ES VOLUME 2
Technical Appendices

D - Noise

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Lea Castle Farm, Wolverley, Worcestershire
Proposed Sand and Gravel Extraction and Restoration
Noise Assessment Report

Date 12 September 2019

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The Author

Paul Cockcroft BEng PhD CEng MIMMM FIOA (Senior Partner) has been practising in mining engineering and acoustics since 1983. He joined WBM in 1989, became a Partner in 1997 and Senior Partner in 2004. Paul has worked for many of the major mineral extraction and waste disposal companies in the UK and Mineral Planning Authorities on a wide range of surface mineral workings, aggregate related plant sites, waste disposal and recycling projects, including advising safeguarded wharf operators to protect vital industrial operations. He also specialises in the measurement and prediction of environmental, industrial and transportation noise and acoustic aspects of site development, road schemes, rail-linked sites, traincare depots and commercial and residential developments. Paul has prepared and presented evidence at planning appeals and for court cases, including Judicial Review applications, Breach of Condition Notices, nuisance cases and is known for his rigorous approach.

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Robert Storey BEng PhD MIOA (Consultant) obtained his degree in Mining Engineering from the University of Leeds in 1993 before going on to complete a PhD in “The Acoustic Response of Structures to Blast Induced Ground Vibration” in 1998. He joined WBM in 2007 after working in acoustic consultancy and environmental health since 1999. Robert is involved mainly in environmental noise, working closely with the Senior Partner on mineral extraction, waste and industrial projects, including surveys, routine noise monitoring and assessments. He is experienced in noise modelling using SoundPlan for transportation, industrial and environmental sources

WBM

WBM (the trading name of The Walker Beak Mason Partnership) is an established independent acoustic consultancy specialising in architectural & building acoustics, environmental noise, planning issues and expert work. WBM is a member of the Association of Noise Consultants and is also a Corporate Member of the Institute of Environmental Management & Assessment. The consultants are Members or Fellows of the Institute of Acoustics.

ACOUSTIC CONSULTANTS

Contents

1 Introduction

NRS Aggregates Limited proposes the extraction of sand and gravel with progressive restoration using the stripped soils and imported inert material at a site at Lea Castle Farm near Wolverley, Worcestershire.

The application is for the extraction and processing on site of an estimated 3 million tonnes of sand and gravel over a 10 year period. The void will be infilled with the previously stripped soils and overburden as well as imported inert waste material (approximately 60,000 m^3 per annum) and progressively restored.

The location of the proposed quarry is approximately 0.35 km north of Kidderminster, 0.7 km east of Wolverley and 0.38 km south-west of Cookley. The site lies immediately north of the A4189 Wolverley Road and west of the A449 Wolverhampton Road.

Site noise limits are suggested based on current advice from the government contained in the web document "*Planning Practice Guidance*" for Minerals, dated March 2014, and the results of noise surveys conducted in June and July 2018 to obtain baseline noise data.

This report sets out the calculated noise levels arising from the workings and compares these calculated noise levels with the suggested site noise limits at the nearest dwellings to the proposed site. Mitigation measures have been explored to reduce site noise levels.

To aid comprehension, a glossary of acoustic terms is presented in Appendix A.

2 Assessment Methodology

The various noise guidance documents referenced in this assessment are detailed below.

2.1 Noise Policy Statement for England

The Noise Policy Statement for England (NPSE) was published in March 2010. The aim of the document is to "…*provide clarity regarding current policies and practices to enable noise management decisions to be made within the wider context, at the most appropriate level, in a cost-effective manner and in a timely fashion*".

The long term vision of noise policy is to "*Promote good health and a good quality of life through the effective management of noise within the context of Government policy on sustainable development*".

The long term vision is supported by three aims:

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

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

The Explanatory Note to the NPSE introduces the concepts of observed effect levels with regard to noise.

NOEL (No Observed Effect Level) - this is the level below which no effect can be detected, i.e. below this level there is no detectable effect on health and quality of life due to noise.

LOAEL (Lowest Observed Adverse Effect Level) – this is the level above which adverse effects on health and quality of life can be detected due to noise.

SOAEL (Significant Observed Adverse Effect Level) – this is the level above which significant adverse effects on health and quality of life occur due to noise.

With regard to the first aim of the NPSE, any noise impacts that are above SOAEL should be avoided.

Where the impact lies somewhere between LOAEL and SOAEL, the second aim of the NPSE requires that all reasonable steps should be taken to mitigate and minimise adverse effects on health and quality of life. However, as stated in paragraph 2.24 of the Explanatory Note to the NPSE "*This does not mean that such adverse effects cannot occur*".

2.2 National Planning Policy Framework

The National Planning Policy Framework (NPPF) set out the Government's planning policies for England. The latest version was published in February 2019. At the heart of the NPPF is a presumption in favour of sustainable development.

Section 15 of the NPPF (Conserving and enhancing the natural environment) refers specifically to noise in the following paragraphs:

"*170. Planning policies and decisions should contribute to and enhance the natural and local environment by…*

(e) preventing new and existing development from contributing to, being put at unacceptable risk from, or being adversely affected by, unacceptable levels of soil, air, water or noise pollution or land instability..."

"*180. Planning policies and decisions should also ensure that new development is appropriate for its location taking into account the likely effects (including cumulative effects) of pollution on health, living conditions and the natural environment, as well as the potential sensitivity of the site or the wider area to impacts that could arise from the development. In doing so they should:*

a) mitigate and reduce to a minimum potential adverse impacts resulting from noise from new development – and avoid noise giving rise to significant adverse impacts on health and the quality of life;

b) identify and protect tranquil areas which have remained relatively undisturbed by noise and are prized for their recreational and amenity value for this reason…"

Paragraph 180 (a) refers to the Explanatory Note to NPSE, 2010.

Paragraph 182 refers to the integration of new development with existing businesses and facilities:

"*182. Planning policies and decisions should ensure that new development can be integrated effectively with existing businesses and community facilities (such as places of worship, pubs, music venues and sports clubs). Existing businesses and facilities should not have unreasonable restrictions placed on them as a result of development permitted after they were established. Where the operation of an existing business or community facility could have a significant adverse effect on new development (including changes of use) in its vicinity, the applicant (or 'agent of change') should be required to provide suitable mitigation before the development has been completed.*"

Mineral sites are considered in Section 17 "*Facilitating the sustainable use of minerals*" of the NPPF.

"*204. Planning policies should …*

(e) safeguard existing, planned and potential sites for: the bulk transport, handling and processing of minerals; the manufacture of concrete and concrete products; and the handling, processing and distribution of substitute, recycled and secondary aggregate material;

f) set out criteria or requirements to ensure that permitted and proposed operations do not have unacceptable adverse impacts on the natural and historic environment or human health, taking into account the cumulative effects of multiple impacts from individual sites and/or a number of sites in a locality;

(g) when developing noise limits, recognise that some noisy short-term activities, which may otherwise be regarded as unacceptable, are unavoidable to facilitate minerals extraction..."

"*205. When determining planning applications, great weight should be given to the benefits of mineral extraction, including to the economy. In considering proposals for mineral extraction, minerals planning authorities should…*

(c) ensure that any unavoidable noise, dust and particle emissions and any blasting vibrations are controlled, mitigated or removed at source, and establish appropriate noise limits for extraction in proximity to noise sensitive properties..."

Paragraph 205 (c) advises that the national planning guidance on minerals sets out how these policies should be implemented, see Section 2.4 below.

2.3 Planning Practice Guidance Noise

Technical guidance on noise is provided by Planning Practice Guidance, published by the Ministry of Housing, Communities & Local Government.

Planning Practice Guidance Noise (PPGN) was published in March 2014 and updated in July 2019. PPGN provides advice on how planning can manage potential noise impacts in new development. It makes reference to the Explanatory Note of the NPSE and the NPPF.

Paragraph 005 Reference ID: 30-005-20190722 of the PPGN provides guidance on how to establish if noise is likely to be a concern, including a table summarising the noise exposure hierarchy based on the likely average response of those affected.

Summary Table of Noise Exposure Hierarchy, based on the likely average response

Response	Examples of outcomes	Increasing effect level	Action
No Observed Effect Level			
Not present	No Effect	No Observed Effect	No specific measures required
No Observed Adverse Effect Level			
Present and not intrusive	Noise can be heard, but does not cause any change in behaviour, attitude or other physiological response. Can slightly affect the acoustic character of the area but not such that there is a change in the quality of life.	No Observed Adverse Effect	No specific measures required
Lowest Observed Adverse Effect Level			
Present and intrusive	Noise can be heard and causes small changes in behaviour, attitude or other physiological response, e.g. turning up volume of television; speaking more loudly; where there is no alternative ventilation, having to close windows for some of the time because of the noise. Potential for some reported sleep disturbance. Affects the acoustic character of the area such that there is a small actual or perceived change in the quality of life.	Observed Adverse Effect	Mitigate and reduce to a minimum
Significant Observed Adverse Effect Level			
Present and disruptive	The noise causes a material change in behaviour, attitude or other physiological response, e.g. avoiding certain activities during periods of intrusion; where there is no alternative ventilation, having to keep windows closed most of the time because of the noise. Potential for sleep disturbance resulting in difficulty in getting to sleep, premature awakening and difficulty in getting back to sleep. Quality of life diminished due to change in acoustic character of the area.	Significant Observed Adverse Effect	Avoid
Present and very disruptive	Extensive and regular changes in behaviour, attitude or other physiological response and/or an inability to mitigate effect of noise leading to psychological stress, e.g. regular sleep deprivation/awakening; loss of appetite, significant, medically definable harm, e.g. auditory and non-auditory	Unacceptable Adverse Effect	Prevent

The "*Examples of Outcomes*" tabulated above can be referred to in the consideration of the effects of impacts.

