.0	52.5	36.1

Table A2: Environmental Noise Measurements at MP2, 7 Feb 2012

Description	Start Time	Elapsed Time (min:sec)	L_{Aeq} (dB)	L_{AFmax} (dB)	L_{AF90} (dB)
Position MP2 7 Feb 2012	11:02:24	00:02:36	63.1	45.1	37.1
	11:05:00	00:05:00	54.4	41.2	37.9
	11:10:00	00:05:00	58.9	45.0	38.9
	11:15:00	00:05:00	57.9	44.5	36.1
	11:20:00	00:05:00	53.7	38.3	36.0
	11:25:00	00:05:00	53.9	39.0	36.5
	11:30:00	00:05:00	45.0	37.6	35.5
	11:35:00	00:05:00	56.2	39.8	36.7
	11:40:00	00:05:00	62.0	40.8	36.7
	11:45:00	00:05:00	54.1	40.1	36.8
	11:50:00	00:05:00	59.0	44.8	37.7
	11:55:00	00:05:00	59.4	40.4	35.7
	12:00:00	00:04:12	64.7	48.8	37.5
	12:05:00	00:05:00	45.5	38.1	36.2
	12:10:00	00:05:00	51.8	38.9	36.4
	12:15:00	00:05:00	62.2	41.0	36.8
	12:20:00	00:05:00	65.7	45.1	36.1
	12:25:00	00:05:00	55.0	41.4	37.9
	12:30:00	00:05:00	58.3	45.4	37.7
	12:35:00	00:05:00	60.4	45.0	37.1
	12:40:00	00:05:00	70.7	50.0	38.2
	12:45:00	00:02:29	58.5	43.1	39.4

Table A3: Environmental Noise Measurements at MP3, 7 Feb 2012

Description	Start Time	Elapsed Time (min:sec)	L_{Aeq} (dB)	L_{AFmax} (dB)	L_{AF90} (dB)
Position MP3 7 Feb 2012	12:52:35	00:02:25	65.8	45.2	41.3
	12:55:00	00:05:00	52.9	42.2	39.5
	13:00:00	00:05:00	55.2	44.1	40.1
	13:05:00	00:05:00	54.2	42.8	39.9
	13:10:00	00:05:00	57.4	44.3	40.8
	13:15:00	00:05:00	64.6	43.3	40.4
	13:20:00	00:05:00	49.4	42.1	40.1
	13:25:00	00:05:00	50.6	42.8	40.3
	13:30:00	00:05:00	49.3	43.5	40.8
	13:35:00	00:05:00	51.9	44.2	40.2
	13:40:00	00:05:00	50.2	42.1	40.1
	13:45:00	00:05:00	54.0	44.9	42.8
	13:50:00	00:02:35	50.8	44.5	42.8

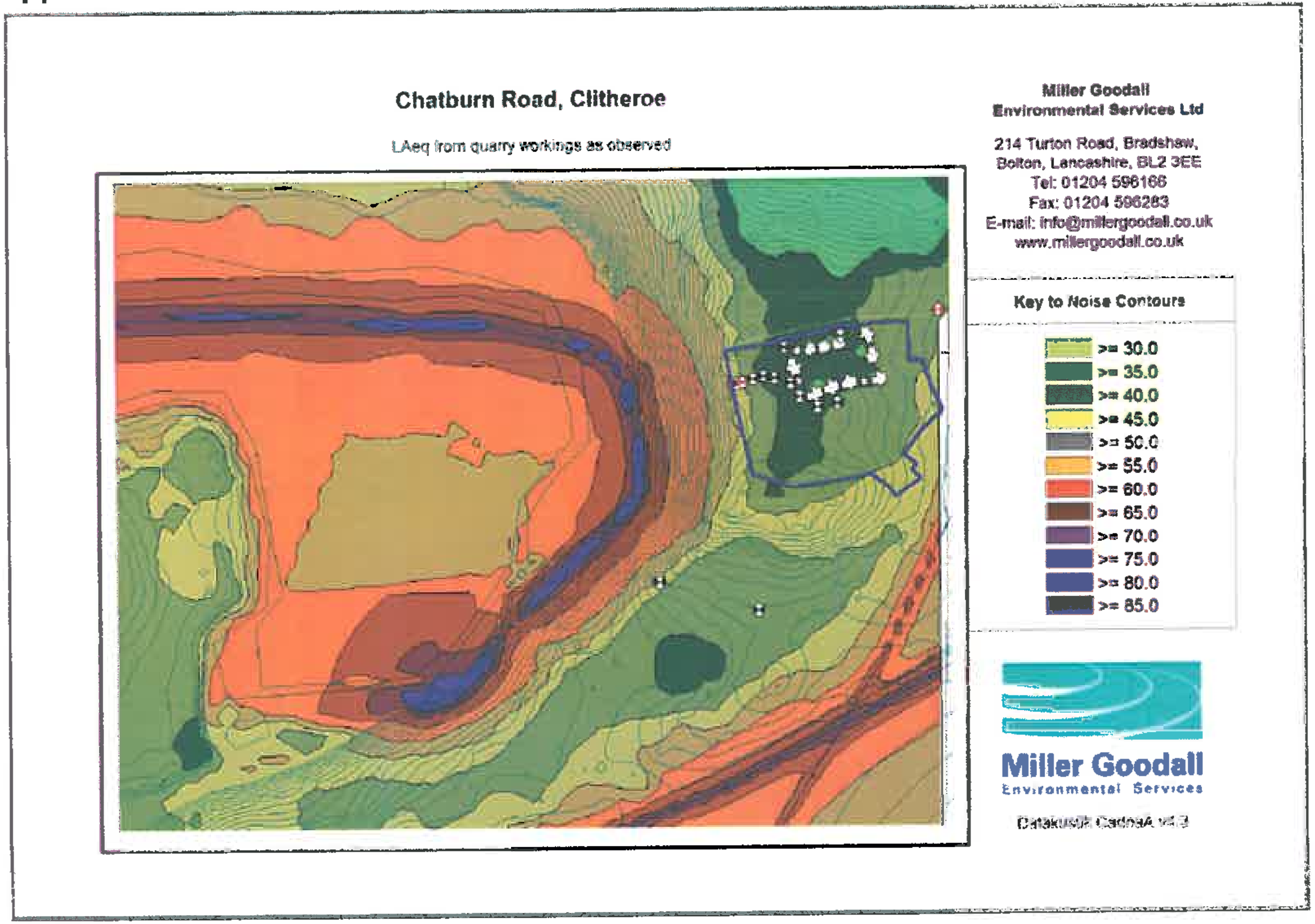
Table A4: Environmental Noise Measurements at MP4, 14 May 2014