2.4 Planning Practice Guidance Minerals (PPGM)

Paragraphs 19 to 22 inclusive of the "*Minerals*" chapter of the Planning Practice Guidance, also dated March 2014, are under the heading "*Noise emissions*" within the section "*Assessing environmental impacts from mineral extraction*".

Paragraph 019 Reference ID: 27-019-20140306 states:

"***How should minerals operators seek to control noise emissions?***

Those making mineral development proposals, including those for related similar processes such as aggregates recycling and disposal of construction waste, should carry out a noise impact assessment, which should identify all sources of noise and, for each source, take account of the noise emission, its characteristics, the proposed operating locations, procedures, schedules and duration of work for the life of the operation, and its likely impact on the surrounding neighbourhood.

Proposals for the control or mitigation of noise emissions should:

- *consider the main characteristics of the production process and its environs, including the location of noise-sensitive properties and sensitive environmental sites;*
- *assess the existing acoustic environment around the site of the proposed operations, including background noise levels at nearby noise-sensitive properties;*
- *estimate the likely future noise from the development and its impact on the neighbourhood of the proposed operations;*
- *identify proposals to minimise, mitigate or remove noise emissions at source;*
- *monitor the resulting noise to check compliance with any proposed or imposed conditions."*

Paragraph 020 Reference ID: 27-020-20140306 states:

"*How should mineral planning authorities determine the impact of noise?*

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.*

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 and the lowest observed adverse effect level for the given situation. As noise is a complex technical issue, it may be appropriate to seek experienced specialist assistance when applying this policy."

Paragraph 021 Reference ID: 27-021-20140306 states:

"What are the appropriate noise standards for mineral operators for normal operations?

Mineral planning authorities should aim to establish a noise limit, through a planning condition, at the noise-sensitive property that does not exceed the background noise level (LA90,1h) by more than 10dB(A) during normal working hours (0700-1900). Where it will be difficult not to exceed the background level by more than 10dB(A) without imposing unreasonable burdens on the mineral operator, the limit set should be as near that level as practicable. In any event, the total noise from the operations should not exceed 55dB(A) LAeq, 1h (free field).

For operations during the evening (1900-2200) the noise limits should not exceed the background noise level (LA90,1h) by more than 10dB(A) and should not exceed 55dB(A) LAeq, 1h (free field). For any operations during the period 22.00 – 07.00 noise limits should be set to reduce to a minimum any adverse impacts, without imposing unreasonable burdens on the mineral operator. In any event the noise limit should not exceed 42dB(A) LAeq,1h (free field) at a noise sensitive property.

Where the site noise has a significant tonal element, it may be appropriate to set specific limits to control this aspect. 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 frequency bands – and that should not be allowed to occur regularly at night.)

Care should be taken, however, to avoid any of these suggested values being implemented as fixed thresholds as specific circumstances may justify some small variation being allowed."

Paragraph 022 Reference ID: 27-022-20140306 states:

"What type of operations may give rise to particularly noisy short-term activities and what noise limits may be appropriate?

Activities such as 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.

Increased temporary daytime noise limits of up to 70dB(A) LAeq 1h (free field) for periods of up to eight 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 eight 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.

2.5 Worcestershire Regulatory Services

The proposed site is in Worcestershire and technical guidance on noise is provided by Worcestershire Regulatory Services (WRS). WRS prepared "*Noise Control Technical Guidance – Development Control*" 1st Edition November 2013 Version 1.2.4.

The WRS "*Noise Control Technical Guidance"* has been reviewed and contains no information specifically for minerals sites. Accordingly, the planning practice guidance for minerals from the Government is used for this noise assessment.

3 Site Description

The location of the proposed quarry is approximately 0.35 km north of Kidderminster, 0.7 km east of Wolverley and 0.375 km south-west of Cookley in Worcestershire. The site is north of the B4189 Wolverley Road and west of the A449 Wolverhampton Road.

It is proposed that the mineral will be excavated by means of an excavator and loaded into a dump truck for transport on an internal haul route back to the proposed plant site for processing.

The rate of extraction will be about 300,000 tonnes per annum over the course of 10 years.

The nearest residential properties to the proposed quarry site are located to the south, west, north and north-east of the site.

To the south of the site there are properties along the B4189 Wolverley Road including Heathfield Knoll School, South Lodge , Broom Cottage and others.

To the west of the site there are dwellings off Brown Westhead Park.

To the north of the site, there are properties in the vicinity of the Lea Castle Equestrian Centre including Keeper's Cottage and McDonalds Bungalow.

There are also dwellings at the converted barns at Castle Barns to the north-east of the site.

The proposed operating hours of the site are Monday to Friday 07:00 to 19:00 hours and Saturdays from 07:00 to 13:00 hours with no site activity outside these hours and on Sundays, Bank Holidays or National Holidays other than environmental monitoring.

4 Baseline Noise Measurements (June / July 2018)

The dwellings at which the baseline noise measurements were undertaken in June 2018 and July 2018 were selected as being representative of the nearest properties to the proposed extraction/infilling area and processing plant.

Baseline noise surveys were conducted on three days at seven locations representative of the selected dwellings. Twenty-eight sample measurements were made over the three surveys which took place on Wednesday 27 June 2018, Tuesday 03 July 2018 and Wednesday 04 July 2018 in relatively light wind and dry conditions.

The measurements were undertaken between about 12:40 and 15:30 hours on Wednesday 27 June 2018; between about 10:30 and 15:05 on Tuesday 03 July 2018; between about 10:30 and 13:15 on Wednesday 04 July 2018.

The measurements were taken at a microphone height of approximately 1.4 metres above local ground level away from reflecting surfaces other than the ground, with a wind shield used throughout each measurement. The sample measurements were of 15 minute duration.

The parameters reported are the statistical indices $L_{A10,T}$ and the Background Noise Level, $L_{A90,T}$ as well as the Equivalent Continuous Noise Level, $L_{Aeq,T}$. An explanation of the noise units presented is given in Appendix A.

Site plans showing the survey locations and the phasing plan are presented in Appendix B.

Data logging sound level meters installed at the rear of Castle Barns and in the garden of Broom Cottage on Wednesday 27 June 2018 and collected on Wednesday 04 July 2018.

The survey, instrumentation and calibration details for the sample measurements undertaken in June and July 2018 are shown in Appendix C with the detailed results of the sample measurements set out in Appendix D.

Noise levels were generally controlled by distant and local road traffic, birdsong, breeze in the trees, aircraft movements and local activity.

The survey, instrumentation and calibration details for the installed sound level meters at Castle Barns and Broom Cottage are presented in Appendix E with the detailed results in Appendix F. The data from the weather station installed at Broom Cottage is presented in Appendix G.

The average measured noise levels, dB $L_{A90, T}$ and dB $L_{Aeq, T}$ are tabulated below.

Location	**Average Measured dB $L_{A90, 15\ min\ free\ field}$**	**Average Measured dB $L_{Aeq, 1\ hour\ free\ field}$**
1. Broom Cottage	41 (43)	51 (54)
2. South Lodge	47	55
3. Heathfield Knoll	48	55
4. Brown Westhead Park	36	54
5. McDonalds Bungalow	35	43
6. Keeper's Cottage	39	49
7. Castle Barns	39 (41)	45 (47)

The values in brackets are obtained from the data from the installed sound level meters.

5 Suggested Site Noise Limits

Site noise limits are suggested based on current advice from the government contained in paragraph 021 of the web document "*Planning Practice Guidance*" for Minerals, dated March 2014, and the results of noise surveys conducted in June and July 2018 to obtain baseline noise data.

Location	**Average Measured dB $L_{A90, 15\ min\ free\ field}$**	**Suggested Site Noise Limit dB $L_{Aeq, 1\ hour\ free\ field}$**
1. Broom Cottage	41 (43)	53

2. South Lodge	47	55
3. Heathfield Knoll	48	55
4. Brown Westhead Park	36	46
5. McDonalds Bungalow	35	45
6. Keeper's Cottage	39	49
7. Castle Barns	39 (41)	51

The values in brackets are obtained from the data from the installed sound level meters and the suggested site noise limits for these two locations are based on the average dB $L_{A90, T}$ values from the installed sound level meters.

The suggested site noise limits for temporary operations of no more than 8 weeks duration in any calendar year is 70 dB $L_{Aeq, 1\ hour\ free}$ based on the advice contained in Paragraph 022 of the Minerals section of Planning Practice Guidance.

6 Calculated Site Noise Levels

The Equivalent Continuous Noise Level, $L_{Aeq, T}$, is the preferred unit for assessing noise sources. It is the value of a continuous level that would have equivalent energy to the continuously varying noise over the specified period "T". This unit is recommended internationally for the description of environmental noise and is in general use. It is the chosen unit of BS 5228 for Construction and Open site noise; Planning Practice Guidance to the National Planning Policy Framework and BS 7445 for the Description and Measurement of Environmental noise.

The noise levels likely to arise at dwellings depend on the method of working and the sound power levels of the plant chosen to work at the site, as much as on the distance to the properties and the effects of intervening ground. Proper allowance can be made for these variables in order to calculate site noise levels.

6.1 Noise Calculation Methodology

The Planning Practice Guidance Minerals (PPGM) in paragraph 019 states those making development proposals should "*estimate the likely future noise from the development and its impact on the neighbourhood of the proposed operations*".

The PPGM does not contain details of noise prediction methods and in the absence of detailed guidance in the PPGM, the calculations in this report are based on the methods contained in BS5228-1: 2009 + A1: 2014 "*Code of practice for noise and vibration control on construction and open sites – Part 1: Noise*".

Further details of the calculation methods are set out in Appendix H to this report. Summary site noise calculation sheets for one of the seven locations considered is also included in Appendix H.

For the purposes of examining a reasonable worst case, various plant items have been assumed to operate at the closest practical position of the proposed operating areas to each receiver location. These plant items and the corresponding Sound Power Levels (L_{WA}) are listed in Section 6.2.

6.2 Noise Sources and Sound Power Levels

The plant items proposed to work at the site are tabulated below. Sound Power Levels, dB L_{WA}, of each selected plant item are shown, based on similar plant items on the WBM plant noise database. The plant data are used in the calculations and are shown in the summary site noise calculation sheet presented in Appendix H:

Plant Item	**dB L_{WA}**
Excavator for sand and gravel extraction (50% of the time)	104
Excavator loading dump truck (50% of the time)	104
Loading shovel at processing plant	106
Duo processing plant – crusher & sand plant	106
Duo processing plant – screen & conveyors	106
Dump trucks to and from processing plant	106
Lorries for imported inert material	104
Dozer to profile imported inert material	108
Lorries on site access road	104
Excavator for temporary operations	104
Dump trucks for temporary operations	106
Dozer for temporary operations	108

6.3 Recommended Mitigation Measures

The calculations assume that all plant on site is operating simultaneously in the closest likely working areas to each receiver location for the proposed extraction / infilling. The ground between the site and the assessment locations is assumed to be 90% soft.

Stand-off distances to dwellings and bund positions and heights have been examined carefully and discussed with the team such that appropriate mitigation measures are built-in to the scheme.

The mitigation measures have been developed in order to be able to demonstrate that the reasonable worst case calculated site noise levels comply with the suggested site noise limits at dwellings without imposing unreasonable burdens on the mineral operator.

6.4 Effects on Assessment Locations

Routine Extraction Operations

Site noise limits have been suggested, in line with the advice contained in the web document Planning Practice Guidance Minerals, based on the average background noise level plus 10 dB(A) and not to exceed 55 dB $L_{Aeq,\ 1\ hour,\ free\ field}$ at the nearest noise sensitive premises during routine daytime operations on site.

Site noise calculations have been undertaken for the seven receiver locations corresponding to the locations that are closest to the proposed extraction / infilling area and the processing plant site.

A comparison of the calculated daytime site noise levels at the receiver locations and the suggested site noise limits is shown in the following table, with the summary site noise calculation sheet for one location presented in Appendix H. The calculated site noise levels and the suggested site noise limits in the table below are all in terms of dB $L_{Aeq,\ 1\ hour,\ free\ field}$.

Calculated daytime site noise levels are presented for all expected plant operations in the nearest proposed extraction / infilling area combined with the proposed processing plant site. For most dwellings, the activity in the phases for extraction and infilling would not take place simultaneously at the closest part of the site.

Site Noise Calculation Receiver Location	Calculated Site Noise Level dB $L_{Aeq, 1 hour, free field}$ (Mineral Extraction, Infilling & Processing)	Suggested Site Noise Limit dB $L_{Aeq, 1 hr free field}$
1. Broom Cottage	51	53
2. South Lodge	54	55
3. Heathfield Knoll	53	55
4. Brown Westhead Park	45	46
5. McDonalds Bungalow	45	45
6. Keeper's Cottage	46	49
7. Castle Barns	48	51

The calculated site noise levels due to operations at the proposed site comply with the suggested site noise limits at the seven chosen assessment locations.

Temporary Operations

The operations of topsoil and overburden stripping, bund formation and the final restoration processes are often noisier than extraction, as noted in Paragraph 022 of PPGM, as they tend to be closer and are usually unscreened. They are relatively short duration operations that are capable of completion in a total period of no more than eight weeks in any twelve month period.

The construction of a bund is a brief operation taking typically a matter of two or three weeks to complete. For each dwelling the highest noise level that is calculated for storage bund formation would be reached only on a few days.

Temporary operations are exempted from the nominal daytime noise limit in the PPGM but should conform with a site noise limit of 70 dB $L_{Aeq, 1 hour, free field}$ at dwellings.

Operations with noise levels exceeding the corresponding daytime noise limit for routine operations should not exceed a total of eight weeks duration at any noise sensitive properties in any twelve month period.

The highest $L_{Aeq,T}$ noise levels expected from the closest temporary operations in the proposed extraction and infill area, with one set of equipment as set out in the calculation sheets in Appendix H, are shown in the following table.

Site Noise Calculation Receiver Location	Calculated Site Noise Level dB $L_{Aeq, 1\ hour, free\ field}$ (Temporary Operations)	Site Noise Limit (Temporary Operations) dB $L_{Aeq, 1\ hr\ free\ field}$
1. Broom Cottage	68	70
2. South Lodge	70	70
3. Heathfield Knoll	60	70
4. Brown Westhead Park	63	70
5. McDonalds Bungalow	66	70
6. Keeper's Cottage	54	70
7. Castle Barns	58	70

The proposals comply with a 70 dB $L_{Aeq, 1\ hour, free\ field}$ noise limit for temporary works in line with current Government guidance.

7 Summary and Conclusions

As part of a planning application for the proposed extraction and processing of sand and gravel and progressive restoration (using soils/overburden and imported inert material) at Lea Castle Farm near Wolverley, Worcestershire, a noise assessment has been conducted to establish baseline noise levels, suggest site noise limits at the nearest dwellings to the site and to test compliance with those noise limits to examine the potential noise impact of the proposals.

Noise surveys were conducted in June and July 2018 to obtain information regarding the existing noise environment to inform the suggestion of site noise limits to protect the amenity of the nearest residences to the site.

Site noise calculations have been undertaken for the proposed operations at the quarry.

The extraction, infilling and processing operations have been described and set out in terms of the equipment proposed to be used and typical noise output of the various plant items to be used.

Calculated daytime site noise levels are presented for all expected plant operations in the nearest proposed extraction / infilling area combined with the proposed processing plant site. For most dwellings, the activity in the phases for extraction and infilling would not take place simultaneously at the closest part of the site.

The calculated site noise levels due to operations at the proposed site comply with the suggested site noise limits at the seven chosen assessment locations.

Paul Cockcroft BEng PhD CEng MIMMM FIOA
Senior Partner

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Appendix A – Glossary of Acoustic Terms

General Noise and Acoustics

The following section describes some of the parameters that are used to quantify noise.

Decibels dB

Noise levels are measured in decibels. The decibel is the logarithmic ratio of the sound pressure to a reference pressure ($2x10^{-5}$ Pascals). The decibel scale gives a reasonable approximation to the human perception of relative loudness. In terms of human hearing, audible sounds range from the threshold of hearing (0 dB) to the threshold of pain (140 dB).

A-weighted Decibels dB(A)

The 'A'-weighting filter emulates human hearing response for low levels of sound. The filter network is incorporated electronically into sound level meters. Sound pressure levels measured using an 'A'-weighting filter have units of dB(A) which is a single figure value to represent the overall noise level for the entire frequency range.

A change of 3 dB(A) is the smallest change in noise level that is perceptible under normal listening conditions. A change of 10 dB(A) corresponds to a doubling or halving of loudness of the sound. The background noise level in a quiet bedroom may be around 20 –30 dB(A); normal speech conversation around 60 dB(A) at 1 m; noise from a very busy road around 70-80 dB(A) at 10m; the level near a pneumatic drill around 100 dB(A).

Façade Noise Level

Façade noise measurements are those undertaken near to reflective surfaces such as walls, usually at a distance of 1m from the surface. Façade noise levels at 1m from a reflective surface are normally around 3 dB greater than those obtained under freefield conditions.

Freefield Noise Level

Freefield noise measurements are those undertaken away from any reflective surfaces other than the ground

Frequency Hz

The frequency of a noise is the number of pressure variations per second, and relates to the "pitch" of the sound. Hertz (Hz) is the unit of frequency and is the same as cycles per second. Normal, healthy human hearing can detect sounds from around 20 Hz to 20 kHz.

Octave and Third-Octave Bands

Two frequencies are said to be an octave apart if the frequency of one is twice the frequency of the other. The octave bandwidth increases as the centre frequency increases. Each bandwidth is 70% of the band centre frequency.

Two frequencies are said to be a third-octave apart if the frequency of one is 1.26 times the other. The third octave bandwidth is 23% of the band centre frequency.