Description	Start Time	Elapsed Time (min:sec)	L_{Aeq} (dB)	L_{AFmax} (dB)	L_{AF90} (dB)
Position MP4 14 May 2014	06:02:40	0:02:20	43.5	52.3	38.8
	06:05:00	0:05:00	47.4	63.8	41.6
	06:10:00	0:05:00	46.2	54.7	41.8
	06:15:00	0:05:00	47.0	60.3	41.9
	06:20:00	0:05:00	51.2	69.9	41.7
	06:25:00	0:05:00	46.2	57.4	41.9
	06:30:00	0:05:00	47.6	60.8	42.0
	06:35:00	0:05:00	46.4	56.1	42.7
	06:40:00	0:05:00	46.6	54.2	43.4
	06:45:00	0:05:00	46.2	53.2	43.2
	06:50:00	0:05:00	46.8	54.8	43.3
	06:55:00	0:05:00	48.2	57.7	43.8
	07:00:00	0:02:40	46.9	59.1	43.2
	07:03:02	0:01:58	46.9	56.3	43.3
	07:05:00	0:05:00	45.5	55.1	43.1
	07:10:00	0:05:00	48.0	61.6	43.2
	07:15:00	0:05:00	45.1	56.8	42.5
	07:20:00	0:05:00	46.4	58.3	42.2
	07:25:00	0:05:00	46.1	56.8	43.2
	07:30:00	0:05:00	47.5	58.3	43.6
	07:35:00	0:05:00	46.4	56.1	43.9
	07:40:00	0:05:00	48.6	62.3	43.1
	07:45:00	0:05:00	47.6	61.1	43.7
	07:50:00	0:05:00	45.6	55.9	42.6
	07:55:00	0:05:00	46.9	61.9	43.5
	08:00:00	0:03:02	45.5	54.9	43.0

Table A5: Environmental Spectral Noise Measurements at MP4, 14 May 2014

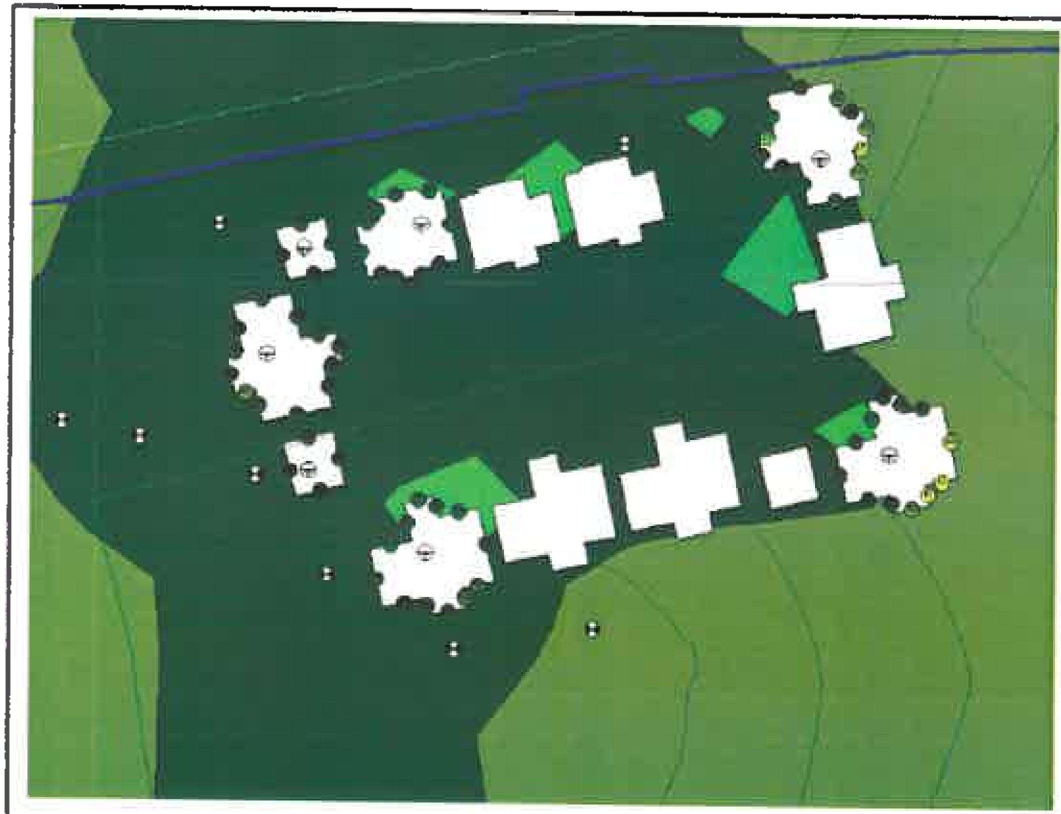
Start Time	Elapsed Time (min: sec)	Sound pressure level (dB L_{Aeq}) in octave band with centre frequency								L_{Aeq} (dB)
		63 Hz	125 Hz	250 Hz	500 Hz	1 kHz	2 kHz	4 kHz	8 kHz	
06:02:40	0:02:20	48.0	40.4	35.4	31.4	36.5	38.3	37.5	26.5	43.5
06:05:00	0:05:00	49.5	43.6	39.9	36.5	41.8	41.9	40.3	34.7	47.4
06:10:00	0:05:00	50.8	43.6	40.6	37.3	41.0	38.9	40.1	30.2	46.2
06:15:00	0:05:00	49.5	43.2	36.8	33.8	39.9	42.6	40.2	30.9	47.0
06:20:00	0:05:00	52.5	45.3	40.3	35.9	40.9	48.4	42.8	32.3	51.2
06:25:00	0:05:00	52.2	46.7	41.8	39.4	41.5	40.6	36.1	27.6	46.2
06:30:00	0:05:00	52.4	47.7	42.2	36.3	41.7	42.2	40.6	28.4	47.6
06:35:00	0:05:00	53.0	48.5	43.4	37.4	41.9	38.7	39.3	26.0	46.4
06:40:00	0:05:00	53.0	48.3	42.8	36.1	41.2	39.4	40.5	26.5	46.6
06:45:00	0:05:00	53.5	48.7	42.9	36.8	41.3	38.9	39.3	28.7	46.2
06:50:00	0:05:00	53.7	49.5	43.8	37.3	42.0	39.4	39.6	29.7	46.8
06:55:00	0:05:00	52.9	48.6	43.4	35.6	40.6	42.9	42.2	27.3	48.2
07:00:00	0:02:40	53.9	52.4	46.2	37.0	40.7	39.1	40.2	30.2	46.9
07:03:02	0:01:58	55.0	54.7	44.0	36.4	40.3	38.5	41.2	27.6	46.9
07:05:00	0:05:00	56.1	54.0	44.8	36.2	40.1	38.5	35.2	21.8	45.5
07:10:00	0:05:00	54.9	51.1	44.5	36.9	40.0	39.9	43.6	30.7	48.0
07:15:00	0:05:00	55.6	51.2	44.6	36.5	39.9	37.7	36.4	26.1	45.1
07:20:00	0:05:00	55.1	54.5	44.1	36.3	38.3	38.9	40.8	27.2	46.4
07:25:00	0:05:00	56.6	55.6	45.9	35.8	37.6	38.4	39.4	30.0	46.1
07:30:00	0:05:00	56.9	54.5	45.8	36.5	38.5	40.3	41.8	30.2	47.5
07:35:00	0:05:00	56.5	55.8	45.8	36.8	39.6	38.6	38.4	26.8	46.4
07:40:00	0:05:00	57.0	52.9	46.3	37.6	39.5	41.4	43.3	34.3	48.6
07:45:00	0:05:00	57.7	54.7	45.5	36.1	38.3	39.9	42.3	30.7	47.6
07:50:00	0:05:00	56.0	54.0	45.9	36.5	37.9	37.6	38.4	26.8	45.6
07:55:00	0:05:00	56.4	53.9	45.5	36.9	38.0	39.0	41.9	30.5	46.9
08:00:00	0:03:02	56.0	54.6	45.3	36.2	38.2	37.2	38.7	26.3	45.5

Appendix 3: CadnaA screenshots.