There are recognised octave band and third octave band centre frequencies. The octave or third-octave band sound pressure level is determined from the energy of the sound which falls within the boundaries of that particular octave of third octave band.

Appendix A (continued)

Equivalent Continuous Sound Pressure Level $L_{Aeq,T}$

The 'A'-weighted equivalent continuous sound pressure level $L_{Aeq,T}$, is a notional steady level which has the same acoustic energy as the actual fluctuating noise over the same time period T. The $L_{Aeq,T}$ unit is dominated by higher noise levels, for example, the $L_{Aeq,T}$ average of two equal time periods at, for example, 70 dB(A) and 50 dB(A) is not 60 dB(A) but 67 dB(A).

The $L_{Aeq,}$ is the chosen unit of BS 7445-1:2003 "Description and Measurement of Environmental noise".

Maximum Sound Pressure Level L_{Amax}

The L_{Amax} value describes the overall maximum 'A'-weighted sound pressure level over the measurement interval. Maximum levels are measured with either a fast or slow time weighted, denoted as $L_{Amax,f}$ or $L_{Amax,s}$ respectively.

Noise Rating NR

The noise rating level is a single figure index obtained from an octave band analysis of a noise. The NR level is obtained by comparing the octave band sound pressure levels to a set of reference curves and the highest NR curve that is intersected by the sound pressure levels gives the NR level.

Sound Exposure Level L_{AE} or SEL

The sound exposure level is a notional level which contains the same acoustic energy in 1 second as a varying 'A'-weighted noise level over a given period of time. It is normally used to quantify short duration noise events such as aircraft flyover or train passes.

Statistical Parameters L_N

In order to cover the time variability aspects, noise can be analysed into various statistical parameters, i.e. the sound level which is exceeded for N% of the time. The most commonly used are the $L_{A01,T}$, $L_{A10,T}$ and the $L_{A90,T}$.

$L_{A01,T}$ is the 'A'-weighted level exceeded for 1% of the time interval T and is often used to gives an indication of the upper maximum level of a fluctuating noise signal.

$L_{A10,T}$ is the 'A'-weighted level exceeded for 10% of the time interval T and is often used to describe road traffic noise. It gives an indication of the upper level of a fluctuating noise signal. For high volumes of continuous traffic, the $L_{A10,T}$ unit is typically 2–3 dB(A) above the $L_{Aeq,T}$ value over the same period.

$L_{A90,T}$ is the 'A'-weighted level exceeded for 90% of the time interval T, and is often used to describe the underlying background noise level.

Appendix B – Site Location Plan & Noise Survey Locations

Phasing Plan Showing Noise Survey Locations

Location	Description
1. Broom Cottage	Install in rear garden by fence (north of dwelling), by fence for samples
2. South Lodge	On driveway to west of property, ~ 20 m from edge of road
3. Heathfield Knoll	On bridleway opposite school, ~ 15 m from edge of road
4. Brown Westhead Park	By Playing Fields entrance gates, west side of road
5. McDonalds Bungalow	On track in field to west of property
6. Keeper's Cottage	Near tree by entrance and corner of fence, opposite house
7. Castle Barns	Install in field south of garden by telegraph pole, by fence for samples

Appendix C – Instrumentation & Calibration Details (Sample Measurements)

Date and Locations of Survey

Wednesday 27 June 2018

Tuesday 03 July 2018

Wednesday 04 July 2018

Noise measurements locations as described in Appendix B

Surveys carried out by

Dr Robert Storey

Weather Conditions

Date	Weather Condition
Wednesday 27 June 2018	Dry, clear, sunny 22 to 25^{o}C, wind 1 to 3 m/s, E to SE
Tuesday 03 July 2018	Dry, clear, sunny 21 to 26^{o}C, wind 0 to 3 m/s, E to NE
Wednesday 04 July 2018	Dry, clear, sunny 20 to 23^{o}C, virtually calm

Instrumentation used (Serial Number)

Date	Instrumentation
Wednesday 27 June 2018, Tuesday 03 July 2018 & Wednesday 04 July 2018	Norsonic 140 Sound Level Meter (1404819) Norsonic 1251 Calibrator (33321)

Calibration

The sensitivity of the meter was verified on site immediately before and after the surveys. The measured calibration levels were as follows:

Survey Date	Start Calibration	End Calibration
Wednesday 27 June 2018	113.5 dB(A)	113.3 dB(A)
Tuesday 03 July 2018	113.7 dB(A)	113.5 dB(A)
Wednesday 04 July 2018	113.6 dB(A)	113.6 dB(A)

The meter and calibrator are tested monthly against a Brüel and Kjær Pistonphone, type 4220 (serial number 375806) and a Norsonic Calibrator, type 1253 (serial number 22906) with UKAS approved laboratory certificate of calibration.

In addition, the meter and calibrator undergo traceable calibration at an external laboratory every two years.

The start times of each sample are tabulated with the results in Appendix D.

Appendix D – Baseline Survey Results (Sample Measurements)

Results and Observations

Wednesday 27 June 2018, 12:40 to 15:30

Location	Start Time	Results dB (T = 15 minutes)				Comments / Observations
		$L_{Aeq,T}$	$L_{Amax,f}$	$L_{A10,T}$	$L_{A90,T}$	
6. Keeper's Cottage	12:39	45	66	55	35	Distant road traffic, birdsong, aircraft, breeze in trees, dog barking paused out
7. Castle Barns	13:02	45	61	48	39	Road traffic, birdsong, dog barking, aircraft, local activity
1. Broom Cottage	13:42	52	74	56	41	Road traffic, birdsong, breeze in trees, aircraft, local activity
4. Brown Westhead Park	14:09	50	86	45	36	Distant road traffic, birdsong, breeze in trees, aircraft
2. South Lodge	14:27	55	79	58	47	Road traffic, local activity, birdsong, aircraft
5. McDonalds Bungalow	14:48	45	65	47	35	Distant road traffic, breeze in trees, aircraft, local activity
3. Heathfield Knoll	15:12	55	67	58	50	Road traffic, birdsong, breeze in trees, aircraft

Appendix D (continued)

Results and Observations

Tuesday 03 July 2018, 10:30 to 15:05

Location	Start Time	Results dB (T = 15 minutes)				Comments / Observations
		$L_{Aeq,T}$	$L_{Amax,f}$	$L_{A10,T}$	$L_{A90,T}$	
1 Broom Cottage	10:32	51	71	55	43	Road traffic, breeze in trees, aircraft, birdsong
4 Brown Westhead Park	10:51	58	86	51	38	Road traffic, birdsong, breeze in trees, aircraft, local cars
2 South Lodge	11:09	54	72	57	48	Road traffic, birdsong, breeze in trees, aircraft
3 Heathfield Knoll	11:28	55	64	58	48	Road traffic, breeze in trees, birdsong, aircraft
5 McDonalds Bungalow	11:51	44	64	47	37	Distant road traffic, birdsong, breeze in these, local activity
7 Castle Barns	12:12	46	58	49	43	Road traffic, breeze in trees, birdsong, aircraft
6 Keeper's Cottage	12:31	48	68	50	41	Distant road traffic, breeze in trees, birdsong, dog barking
1 Broom Cottage	12:53	50	65	54	40	Road traffic, breeze in trees, birdsong
4 Brown Westhead Park	13:11	53	87	46	37	Distant road traffic, birdsong, breeze in trees, local activity
2 South Lodge	13:29	54	67	57	47	Road traffic, breeze in trees, birdsong
3 Heathfield Knoll	13:48	54	67	57	46	Road traffic, breeze in trees, birdsong, voices at school
5 McDonalds Bungalow	14:11	43	63	46	36	Distant road traffic, birdsong, breeze in trees
7 Castle Barns	14:31	46	60	48	42	Road traffic, breeze in trees, birdsong, local activity
6 Keeper's Cottage	14:50	47	64	48	40	Distant road traffic, birdsong, breeze in trees, aircraft, dog

Appendix D (continued)

Results and Observations

Wednesday 04 July 2018, 10:30 to 13:15

Location	Start Time	Results dB (T = 15 minutes)				Comments / Observations
		$L_{Aeq,T}$	$L_{Amax,f}$	$L_{A10,T}$	$L_{A90,T}$	
1 Broom Cottage	10:30	51	65	55	40	Road traffic, birdsong, activity at property
4 Brown Westhead Park	11:03	47	79	44	34	Distant road traffic, birdsong, slight movement in trees, local cars and other activity
2 South Lodge	11:21	56	77	58	46	Road traffic, birdsong, slight breeze in trees, aircraft
3 Heathfield Knoll	11:40	54	65	57	47	Road traffic, birdsong
5 McDonalds	12:07	37	62	38	31	Distant road traffic, birdsong
7 Castle Barns	12:30	40	63	41	33	Distant road traffic, birdsong, aircraft, slight breeze in trees
6 Keeper's Cottage	12:59	53	71	53	39	Distant road traffic, birdsong, local activity, dog barking

Appendix E – Instrumentation & Calibration Details (Installed Meters)

Date and Locations of Installation Survey

Wednesday 27 June 2018 to Wednesday 04 July 2018

Meters installed at:

Castle Barns at the rear (south) of the property; and

Broom Cottage in the garden (north) of the property

Meters installed and collected by

Dr Robert Storey

Weather Conditions

See Appendix G for Weather Station Data

Instrumentation used (Serial Number)

Location	**Instrumentation**
Castle Barns	RION NL-52 Sound Level Meter (420716)
	RION NC-74 Calibrator (34425557)
Broom Cottage	RION NL-52 Sound Level Meter (420715)
	RION NC-74 Calibrator (34425556)

Calibration

The sensitivity of the meters was verified on site immediately before and after the surveys. The measured calibration levels were as follows:

Location	**Start Calibration**	**End Calibration**
Castle Barns	93.8 dB(A)	93.9 dB(A)
Broom Cottage	94.0 dB(A)	94.0 dB(A)

The meter and calibrator are tested monthly against a Brüel and Kjær Pistonphone, type 4220 (serial number 375806) and a Norsonic Calibrator, type 1253 (serial number 22906) with UKAS approved laboratory certificate of calibration.