Chatburn Road, Clitheroe

LAeq from quarry workings as observed



Miller Goodall Environmental Services Ltd

214 Turton Road, Bradshaw, Bolton, Lancashire, BL2 3EE
Tel: 01204 596166
Fax: 01204 596283
E-mail: info@millergoodall.co.uk
www.millergoodall.co.uk

Key to Noise Contours

- >= 30.0
- >= 35.0
- >= 40.0
- >= 45.0
- >= 50.0
- >= 55.0
- >= 60.0
- >= 65.0
- >= 70.0
- >= 75.0
- >= 80.0
- >= 85.0

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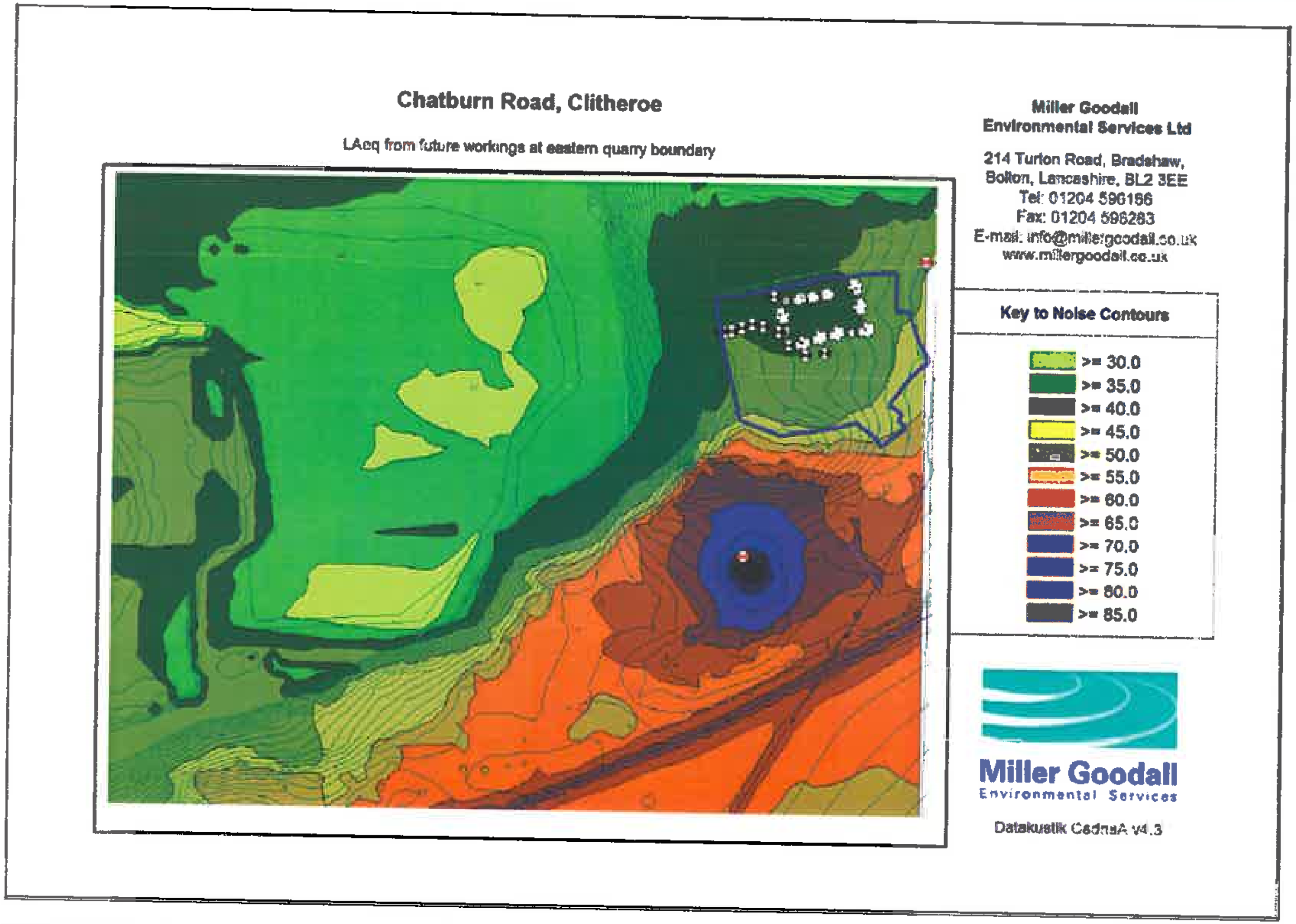
Chatburn Road, Clitheroe
LAeq from future workings at eastern quarry boundary
Miller Goodall
Environmental Services Ltd
214 Turton Road, Bradshaw,
Bolton, Lancashire, BL2 3EE
Tel: 01204 596166
Fax: 01204 596283
E-mail: info@millergoodall.co.uk
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>= 60.0
>= 65.0
>= 70.0
>= 75.0
>= 80.0
>= 85.0
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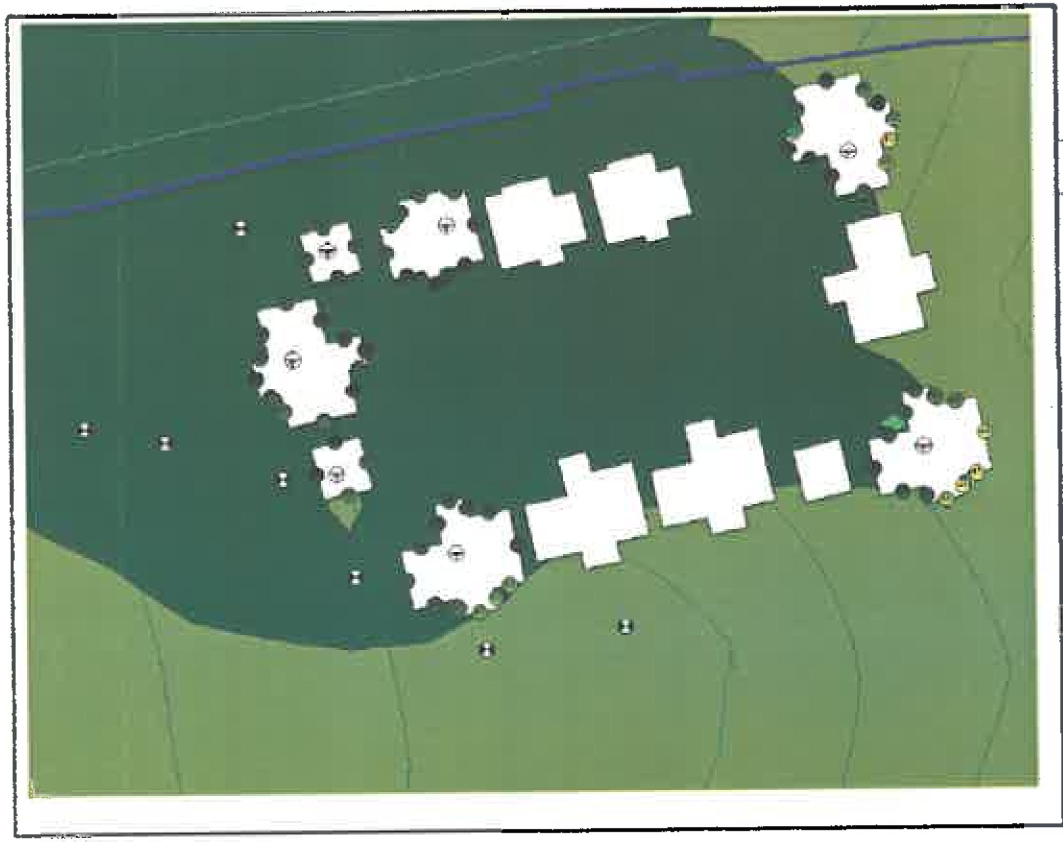
LAeq from future workings at eastern quarry boundary