In addition, the meter and calibrator undergo traceable calibration at an external laboratory every two years.

The detailed results from the installed sound level meters are tabulated in Appendix F.

Appendix F – Survey Results (Installation)

Position – Castle Barns

Wednesday 27 June 2018 to Wednesday 04 July 2018

Date	Start Time	$L_{Aeq,T}$	$L_{Amax,f}$	$L_{A10,T}$	$L_{A90,T}$
27.06.18	13:30	47	79	47	39
	13:45	45	61	47	40
	14:00	45	62	48	40
	14:15	44	56	46	39
	14:30	49	66	53	44
	14:45	48	63	51	42
	15:00	48	63	51	42
	15:15	45	58	49	39
	15:30	43	52	45	40
	15:45	44	56	47	40
	16:00	47	65	49	40
	16:15	45	56	48	41
	16:30	46	59	49	42
	16:45	48	63	51	43
	17:00	47	60	49	43
	17:15	47	64	48	42
	17:30	46	55	48	43
	17:45	47	60	49	43
	18:00	47	57	49	43
	18:15	47	68	49	43
	18:30	48	59	50	44
	18:45	46	57	49	42
	19:00	47	63	50	42
	19:15	50	71	52	44
	19:30	51	72	54	43
	19:45	47	62	50	42
	20:00	47	59	50	42
	20:15	48	60	51	43
	20:30	46	63	49	41
	20:45	48	71	50	41
	21:00	48	66	49	41
	21:15	47	61	50	41
	21:30	46	64	49	41
	21:45	47	65	50	39
	22:00	46	61	49	41
	22:15	46	63	49	39
	22:30	44	56	47	38
	22:45	47	66	48	36
	23:00	43	58	46	37
	23:15	40	53	44	30

	23:30	41	57	44	31
	23:45	38	53	42	28
28.06.18	00:00	37	52	40	26
	00:15	39	53	44	27
	00:30	36	53	40	24
	00:45	34	49	38	22
	01:00	33	48	37	23
	01:15	37	51	41	27
	01:30	35	50	39	24
	01:45	36	55	38	23
	02:00	33	48	37	22
	02:15	34	49	38	22
	02:30	36	54	39	21
	02:45	35	51	38	21
	03:00	32	45	36	24
	03:15	35	53	39	24
	03:30	36	50	41	24
	03:45	39	54	43	28
	04:00	40	55	45	29
	04:15	40	53	44	31
	04:30	42	58	46	34
	04:45	41	57	44	36
	05:00	44	67	45	37
	05:15	45	64	47	38
	05:30	45	61	47	39
	05:45	42	56	44	38
	06:00	44	59	47	40
	06:15	43	53	46	39
	06:30	44	55	46	40
	06:45	45	60	47	42
	07:00	46	59	48	42
	07:15	46	58	49	43
	07:30	47	61	50	43
	07:45	46	61	48	43
	08:00	46	64	48	42
	08:15	47	60	50	42
	08:30	48	64	51	43
	08:45	46	59	47	41
	09:00	44	60	46	39
	09:15	48	60	51	42
	09:30	45	69	46	40
	09:45	48	66	49	40
	10:00	41	53	43	38
	10:15	41	55	44	37
	10:30	43	57	45	37

10:45	42	63	43	38
11:00	42	58	45	38
11:15	42	57	44	38
11:30	41	54	43	38
11:45	41	53	44	38
12:00	43	60	43	38
12:15	43	62	43	36
12:30	40	55	42	37
12:45	49	69	51	40
13:00	43	55	47	38
13:15	45	63	47	38
13:30	42	58	45	38
13:45	45	68	46	39
14:00	44	54	47	39
14:15	42	54	45	39
14:30	51	72	48	39
14:45	43	53	46	39
15:00	46	60	49	39
15:15	44	52	47	41
15:30	43	52	46	39
15:45	44	53	46	42
16:00	44	52	47	40
16:15	45	67	47	42
16:30	46	65	48	42
16:45	46	75	46	43
17:00	46	61	49	43
17:15	47	65	49	43
17:30	47	59	49	44
17:45	47	59	50	43
18:00	46	59	48	43
18:15	47	62	49	43
18:30	50	66	53	45
18:45	49	62	52	43
19:00	47	65	50	42
19:15	46	63	48	41
19:30	45	63	48	40
19:45	45	57	49	39
20:00	46	60	49	40
20:15	44	58	47	38
20:30	47	67	49	39
20:45	45	60	48	40
21:00	46	63	49	40
21:15	44	54	47	40
21:30	46	65	49	40
21:45	46	56	49	41

	22:00	45	56	49	40
	22:15	43	52	46	37
	22:30	42	53	45	37
	22:45	42	50	45	36
	23:00	42	54	46	33
	23:15	42	55	45	35
	23:30	42	56	46	30
	23:45	40	55	45	29
29.06.18	00:00	40	54	44	30
	00:15	37	53	40	26
	00:30	37	51	41	24
	00:45	35	51	39	25
	01:00	36	52	41	23
	01:15	57	73	58	30
	01:30	53	77	46	25
	01:45	37	56	40	23
	02:00	31	46	35	23
	02:15	34	50	39	21
	02:30	33	49	38	20
	02:45	30	51	35	20
	03:00	31	47	36	22
	03:15	32	48	36	22
	03:30	37	57	40	25
	03:45	39	55	43	26
	04:00	38	55	41	29
	04:15	38	50	41	31
	04:30	40	54	43	35
	04:45	42	55	45	36
	05:00	42	58	45	36
	05:15	42	54	45	38
	05:30	45	60	49	39
	05:45	45	72	45	39
	06:00	44	59	47	41
	06:15	44	56	46	40
	06:30	45	60	47	42
	06:45	45	59	47	42
	07:00	48	66	49	43
	07:15	46	60	48	43
	07:30	48	68	51	44
	07:45	47	61	50	44
	08:00	45	55	47	43
	08:15	45	52	47	42
	08:30	47	72	49	42
	08:45	45	56	48	41
	09:00	44	60	46	40

09:15	45	60	46	40
09:30	44	61	47	40
09:45	44	56	46	41
10:00	43	55	45	41
10:15	44	57	46	41
10:30	44	57	46	41
10:45	44	56	47	41
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11:30	52	75	48	41
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15:15	47	60	50	42
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16:30	50	71	52	44
16:45	47	62	50	43
17:00	47	56	49	45
17:15	48	64	49	43
17:30	47	54	49	44
17:45	48	55	50	44
18:00	48	56	50	45
18:15	54	72	56	45
18:30	51	67	53	47
18:45	48	58	50	44
19:00	53	69	56	46
19:15	49	62	51	44
19:30	48	63	50	43
19:45	48	57	50	43
20:00	47	57	50	42
20:15	47	58	50	42

	20:30	47	58	50	42
	20:45	46	57	49	42
	21:00	46	57	50	40
	21:15	45	61	48	39
	21:30	44	56	48	39
	21:45	44	57	47	38
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	23:15	42	55	46	34
	23:30	39	50	42	34
	23:45	38	50	41	32
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	00:30	47	76	44	30
	00:45	40	56	45	29
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	01:30	35	50	39	24
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	03:30	37	58	41	27
	03:45	39	57	43	27
	04:00	42	55	46	31
	04:15	41	55	45	31
	04:30	38	54	41	30
	04:45	41	58	45	33
	05:00	40	54	44	33
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	05:45	43	59	47	35
	06:00	42	58	46	35
	06:15	42	55	46	35
	06:30	42	57	46	36
	06:45	41	62	44	36
	07:00	46	71	47	37
	07:15	41	61	44	35
	07:30	42	52	45	39

07:45	43	57	46	38
08:00	45	59	47	40
08:15	44	60	46	40
08:30	45	61	47	39
08:45	49	63	52	42
09:00	50	69	53	43
09:15	51	73	52	42
09:30	46	62	48	40
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10:00	45	70	46	40
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11:15	45	55	48	41
11:30	48	60	50	44
11:45	47	59	50	43
12:00	49	58	51	44
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12:45	48	61	51	43
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13:45	46	57	49	42
14:00	47	56	50	42
14:15	48	62	50	44
14:30	49	66	51	44
14:45	46	54	48	43
15:00	47	58	50	42
15:15	47	57	49	43
15:30	47	61	50	42
15:45	46	60	49	40
16:00	46	57	49	42
16:15	46	55	49	41
16:30	50	68	51	43
16:45	46	59	48	42
17:00	49	68	50	42
17:15	47	59	50	42
17:30	47	62	50	43
17:45	47	59	49	42
18:00	47	69	49	42
18:15	47	58	50	44
18:30	47	58	49	43
18:45	46	61	49	42