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Tel: 01204 596166
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- >= 80.0
- >= 85.0

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Appendix 4: Noise Ingress Calculations

Miller Goodall Environmental Services: Noise Ingress Calculation

Project:	Chatburn Old Road	**Calcs By:**	CF
Description:	External noise level measured at 06:15 on 14/5/14 Open Windows	**Date:**	20/05/2014

Calculation is based on methodology within BS 8233:2014 & BSEN ISO 12354-3. The following equation is utilised:

$$L_{internal} = L_{external} - \Sigma R + 10 \log S/A + 3$$

where A = 0.16V/T

This can be broken down further to:

$$L_{eq,2} = L_{eq,ff} + 10x\log((A_0/Sx10\wedge(-D_{n,e}/10)) + (S_{wi}/Sx10\wedge(-R_{wi}/10)) + (S_{ew}/Sx10\wedge(-R_{ew}/10)) + (Sow/Sx10\wedge(-R_{rr}/10))) + 10x\log(S/A) + 3$$

The above terms are described below.

Description	Term	Value	
Total facade area (m2)	S_f	7.5	Room assessed: Bedroom, 3.0 m wide x 4.0 m deep x 2.5 m high
Window area (m2)	S_{wi}	1.5	
External wall area (Sf - Swi)	S_{ew}	6	
Area of open window (m2)	S_{ow}	0.1	Assume open area of window measures 1 m x 0.1 m
Total area of elements (Sf + Srr)	S	7.6	
Volume of receiving room (m3)	V	30	
Reference absorption area (m2)	A_0	10	
Number of ventilators in facade:		0	

Octave band centre frequency, Hz

	63	125	250	500	1k	2k	4k	8k	dBA	Rw	Ctr	Rw+ Ctr	Notes
External Leq, freefield (dB Leq,ff)	50	43	37	34	40	43	40	31	47				Freefield night-time level
External Lmax, freefield (dB Lmax,ff)	60	52	43	47	49	58	55	47	61				95th% Freefield night-time level
Dne of each ventilator	0	0	0	0	0	0	0	0		1	-1	0	
Total Dne of all ventilators	####	####	####	####	####	####	####	####		#####	######	######	
SRI of window (Rwi)	18	24	20	25	35	38	35	35		31	-4	27	4/12/4 glazing
SRI of external wall (Rew)	35	37	42	52	60	63	68	69		54	-6	48	Double leaf 112 mm brickwork, 50 mm cavity, rigid wall ties
SRI of open window (Row)	0	0	0	0	0	0	0	0		1	-1	0	
Rev time of receiving room (T) - secs	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5					Habitable room ref Part E
All ventilators [eqn. B]	####	####	####	####	####	####	####	####					A0/S x 10^(-Dne/10)
Glazing [eqn. C]	0	0	0	0	0	0	0	0					Swi/S x 10^(-Rwi/10)
External wall [eqn. D]	0	0	0	0	0	0	0	0					Sew/S x 10^(-Rew/10)
Ceiling [eqn. E]	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01					Sow/S x 10^(-Row/10)
All ventilators [10 x log "B"]	####	####	####	####	####	####	####	####					
Glazing [10 x log "C"]	-25.0	-31.0	-27.0	-32.0	-42.0	-45.0	-42.0	-42.0					
External wall [10 x log "D"]	-36.0	-38.0	-43.0	-53.0	-61.0	-64.0	-69.0	-69.0					
Open window [10 x log "E"]	-18.8	-18.8	-18.8	-18.8	-18.8	-18.8	-18.8	-18.8					
All elements combined [eqn. F]	-17.8	-18.5	-18.2	-18.6	-18.8	-18.8	-18.8	-18.8					Log sum of equations B,C,D,E
Equiv. absorption area of rec. room (m^2)	10	10	10	10	10	10	10	10					
10 x log(S/A) [eqn. G]	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0					

	63	125	250	500	1k	2k	4k	8k	dBA	Target	Exc.	
Internal Leq,2	34	27	21	17	23	26	23	14	30	30	0	Equations (A+F+G) +3 dB
Internal Lmax,2	44	35	27	30	32	41	38	30	44	45	-1	Equations (A+F+G) +3 dB

Miller Goodall Environmental Services: Noise Ingress Calculation

Project:	Chatburn Old Road	**Calcs By:**	CF
Description:	External noise level measured at 07:55 on 14/5/14	**Date:**	20/05/2014
	Open Windows		

Calculation is based on methodology within BS 8233:2014 & BSEN ISO 12354-3. The following equation is utilised:

$$L_{internal} = L_{external} - \Sigma R + 10 \log S/A + 3$$

where A = 0.16V/T

This can be broken down further to:

$L_{eq,2} = L_{eq,ff} + 10\log((A_0/S \times 10^{(-D_{n,e}/10)}) + (S_{wi}/S \times 10^{(-R_{wi}/10)}) + (S_{ew}/S \times 10^{(-R_{ew}/10)}) + (S_{ow}/S \times 10^{(-R_{ri}/10)})) + 10\log(S/A) + 3$

The above terms are described below.

Description	Term	Value	
Total facade area (m2)	S_f	7.5	Room assessed: Bedroom, 3.0 m wide x 4.0 m deep x 2.5 m high
Window area (m2)	S_{wi}	1.5	
External wall area (Sf - Swi)	S_{ew}	6	
Area of open window (m2)	S_{ow}	0.1	Assume open area of window measures 1 m x 0.1 m
Total area of elements (Sf + Srr)	S	7.6	
Volume of receiving room (m3)	V	30	
Reference absorption area (m2)	A_0	10	
Number of ventilators in facade:		0	

Octave band centre frequency, Hz

	63	125	250	500	1k	2k	4k	8k	dBA	Rw	Ctr	Rw+ Ctr	Notes
External Leq, freefield (dB Leq,ff)	56	54	45	37	38	39	42	31	47	-	-	-	Freefield night-time level
External Lmax, freefield (dB Lmax,ff)	64	66	55	49	43	50	61	47	63	-	-	-	95th% Freefield night-time level
Dne of each ventilator	0	0	0	0	0	0	0	0		1	-1	0	
Total Dne of all ventilators	####	####	####	####	####	####	####	####		#####	######	######	
SRI of window (Rwi)	[illegible]	24	20	25	35	38	35	35		31	-4	27	4/12/4 glazing
SRI of external wall (Rew)	35	37	42	52	60	63	68	68		54	-6	48	Double leaf 112 mm brickwork, 50 mm cavity, rigid wall ties
SRI of open window (Row)	0	0	0	0	0	0	0	0		1	-1	0	
Rev time of receiving room (T) - secs	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5					Habitable room ref Part E
All ventilators [eqn. B]	####	####	####	####	####	####	####	####					A0/S x 10^(-Dne/10)
Glazing [eqn. C]	0	0	0	0	0	0	0	0					Swi/S x 10^(-Rwi/10)
External wall [eqn. D]	0	0	0	0	0	0	0	0					Sew/S x 10^(-Rew/10)
Ceiling [eqn. E]	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01					Sow/S x 10^(-Row/10)
All ventilators [10 x log "B"]	####	####	####	####	####	####	####	####					
Glazing [10 x log "C"]	-25.0	-31.0	-27.0	-32.0	-42.0	-45.0	-42.0	-42.0					
External wall [10 x log "D"]	-36.0	-38.0	-43.0	-53.0	-61.0	-64.0	-69.0	-69.0					
Open window [10 x log "E"]	-18.8	-18.8	-18.8	-18.8	-18.8	-18.8	-18.8	-18.8					
All elements combined [eqn. F]	-17.8	-18.5	-18.2	-18.6	-18.8	-18.8	-18.8	-18.8					Log sum of equations B,C,D,E
Equiv. absorption area of rec. room (m^2)	10	10	10	10	10	10	10	10					
10 x log(S/A) [eqn. G]	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0					

	63	125	250	500	1k	2k	4k	8k	dBA	Target	Exc.	
Internal Leq,2	41	37	29	20	21	22	25	14	30	30	0	Equations (A+F+G) +3 dB
Internal Lmax,2	48	49	38	32	26	33	44	30	46	45	1	Equations (A+F+G) +3 dB

Miller Goodall Environmental Services: Noise Ingress Calculation

Project:	Chatburn Old Road	**Calcs By:**	CF
Description:	External noise level measured at 06:15 on 14/5/14	**Date:**	20/05/2014
	Trickle Vents and closed windows		

Calculation is based on methodology within BS 8233:2014 & BSEN ISO 12354-3. The following equation is utilised:

$$L_{internal} = L_{external} - \Sigma R + 10 \log S/A + 3$$

where A = 0.16V/T

This can be broken down further to:

$$L_{eq,2} = L_{eq,ff} + 10x\log ((A_0/Sx10^{\wedge}(-D_{n,e}/10)) + (S_{wi}/Sx10^{\wedge}(-R_{wi}/10)) + (S_{ew}/Sx10^{\wedge}(-R_{ew}/10)) + (S_{rr}/Sx10^{\wedge}(-R_{rr}/10))) + 10x\log (S/A) + 3$$

The above terms are described below.

Description	Term	Value
Total facade area (m2)	S_f	7.5
Window area (m2)	S_{wi}	1.5
External wall area (Sf - Swi)	S_{ew}	6
Area of ceiling (m2)	S_{rr}	0
Total area of elements (Sf + Srr)	S	7.5
Volume of receiving room (m3)	V	30
Reference absorption area (m2)	A_0	10
Number of ventilators in facade:		2

Room assessed: Bedroom, 3.0 m wide x 4.0 m deep x 2.5 m high

Octave band centre frequency, Hz

	63	125	250	500	1k	2k	4k	8k	dBA	Rw	Ctr	Rw+ Ctr	Notes
External Leq, freefield (dB Leq,ff)	50	43	37	34	40	43	40	31	47	-	-	-	Freefield night-time level
External Lmax, freefield (dB Lmax,ff)	60	52	43	47	49	58	55	47	61	-	-	-	95th% Freefield night-time level
Dne of each ventilator	29	33	32	29	28	30	34	40		30	-1	29	Greenwood 8000HDW, open (report ref. ATV40)
Total Dne of all ventilators	26	30	29	26	25	27	31	37		26	0	26	
SRI of window (Rwi)	18	24	20	25	35	38	35	35		31	-4	27	4/12/4
SRI of external wall (Rew)	35	37	42	52	60	63	68	68		54	-6	48	Double leaf 112 mm brickwork, 50 mm cavity, rigid wall ties
SRI of roof and ceiling (Rrr)	0	0	0	0	0	0	0	0		#####	#####	######	
Rev time of receiving room (T) - secs	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5					Habitable room ref Part E
All ventilators [eqn. B]	0	0	0	0	0	0	0	0					A0/S x 10^(-Dne/10)
Glazing [eqn. C]	0	0	0	0	0	0	0	0					Swi/S x 10^(-Rwi/10)
External wall [eqn. D]	0	0	0	0	0	0	0	0					Sew/S x 10^(-Rew/10)
Ceiling [eqn. E]	0	0	0	0	0	0	0	0					Srr/S x 10^(-Rrr/10)
All ventilators [10 x log "B"]	-24.7	-28.7	-27.7	-24.7	-23.7	-25.7	-29.7	-35.7					
Glazing [10 x log "C"]	-25.0	-31.0	-27.0	-32.0	-42.0	-45.0	-42.0	-42.0					
External wall [10 x log "D"]	-36.0	-38.0	-43.0	-53.0	-61.0	-64.0	-69.0	-69.0					
Ceiling [10 x log "E"]	####	####	####	####	####	####	####	####					
All elements combined [eqn. F]	-21.7	-26.4	-24.3	-24.0	-23.7	-25.7	-29.5	-34.8					Log sum of equations B,C,D,E
Equiv. absorption area of rec. room (m^2)	10	10	10	10	10	10	10	10					
10 x log(S/A) [eqn. G]	-1.1	-1.1	-1.1	-1.1	-1.1	-1.1	-1.1	-1.1					

	63	125	250	500	1k	2k	4k	8k	dBA	Target	Exc.	
Internal Leq,2	30	19	14	12	18	19	13	-2	23	30	-7	Equations (A+F+G) +3 dB
Internal Lmax,2	40	27	21	25	27	34	27	14	37	45	-8	Equations (A+F+G) +3 dB

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Miller Goodall Environmental Services: Noise Ingress Calculation

Project:	Chatburn Old Road	**Calcs By:**	CF
Description:	External noise level measured at 07:55 on 14/5/14 Trickle Vents and closed windows	**Date:**	20/05/2014

Calculation is based on methodology within BS 8233:2014 & BSEN ISO 12354-3. The following equation is utilised:

$$L_{internal} = L_{external} - \Sigma R + 10 \log S/A + 3$$

where A = 0.16V/T

This can be broken down further to:

$$L_{eq,2} = L_{eq,ff} + 10x\log((A_0/Sx10\text{^}(-D_{n,e}/10)) + (S_{wi}/Sx10\text{^}(-R_{wi}/10)) + (S_{ew}/Sx10\text{^}(-R_{ew}/10)) + (S_{rr}/Sx10\text{^}(-R_{rr}/10))) + 10x\log(S/A) + 3$$

The above terms are described below.