	19:00	49	67	51	43
	19:15	48	63	51	42
	19:30	48	61	50	43
	19:45	47	60	50	42
	20:00	47	59	49	42
	20:15	49	74	50	42
	20:30	45	55	48	40
	20:45	45	58	48	40
	21:00	45	57	48	39
	21:15	45	58	48	40
	21:30	44	67	47	38
	21:45	44	56	47	38
	22:00	42	53	46	36
	22:15	42	53	45	37
	22:30	41	51	44	35
	22:45	42	55	45	35
	23:00	43	55	46	38
	23:15	42	52	45	35
	23:30	41	54	45	35
	23:45	40	54	44	33
01.07.18	00:00	41	55	45	33
	00:15	41	56	45	32
	00:30	40	55	44	31
	00:45	38	50	42	29
	01:00	37	49	41	29
	01:15	40	54	44	28
	01:30	34	52	38	23
	01:45	35	51	39	24
	02:00	37	54	42	24
	02:15	32	50	36	21
	02:30	35	49	38	25
	02:45	34	49	38	22
	03:00	28	48	32	20
	03:15	31	46	35	22
	03:30	30	44	34	23
	03:45	37	52	42	23
	04:00	40	52	45	27
	04:15	37	53	41	27
	04:30	37	53	41	29
	04:45	41	62	39	31
	05:00	42	59	44	34
	05:15	41	58	44	33
	05:30	46	64	47	36
	05:45	42	58	44	36
	06:00	42	59	45	35

06:15	48	69	49	37
06:30	43	66	44	36
06:45	40	53	43	33
07:00	42	61	45	36
07:15	42	63	44	38
07:30	41	58	44	36
07:45	43	58	46	38
08:00	42	55	45	37
08:15	43	59	45	37
08:30	50	75	49	39
08:45	45	69	46	37
09:00	41	52	44	37
09:15	43	59	45	39
09:30	42	58	45	39
09:45	48	68	47	39
10:00	44	69	47	39
10:15	43	61	45	40
10:30	44	56	46	39
10:45	44	58	46	40
11:00	43	55	46	41
11:15	44	54	46	41
11:30	47	59	50	42
11:45	47	59	51	42
12:00	46	58	50	40
12:15	45	61	47	40
12:30	43	53	45	40
12:45	44	55	46	40
13:00	44	59	46	40
13:15	42	59	45	38
13:30	44	53	47	39
13:45	45	55	48	40
14:00	44	53	47	40
14:15	46	68	47	39
14:30	44	55	47	40
14:45	43	54	45	39
15:00	45	67	47	38
15:15	45	68	46	38
15:30	45	57	48	40
15:45	43	57	45	39
16:00	43	68	44	37
16:15	45	64	47	40
16:30	47	73	47	40
16:45	52	87	48	39
17:00	51	83	47	40
17:15	49	79	47	40

	17:30	48	68	51	42
	17:45	45	58	47	41
	18:00	51	83	49	41
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	00:45	33	56	35	24
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	23:45	36	50	41	25
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11:30	41	61	43	35
11:45	38	62	40	34
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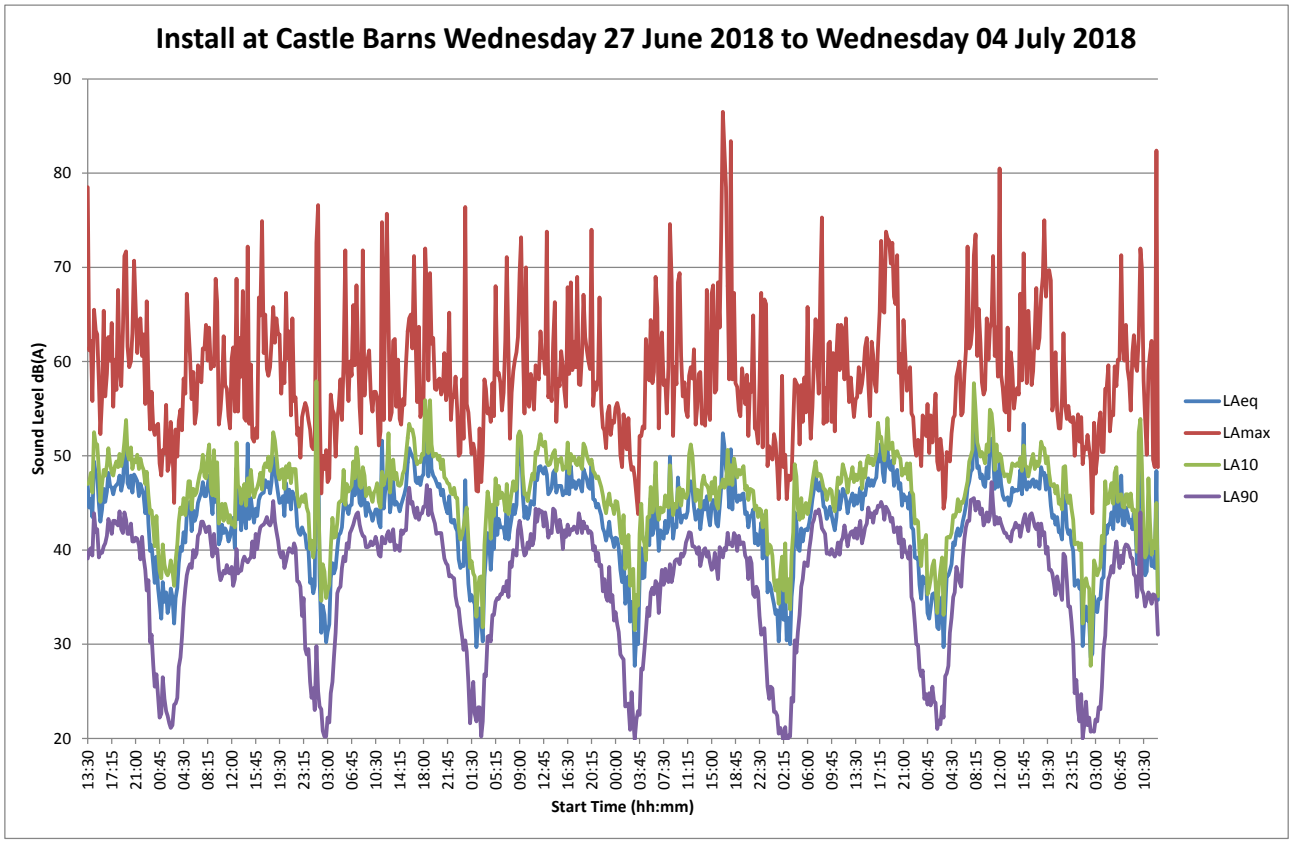
12:30	48	82	45	35
12:45	35	49	35	31


Install at Castle Barns Wednesday 27 June 2018 to Wednesday 04 July 2018
Sound Level dB(A)
90
80
70
60
50
40
30
20
13:30
17:15
21:00
00:45
04:30
08:15
12:00
15:45
19:30
23:15
03:00
06:45
10:30
14:15
18:00
21:45
01:30
05:15
09:00
12:45
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20:15
00:00
03:45
07:30
11:15
15:00
18:45
22:30
02:15
06:00
09:45
13:30
17:15
21:00
00:45
04:30
08:15
12:00
15:45
19:30
23:15
03:00
06:45
10:30
Start Time (hh:mm)
LAeq
LAmax
LA10
LA90

Appendix F continued

Position – Broom Cottage

Wednesday 27 June 2018 to Wednesday 04 July 2018

Date	Start Time	$L_{Aeq,T}$	$L_{Amax,f}$	$L_{A10,T}$	$L_{A90,T}$
27.06.18	14:00	53	76	56	42
	14:15	51	64	55	41
	14:30	52	64	55	42
	14:45	52	62	56	43
	15:00	54	68	57	44
	15:15	52	68	56	41
	15:30	53	71	56	45
	15:45	54	69	57	45
	16:00	53	65	57	44
	16:15	53	67	57	44
	16:30	53	61	56	44
	16:45	54	65	57	44
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	17:45	53	64	57	43
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	18:30	54	67	58	44
	18:45	53	71	57	44
	19:00	54	71	57	42
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	22:45	49	72	53	36
	23:00	49	67	53	35
	23:15	46	61	50	31
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	23:45	44	62	47	27

28.06.18	00:00	41	62	44	26
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	01:30	38	59	39	23
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	02:00	36	60	33	24
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	02:30	38	63	35	22
	02:45	38	60	37	22
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	03:15	38	60	35	24
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	03:45	38	59	40	26
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	04:30	46	66	49	36
	04:45	45	62	48	36
	05:00	53	66	58	34
	05:15	57	82	60	36
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	05:45	49	66	53	36
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	06:45	53	68	58	39
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	07:30	55	67	59	45
	07:45	56	71	59	47
	08:00	55	70	58	46
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	08:45	54	69	58	45
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	10:00	52	66	56	42
	10:15	52	68	55	40
	10:30	52	67	56	40
	10:45	51	65	55	39
	11:00	51	64	55	41

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11:45	51	63	55	40
12:00	51	60	56	40
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12:30	51	62	55	38
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22:00	48	62	53	37
22:15	48	61	52	35

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	00:45	41	60	42	25
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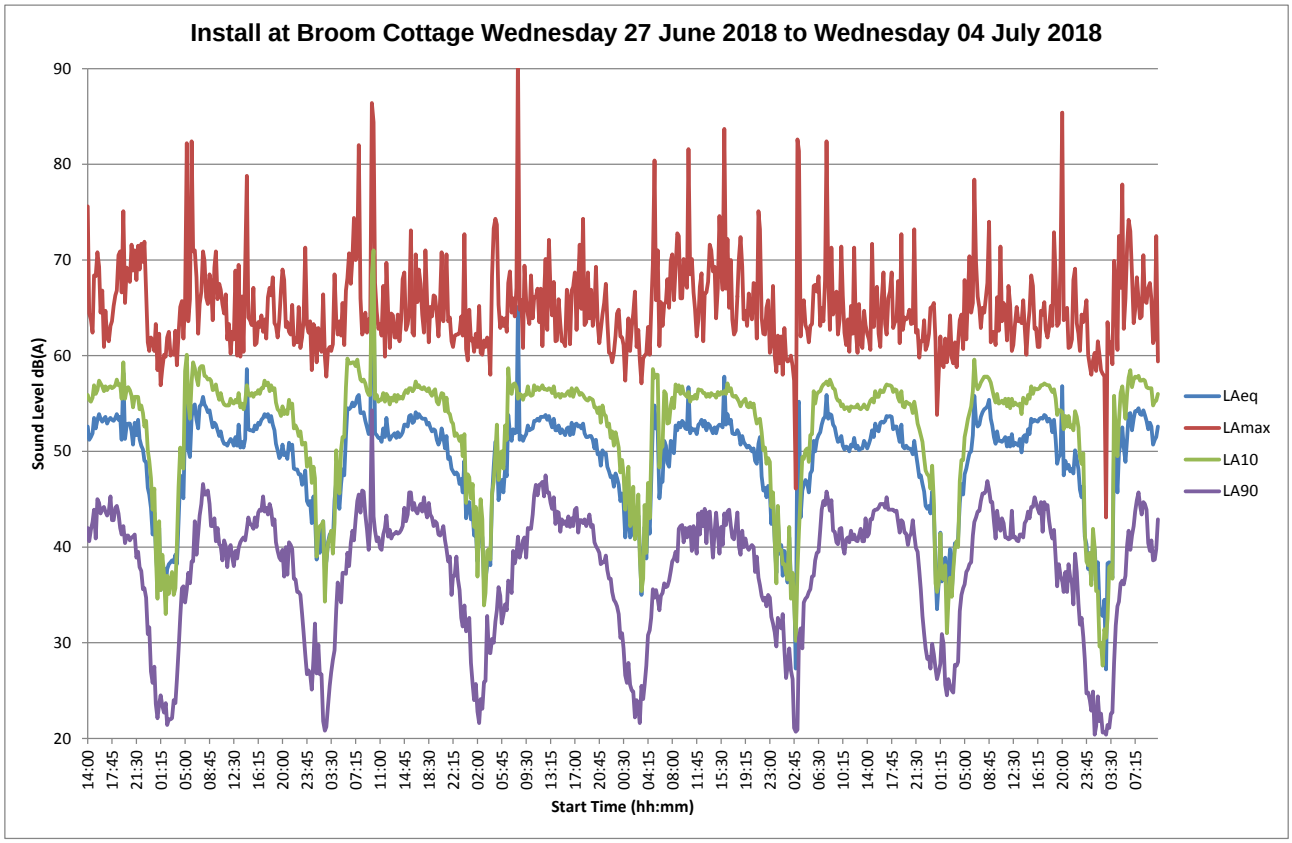
Install at Broom Cottage Wednesday 27 June 2018 to Wednesday 04 July 2018
Sound Level dB(A)
90
80
70
60
50
40
30
20
14:00
17:45
21:30
01:15
05:00
08:45
12:30
16:15
20:00
23:45
03:30
07:15
11:00
14:45
18:30
22:15
02:00
05:45
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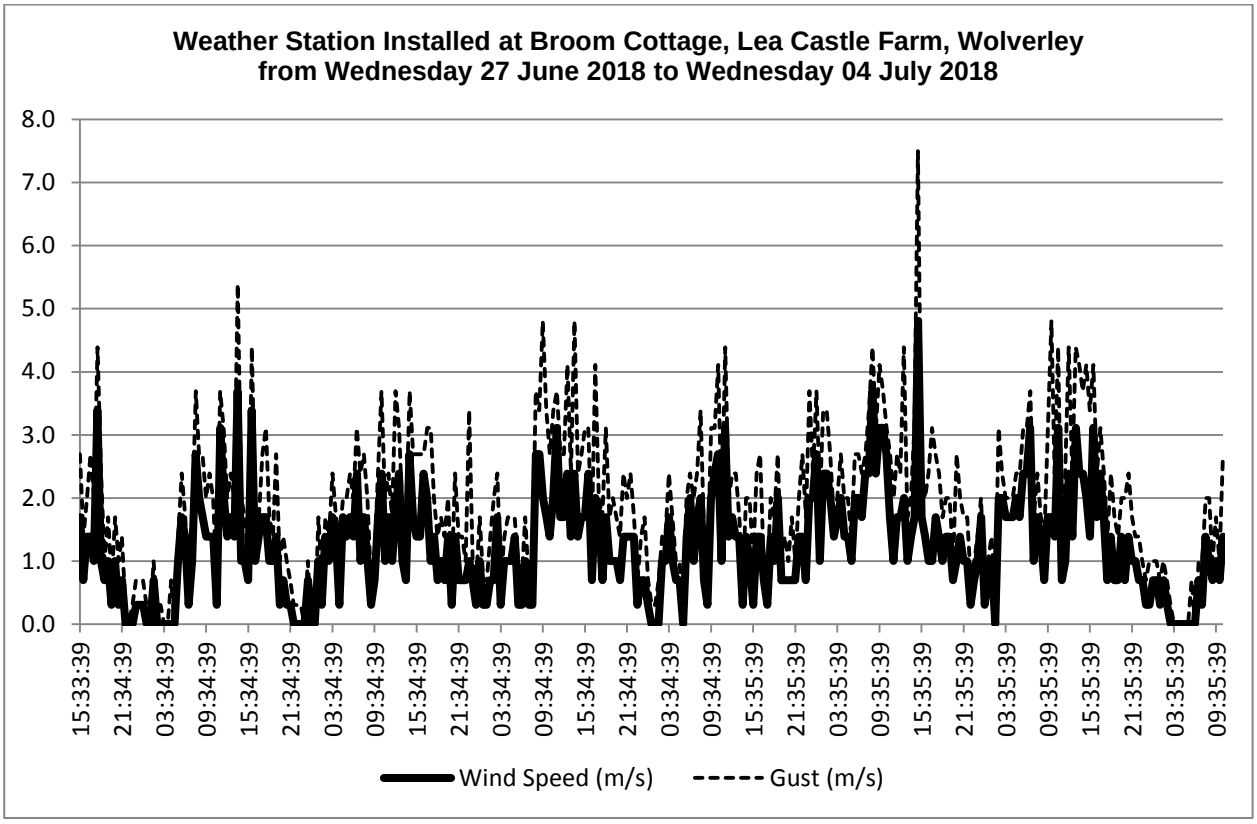
10:15
14:00
17:45
21:30
01:15
05:00
08:45
12:30
16:15
20:00
23:45
03:30
07:15
Start Time (hh:mm)
LAeq
LAmax
LA10
LA90