Description	Term	Value
Total facade area (m2)	S_f	7.5
Window area (m2)	S_{wi}	1.5
External wall area (Sf - Swi)	S_{ew}	6
Area of ceiling (m2)	S_{rr}	0
Total area of elements (Sf + Srr)	S	7.5
Volume of receiving room (m3)	V	30
Reference absorption area (m2)	A_0	10
Number of ventilators in facade:		2

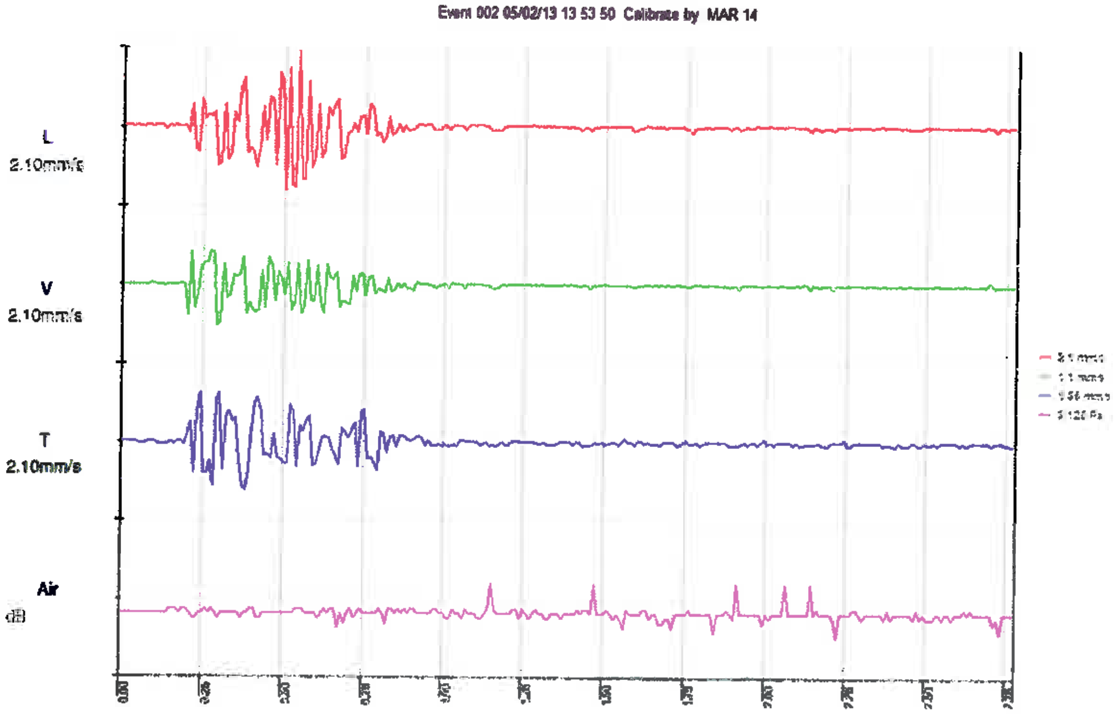
Room assessed: Bedroom, 3.0 m wide x 4.0 m deep x 2.5 m high

Octave band centre frequency, Hz

	63	125	250	500	1k	2k	4k	8k	dBA	Rw	Ctr	Rw+ Ctr	Notes
External Leq, freefield (dB Leq,ff)	56	54	45	37	38	39	42	31	47	-	-	-	Freefield night-time level
External Lmax, freefield (dB Lmax,ff)	64	66	55	49	43	50	61	47	63	-	-	-	95th% Freefield night-time level
Dne of each ventilator	29	33	32	29	28	30	34	40		30	-1	29	Greenwood 8000HDW, open (report ref. ATV40)
Total Dne of all ventilators	26	30	29	26	25	27	31	37		26	0	26	
SRI of window (Rwi)	[illegible]	24	20	25	35	38	35	35		31	-4	27	4/12/4
SRI of external wall (Rew)	35	37	42	52	60	63	68	68		54	-6	48	Double leaf 112 mm brickwork, 50 mm cavity, rigid wall ties
SRI of roof and ceiling (Rrr)	0	0	0	0	0	0	0	0		#####	#####	######	
Rev time of receiving room (T) - secs	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5					Habitable room ref Part E
All ventilators [eqn. B]	0	0	0	0	0	0	0	0					A0/S x 10^(-Dne/10)
Glazing [eqn. C]	0	0	0	0	0	0	0	0					Swi/S x 10^(-Rwi/10)
External wall [eqn. D]	0	0	0	0	0	0	0	0					Sew/S x 10^(-Rew/10)
Ceiling [eqn. E]	0	0	0	0	0	0	0	0					Srr/S x 10^(-Rrr/10)
All ventilators [10 x log "B"]	-24.7	-28.7	-27.7	-24.7	-23.7	-25.7	-29.7	-35.7					
Glazing [10 x log "C"]	-25.0	-31.0	-27.0	-32.0	-42.0	-45.0	-42.0	-42.0					
External wall [10 x log "D"]	-36.0	-38.0	-43.0	-53.0	-61.0	-64.0	-69.0	-69.0					
Ceiling [10 x log "E"]	####	####	####	####	####	####	####	####					
All elements combined [eqn. F]	-21.7	-26.4	-24.3	-24.0	-23.7	-25.7	-29.5	-34.8					Log sum of equations B,C,D,E
Equiv. absorption area of rec. room (m^2)	10	10	10	10	10	10	10	10					
10 x log(S/A) [eqn. G]	-1.1	-1.1	-1.1	-1.1	-1.1	-1.1	-1.1	-1.1					

	63	125	250	500	1k	2k	4k	8k	dBA	Target	Exc.	
Internal Leq,2	37	29	23	15	16	15	14	-2	23	30	-7	Equations (A+F+G) +3 dB
Internal Lmax,2	44	42	32	27	21	26	33	14	36	45	-9	Equations (A+F+G) +3 dB

Appendix 5: Blasting results from 5th February 2013 at 1353 hours



EventNo 002		Plane	
Variable	L	V	T
Bank A			
Max Vel (mm/s)	2.10	1.10	1.35
Frequency (Hz)	35.7	35.7	35.7
Max Acc (g)	.045	.023	.030
Max Disp (mm)	.016	.012	.016
Resultant Max A	2.25mm/s		
Air Overpressure	104dB		
Date	05/02/13		
Time	13:53:50		
Voltage	5.02		

Appendix 6: Blasting results from 27th November 2012 at 1341 hours.

TABLE 1

BLAST DETAILS FROM BLAST ON 27TH NOVEMBER 2012 AT 1341 HOURS

Date:	27th November 2012
Time:	1341 hours
No of Holes:	24 (2 rows of 12)
Diameter:	[illegible]
Depth:	11.5 metres
Burden:	4.5 metres
Spacing:	4.5 metres
Explosive Charge Weight per Hole:	130 kg
Maximum Instantaneous Explosive Charge Weight:	130 kg
Total Explosive Charge Weight:	3052 kg
Explosive Type:	Blendex 70/30
Initiation:	Nonel

TABLE 2

GROUND VIBRATION MEASUREMENTS FROM BLAST ON 27TH NOVEMBER 2012 AT 1341 HOURS

Monitoring Location	*Separation Distance [illegible]*	*Measurement Axis*	*Peak Particle Velocity [illegible]*	*Air Overpressure [illegible]*
Quarry	37	Long Vert Trans	22.0 [illegible] [illegible]	146
Quarry	46	Long Vert Trans	35.6 45.4 38.0	134
Quarry	70	Long Vert Trans	19.8 7.2 11.2	-
Quarry	[illegible]	Long Vert Trans	3.8 3.9 4.4	126
* Chatburn Old Road	140	Long Vert Trans	4.6 3.9 4.3	123
* Chatburn Old Road	165	Long Vert Trans	4.9 4.8 4.3	-
* Chatburn Old Road	190	Long Vert Trans	1.2 0.8 1.5	116
Chatburn Old Road	240	Long Vert Trans	2.4 1.5 2.8	117
Chatburn Old Road	290	Long Vert Trans	0.7 0.6 0.7	115
Chatburn Old Road	390	Long Vert Trans	0.5 0.8 1.2	119
Chatburn Old Road	440	Long Vert Trans	<0.3 <0.3 <0.3	-

* Note. The blast on 27[th] November 2012 was located 212 metres from the truncated end of Chatburn Old Road (i.e. the limit of the public highway). Clearly the readings at 140, 165 and 190 metres from the blast (identified above with an asterisk) could not have been taken on Chatburn Old Road. (See annotated extract from Henson August 2012 survey plan).