Appendix G – Weather Station Data

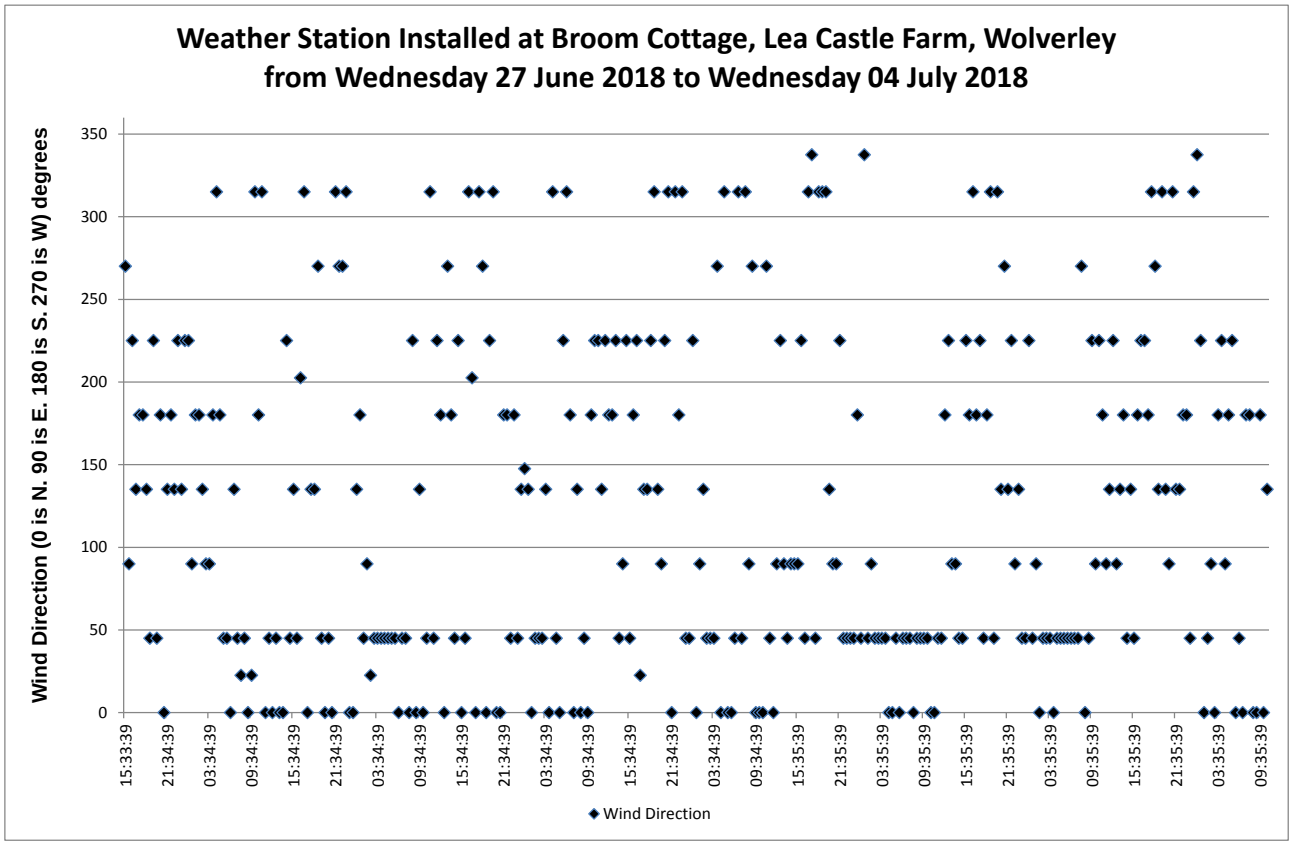
The measured wind speed data and wind direction from the weather station installed at Broom Cottage from Wednesday 27 June 2018 to Wednesday 04 July 2018 is downloaded from the weather station in tabular form but is presented graphically for ease of viewing.

Wind Speed (m/s)



Appendix G continued

Wind Direction (degrees)



Appendix H – Noise Calculation Method and Calculation Sheet

Specific noise levels are predicted or measured in terms of the Equivalent Continuous Noise Level, $L_{Aeq,T}$ over a given reference time interval, T. In the Planning Practice Guidance for Minerals the time interval for daytime, evening and night the reference time interval is 1 hour.

The calculation method for any plant which is relatively fixed in location is that set out in BS 5228-1: 2009 + A1: 2014, Annex F, and is the "Method for activity L_{Aeq}" described in section F.2.2 or the "*Method for plant sound power level*" described in section F.2.3.

The calculation method for site mobile plant such as lorries and dump trucks is that set out in BS 5228-1: 2009 + A1: 2014, Annex F, and is the "*Method for mobile plant using a regular well defined route (e. g. haul roads)*" described in section F. 2. 5.

Ground Absorption has been calculated using the technique set out in BS 5228-1: 2009 + A1: 2014, Annex F, assuming 90% soft ground between the site and the receiver locations.

The method of assessing screening is that attributed to Maekawa as used in BS 5228-1: 2009 + A1: 2014, Annex F and various other Government published documents. This method uses the calculated path difference and octave band noise data for each noise source over the frequency range stated in BS 5228-1: 2009 + A1: 2014, Annex F.

The effects of ground absorption are not used in the calculations if screening has been assessed and offers a higher attenuation.

The nearest distances to the respective dwellings, from the various items of plant, have been used in an acoustic model for the site to calculate the reasonable worst case $L_{Aeq,T}$ site noise levels.

A summary site noise calculation sheet for one of the receiver locations is included below.

Appendix H (continued)

	NRS Aggregates Limited	**4826**	**11-Sep-19**	**PWC**			Receiver Height :		1.5	m	Infill Working Depth :		0.5	m	
							Plant Site Ground Height :		63.5	m AOD	Mineral Working Depth :		0.5	m	
	Land at Lea Castle Farm near Wolverley														
				Activity	Power LWA	1 hour	Capacity	Source		2 way flow	Speed	10		BS5228	
Ref	Plant Item	Comments on Plant		LAeq @ 10 m	or LWA / m	On-time %	Tonnes	Height		Q per hour	V kph	Plant Set back(m)		method	
1	Excavator for sand and gravel extraction			76	104	50		2				10	m back	1	Activity
2	Excavator loading dump truck			76	104	50		2				20	m back	1	Activity
3	Loading shovel at processing plant			78	106	100		2				0	m back	1	Activity
4	Duo processing plant - crusher & sand plant			78	106	100		5				0	m back	1	Activity
5	Duo processing plant - screen & conveyors			78	106	100		6				0	m back	1	Activity
6	Dump trucks to and from processing plant			78	106	100		2		6	15	0	m back	4	Haul Road
7	Lorries for imported inert material			76	104	100		2		8	15	0	m back	4	Haul Road
8	Dozer to profile imported inert material			80	108	75		2				10	m back	1	Activity
9	Lorries on site access road			76	104	100		2		16	25	0	m back	4	Haul Road
10	Plant Item 10			-1027	-999	100		2				0	m back	1	Activity
11	Plant Item 11			-1027	-999	100		2				0	m back	1	Activity
12	Plant Item 12			-1027	-999	100		2				0	m back	1	Activity
13	Excavator for temporary works			76	104	100		2				5	m back	1	Activity
14	Dump trucks for temporary works			78	106	100		2				10	m back	1	Activity
15	Dozer for temporary works			80	108	100		2				15	m back	1	Activity
	Location No.	**1**	**Broom Cottage**												
	Receiver Height	74.5	m AOD												
								Suggested Site Noise Limit							
	Site Noise Level for Items 1 to 6 and 9	47	dB LAeq, 1 hour, free field		Extraction & processing			53	dB LAeq, 1 hour, free field						
	Site Noise Level for Items 3 to 5 and 7 to 9	49	dB LAeq, 1 hour, free field		Infill & processing			53	dB LAeq, 1 hour, free field						
	Site Noise Level for Items 1 to 9	**51**	**dB LAeq, 1 hour, free field**		**Extraction, infill & processing**			**53**	**dB LAeq, 1 hour, free field**						
	Site Noise Level for Items 13 to 15	68	dB LAeq, 1 hour, free field		Temporary works			70	dB LAeq, 1 hour, free field						
Ref	Plant Item	Plan	Working	Ground	Working	Source	Angle	Range	Barrier	Barrier	Path	Barrier	Soft	Ground	Resultant
		Distance	Distance	Height	Height/depth	Height	Degrees	Metres	-Receiver	Height	Diff.	Atten.	Ground %	Atten.	LAeq
1	Excavator for sand and gravel extraction	70	80	78.0	-0.5	79.5	0	0	50	80.0	0.150	11.9	90.0	2.3	43.0
2	Excavator loading dump truck	70	90	78.0	-0.5	79.5	0	0	50	80.0	0.166	12.2	90.0	2.5	41.7
3	Loading shovel at processing plant	220	220	63.5	0.0	65.5	0	0	70	79.0	0.567	16.9	90.0	4.2	34.3
4	Duo processing plant - crusher & sand plant	220	220	63.5	0.0	68.5	0	0	70	79.0	0.430	16.0	90.0	3.3	35.2
5	Duo processing plant - screen & conveyors	220	220	63.5	0.0	69.5	0	0	70	79.0	0.388	15.6	90.0	2.9	35.6
6	Dump trucks to and from processing plant	100	100	78.0	0.0	80.0	90	0	50	80.0	0.150	11.6	90.0	2.7	34.4
7	Lorries for imported inert material	100	100	78.0	-0.5	79.5	90	0	50	80.0	0.179	13.1	90.0	2.7	32.2
8	Dozer to profile imported inert material	70	80	78.0	-0.5	79.5	0	0	50	80.0	0.150	12.1	90.0	2.3	48.6
9	Lorries on site access road	60	60	75.0	0.0	77.0	180	0	50	80.0	0.690	18.2	90.0	1.7	33.1
10	Plant Item 10	10000	10000	0.0	0.0	2.0	0	0	0	0.0	-1.000	0.0	0.0	0.0	-1087.0
11	Plant Item 11	10000	10000	0.0	0.0	2.0	0	0	0	0.0	-1.000	0.0	0.0	0.0	-1087.0
12	Plant Item 12	10000	10000	0.0	0.0	2.0	0	0	0	0.0	-1.000	0.0	0.0	0.0	-1087.0
13	Excavator for temporary works	40	45	0.0	0.0	2.0	0	0	0	0.0	-1.000	0.0	90.0	1.1	61.8
14	Dump trucks for temporary works	40	50	0.0	0.0	2.0	0	0	0	0.0	-1.000	0.0	90.0	1.3	62.7
15	Dozer for temporary works	40	55	0.0	0.0	2.0	0	0	0	0.0	-1.000	0.0	90.0	1.5	63.7