Appendix 7: Historic Blasting Results made available.

Date	Time	Blast Reference	Mic kg	Tot charge Weight (kg)	No. of holes	Hole Dia mm	Hole Depth m	Hole spac-ing m	Type of detonator	Burden m	Vibrograph Location	Trigger	Peak Particle Velocity mm/sec
Jan 05	12.30	55-34	123	5225	50	127	13.7	5	Exel	5	Mr Wells, Chat Old Road	Trigged	2.0
Feb 05	12.33	42-30+31	90	3075	34	127	10.6	5	Exel	5	Mr Goodings, Chat Road	No Trigger	
Feb 05	11.19	36-83	150	2950	40	127	10.6	5	Exel	5	Mr Goodings, Chat Road	No Trigger	
Feb 05	11.15	36-85	140	3650	50	127	10.6	5	Exel	5	Crow Trees Brow	No Trigger	
March 05	11.22	36-86	80	3475	40	127	8.0	5	Exel	5	Chatburn Old Road	No Trigger	
March 05	3.10	36-87	150	4950	67	127	10.6	5	Exel	5	Crow Trees Brow	Trigged	1.3
April 05	11.55	36-89	95	4850	51	127	10.6	5	Exel	5	Crow Trees Brow	No Trigger	
April o5	10.25	36-90	95	6075	64	127	10.6	5	Exel	5	Crow Trees Brow	No Trigger	
April 05	12.25	46-25	80	5500	75	127	10.6	5	Exel	5	Chatburn Old Road	Trigged	1.3
April 05	11.25	35	72	3200	44	127	9	5	Exel	5	Chatburn Old Road	No Trigger	
May 05	10.35	36	98	4750	48	127	10.6	5	Exel	5	Crow Trees Brow	Trigged	1.6
May 05	12.20	42-29+28	140	6950	92	127	10.6	5	Exel	5	Crow Trees Brow	No Trigger	
June 05	2.55	150-32	98	2125	21	127	10.6	5	Exel	5	Crow Trees Brow	No Trigger	
June 05	11.55	150-32	98	4900	50	127	10.6	5	Exel	5	Crow Trees Brow	No Trigger	

July 05	12.10	30-95+96	100	6675	67	127	10.6	5	Exel	5	Crow Trees Brow	Trigged	3.2
Sept 05	12.25	47-37	80	2450	41	127	9	5	Exel	5	Chatburn Old Road	Trigged	0.7
Sept 05	11.41	20-24	60	3525	57	127	8	5	Exel	5	Crow Trees Brow	No Trigger	
Oct 05	2.30	20-27	60	4225	63	127	8	4.25	Exel	4.25	Chatburn Old Road	No Trigger	
Nov 05	1.55	38-46	100	3600	36	127	10.6	5	Exel	4.25	Crow Trees Brow	No Trigger	
Nov 05	1.40	37-41+43	118	6900	63	127	11.6	5	Exel	4.25	Crow Trees Brow	No Trigger	
Dec 05	12.55	38-40	100	2933	53	127	8	4.5	Exel	4.25	Crow Trees Brow	No Trigger	

Appendix 8: Noise and Dust Environmental Management Plan

Miller Goodall
Environmental Services

CONSTRUCTION PHASE ENVIRONMENTAL MANAGEMENT PLAN

for the site at

CHATBURN OLD ROAD, CHATBURN, CLITHEROE

23RD MAY 2014

Miller Goodall Environmental Services Ltd.
214 Turton Road
Bradshaw
Bolton
BL2 3EE

Tel: 01204 596166

www.millergoodall.co.uk

ANC
THE ASSOCIATION OF NOISE CONSULTANTS

1 Introduction

1.1 The applicant recognises the importance of proper attention being paid to the impact that their projects have on their neighbours and is aware that construction activity may be an inconvenience at times.

1.2 The applicant also recognises that this development may precede in a piecemeal fashion and it is anticipated, therefore, that each contractor will be required to produce their own Conctruction Environmental Management Plan at the appropriate time. This document sets out examples of the type of actions contractors will be expected to consider to control the environmental impact of the construction phase of the development. These actions include hours of work, measures to deal with environmental nuisance and the process and systems that may be put in place to ensure good neighbourliness.

2 The Proposal

2.1 The development site is located towards the end of Chatburn Old Road approximately 60 – 65 m from the edge of the Lanehead Quarry site and approximately 200 m from the workings at the base of the quarry. The application site is approximately 2.39 hectares and located in a hollow in the land and is accessed from Chatburn Old Road.

3 Basic Hours of Working

3.1 Construction work on the site which is audible at the site boundaries will normally only be carried out during the strict time periods detailed below.

- 8.00 am to 18.00 Hrs (Monday to Friday)
- 9.00 am to 13.00 Hrs (Saturday)

3.2 No construction work will be undertaken outside of these hours on Sundays or Bank Holidays unless required due to special circumstances. Inevitably on a construction project of such a large scale there will be unplanned events which may require works to be carried out outside these hours. If and when an event like this is foreseen, the Contractor will notify local residents immediately adjoining the site at least 7 days in advance.

4 Noise

4.1 At the construction stage, the applicant appreciates that the proposed developments may impact on the neighbourhood adjacent to the site. In keeping with good practice, the applicant proposes a pro-active approach to the management and control of construction noise and vibration.

4.2 The following 'Best Practicable Means' to reduce noise to a minimum will be employed.

- The need to prohibit night-time working given the proximity of existing local residents to the development site;
- Scheduling of those activities likely to cause the highest levels of noise and vibration to occur at the times when they will cause the least disturbance to local residents;
- Noisy plant or equipment shall be sited as far away as is practicable from sensitive buildings;
- Careful consideration of the selection of sites for contractors' compounds to ensure that local residents are not unreasonably disturbed;
- Appropriate notification should be provided to local residents should it be necessary to programme occasional but unavoidably noisy.
- Machines in intermittent use will be shut down when not in use or throttled down to a minimum. Noise-emitting equipment which is required to run continuously may have to be housed in a suitable acoustic enclosure (refer to BS 5228:2009);
- Vehicles and mechanical plant used will be maintained in good and efficient working order and operated to minimise noise emissions;
- Care will be taken when loading and unloading vehicles, dismantling scaffolding or moving materials etc. to reduce noise impact;
- All deliveries of materials, plant and machinery to the site, and any removals of waste or other material, will take place within the sites operational hours as far as is reasonably practical;
- No employees, sub-contractors and persons employed on the site must cause unnecessary noise from their activities e.g. excessive 'revving' of vehicle engines, music from radios, shouting, singing, etc. and general behaviour;
- Procedures to be agreed with the local authority in the event of specific demolition or construction activities which involve occasional but unavoidably noisy activities (e.g. the use of controlled explosions for particular demolition tasks);
- All construction plant is to be fitted with effective silencers and comply with current EC regulatory noise limits.

4.3 As part of the Project's Considerate Contractors Registration requirements, a site sign board will be erected giving contact details for both office hours and out of hours enquiries.

5 Dust

5.1 Dust arising from construction activities on the site will be controlled by Best Practicable Means. The control of dust will be considered at the design stage and appropriate mitigation measures will be implemented to ensure that the levels of dust generated by construction activities are minimised.

5.2 The range of measures to be implemented will include practicable measure that can be adopted to control dust generation, e.g.

- The sheeting up of loaded vehicles;
- Regulating the speed of vehicles on site – 5 mph;
- The use of jet and wheel washes where necessary;
- Arrangements to provide contact details to local residents affected by the works and to address any issues raised;
- Use of bowsers to damp down during dry spells;
- Sealing of stockpiled materials such as top soil.

5.3 A schedule of Dust Aspects and Impacts will be produced to identify specific areas of concern. For each concern, specific control measures will be identified.

5.4 All identified measures shall be implemented and maintained at all times. Should any equipment used to control dust fail, that activity will cease until the equipment has been repaired or replaced.

5.5 The levels of dust generated will be visually monitored at least twice a day by the Project Manager, Construction Manager and External Works Manager during their walkabouts. Also activities identified on the aspects and impacts schedule will be monitored as they commence. Any situations likely to affect our neighbours will be rectified immediately either by ceasing the operation or damping down. In any case operations will not recommence until the situation has been rectified.

5.6 Particular attention will be paid during periods of dry weather.

5.7 All instances are to be recorded on the Project Manager weekly safety Inspection Report or the Supervisors weekly inspection sheet. This will also record those with responsibility to resolve the issue, remedial actions required and timescales for resolution, usually immediately.

5.8 Best Practicable Means regarding Dust control will be employed on site to minimize dust nuisance arising from the site activities. The following may be adopted.

- Storage locations for all materials that create dust, including soil, will be away from the site boundary unless this is impractical.
- Waste materials and waste for recycling will be managed in accordance with the site waste management plan. A good standard of 'house-keeping' with adequate storage capacity will be maintained.
- There shall be no on-site bonfires for any purpose whatsoever.

- The effectiveness of all dust control measures shall be monitored at regular intervals by the main contractor.

6 Construction Traffic and Road Cleaning

6.1 All necessary precautions will be taken to ensure that mud and dust does not become a nuisance to the surrounding road network and is kept to a minimum. In the first instance this will be achieved by the provision of a road sweeper who will be operating throughout the site access roads to ensure that they are kept clean.

6.2 The Contractor shall ensure that the area around the site, including the public highway, is regularly and adequately swept to prevent any accumulation of dust and dirt from the site.

7 Security

7.1 During the construction activities on the existing site a secure boundary fence will be erected. The purpose of this fence is to provide clear demarcation of the site boundary and ensure that unauthorised access is prevented. The fencing system to be used is likely to be 8 ft timber hoarding. The location of the hoarding will be identified on the Site Traffic Plan drawings to be developed in due course.

8 Health and Safety

8.1 The Contractor's overriding policy for all the sites will be the health and safety of everyone, the General Public, visitors, site staff and our site operatives and staff.

8.2 Project specific safety plans will be prepared together with method statements and COSHH assessments for all aspects of the works and regular inspections and system audits will be undertaken to ensure procedures are being followed. These will be kept on the project filing system and will be available on site.

8.3 The Contractor will invest in safety through regular training both on and off site. All site personnel including trade contractors must receive induction training before being allowed on site and regular tool box talks will be held to keep personnel up to date with site conditions and hazards. The training and tool box talks will also cover environmental issues.

9 Considerate Constructors Scheme

9.1 The Considerate Constructors Scheme is a voluntary scheme and aims to present a more positive image of the construction industry. It does this by constructors committing themselves to higher standards of site cleanliness and tidiness, improved site safety, better site housekeeping and traffic management, a reduction in their impact on the local community and the wider environment. It is likely that the site will be registered under Considerate Constructors Scheme for the duration of the works.

9.2 The scheme gives advice on:

- Minimising any disturbance or negative impact (in terms of noise, dirt and inconvenience) sometimes caused by construction sites to the immediate neighbourhood;
- Eradicating offensive behaviour and language from construction sites;
- Recognising and rewarding the Contractor's commitment to raise standards of site management, safety and environmental awareness beyond statutory requirements.

9.3 This important initiative is a voluntary Code of Considerate Practice, which is adopted by participating construction companies, and everyone involved on the construction site. The Code commits the Contractor to be Considerate and Good Neighbours, as well as clean, respectful, safe, environmentally conscious, responsible and accountable.

9.4 Posters displayed around the construction site that advertise the Scheme and set out the Code to which the constructor is committed. If passers-by wish to comment, the name and telephone number of the Site Manager is clearly displayed alongside the telephone number of the administrators of the Scheme. Those contacted are expected to take the action required.

9.5 The site will be monitored by highly experienced site monitors drawn from senior positions of every discipline within the Industry. The Monitors site visit will consist of an impression of the site from the point of view of the neighbour and/or the general public. The monitor may talk to site neighbours if it seems that it would be informative to do so. The Scheme requires constructors to adhere to the **Code of Considerate Constructors**.

10 Considerate Contractors Code of Practice

Consideration:

- All work is to be carried out with positive consideration to the needs of residents and businesses, site personnel and visitors, pedestrians, shoppers, the general public and the environment in general.
- Special attention is to be given to the needs of those with sight, hearing and mobility difficulties.

Environment:

- Noise from construction operatives and all other sources is to be kept to a minimum at all times.
- Consideration should be given in the selection and use or resources – local resources should be used wherever possible.
- Attention should be paid to waste management and the avoidance of pollution – recycling of surplus materials is to be encouraged.

Cleanliness:

- The working site is to be kept clean and in good order at all times.
- Temporary safety barriers, lights and warning signs are to be maintained in a clean and safe condition.

- Surplus materials, rubbish etc. shall not be allowed to accumulate on the site or spill over to the surrounding environment.
- Dust etc. from construction operations shall be kept to a minimum.

Neighbourliness:

- Full and regular consultation with neighbours including adjacent traders and business regarding programming and site activities shall be maintained from pre-start to completion.
- General information regarding the Scheme for these neighbours using the area shall be provided.

Respect:

- Respectable and safe standards of dress, appropriate to the weather conditions, shall be maintained at all times.
- Lewd or derogatory behaviour and language should not be tolerated under threat of severe disciplinary action.
- Pride in the management and appearance of the site and the surrounding environment is to be shown at all times.
- Operatives shall be instructed in dealing with the general public.

Safety:

- Construction operatives and site vehicle movements are to be carried out with great care and consideration for the safety of the general public, traders, shoppers and as well as site personnel.
- No building activity shall be a security risk to others.

Responsibility:

- Considerate Constructors will ensure that all site personnel, specialist sub-contractors, drivers and any other persons working on the site understand and implement the obligations of this Code and monitor their compliance with it.

Accountability

- Posters relating to the Scheme will be displayed around the site, giving names and telephone numbers of staff who can be contacted in response to issues raised by the general public, traders, shoppers and others affected by the site operation.