ARCUS

BARMSTON DEVELOPMENTS

WENTWORTH WAY

NOISE IMPACT ASSESSMENT

DECEMBER 2015

Prepared By:

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1 INTRODUCTION

Arcus Consultancy Services Ltd (Arcus) has been commissioned by Barmston Developments to undertake a noise impact assessment in relation to the development of four commercial units (the Development) at Wentworth Park Industrial Estate, Tankersley.

The aim of the assessment is to ensure any noise generated by the Development is such that the amenity of residents surrounding the Development is not unreasonably impacted. At this stage, the future occupiers of each unit are unknown; as such, this assessment will determine appropriate noise limits for the Development, which may be applied to the Development through planning condition.

A glossary of terms is included at the end of this report.

2 SITE OVERVIEW

The Development consists of four units, each comprising of warehousing, outdoor yards/parking areas and associated office space.

The Development is located in a semi-urban environment, within Wentworth Park Industrial Estate. A number of existing industrial units are located within the estate, primarily to the south and southeast of the Development. The village of Pilley is located to the northeast, which includes the closest residential dwellings to the Development.

A number of major transport links are found in the vicinity of the Development, including the M1 motorway approximately 1 km to the east of the Development, and the A61 some 700 m to the southeast.

3 CONSULTATION

Consultation was undertaken with the Environmental Health Officer (EHO) of Barnsley Metropolitan Borough Council in November 2015 to agree the scope and assessment methodology. The EHO requested that the background sound survey and subsequent assessment be undertaken in accordance with BS4142:2014[1].

It was agreed that a background sound survey would be undertaken at one location in order to inform the assessment. The agreed location was considered representative of the nearby dwellings. Further details of the survey methodology are detailed in Section 5: *Background Sound Survey*.

4 RELEVANT GUIDANCE

The following guidance and standards are pertinent to the assessment:

- The National Planning Policy Framework (NPPF);
- The Noise Policy Statement for England (NPSE);
- Planning Practice Guidance – Noise; and
- BS4142:2014 Methods for Rating and Assessing Industrial and Commercial Sound.

4.1 The National Planning Policy Framework

The NPPF sets out the Government's planning policies for England, providing a framework within which local policies can be developed. The key principle of the NPPF is a presumption in favour of sustainable development. With regards to noise, the NPPF states that sustainable development can be achieved by:

[1] BS4142:2014 Methods for rating and assessing industrial and commercial sound. British Standards Institute, 2014.

- Avoiding noise from giving rise to significant adverse impacts on health and quality of life as a result of new development;
- Mitigating and reducing to a minimum other adverse impacts on health and quality of life arising from noise from new development, including through the use of conditions;
- Recognising 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 uses since they were established; and
- Identifying and protecting areas of tranquillity which have remained relatively undisturbed by noise and are prized for their recreational and amenity value for this reason.

4.2 The Noise Policy Statement for England

The NPSE sets out the role and purpose of noise policy, which is to *"promote good health and good quality of life through the effective management of noise within the context of policy on sustainable development".*

The aims of the NPSE require that:

- Significant adverse effects on health and quality of life are avoided, while taking into account the guiding principles of sustainable development ;
- Adverse impacts on health and quality of life are minimised or mitigated; and
- Where possible, noise management should seek to improve health and quality of life, within the context of Government policy on sustainable development.

Paragraph 2.24 of the NPSE states that in relation to minimising and mitigating adverse impacts:

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

In addition, the NPSE introduces the concepts of NOEL, LOAEL and SOAEL, which are described as follows;

- **NOEL – No Observed Effect Level**
  This is the level below which no effect can be detected. In simple terms, below this level, there is no detectible effect on health and quality of life due to the noise.
- **LOAEL – Lowest Observed Adverse Effect Level**
  This is the level above which adverse effects on health and quality of life can be detected.
- **SOAEL – Significant Observed Adverse Effect Level**
  This is the level above which significant adverse effects on health and quality of life occur.

It goes on to state that it is not possible to have a single noise-based measure that can apply to all sources of noise in all situations, as such SOAEL values are dependent on the site-specific noise sources and receptors.

4.3 Planning Practice Guidance Noise

Planning Practice Guidance was issued in March 2014 and provides additional guidance on the NPPF. It states that Local Authorities should consider the acoustic environment when decision taking, in particular:

- *"whether or not a significant adverse effect is likely to occur;*
- *whether or not an adverse effect is occurring or likely to occur; and*
- *whether or not a good standard of amenity can be achieved."*

In line with the NPSE, the PPG references the LOAEL and SOAEL in relation to noise impact. As with the NPSE, it does not provide objective noise levels for LOAEL or SOAEL, although it does acknowledge that:

"the subjective nature of noise means that there is not a simple relationship between noise levels and the impact on those affected. This will depend on how various factors combine in any particular situation".

It provides examples of these factors, which are summarised below:

- The source and level of noise combined with the time of day the noise occurs;
- The number, frequency and pattern of individual noise events; and
- The spectral content and general character of the noise.

4.4 BS 4142:2014 Methods for Rating and Assessing Industrial and Commercial Sound

BS 4142:2014 describes methods for rating and assessing industrial or commercial sound, in order to provide an indication of the likely impact of potential noise upon nearby premises (typically residential dwellings).

The specific sound emitted from the Development (dB, L_{Aeq}) is rated by taking into account both the level and character (i.e. tonal elements, impulsivity and intermittency) of the sound. This is achieved by applying appropriate corrections to the specific sound level at the receptor location, which gives the rating level of the sound in question. This is then assessed against the existing representative background sound level (dB, L_{A90}) at that location in order to determine a likely level of impact. The level by which the rating level exceeds the representative background sound level indicates the following potential impacts:

- A difference of 10 dB or more is likely to be an indication of a significant adverse impact, depending on context;
- A difference of around 5 dB is likely to be an indication of an adverse impact, depending on the context; and
- Where the rating level does not exceed the background sound level, this is an indication of the specific sound source having a low impact, depending on the context.

5 BACKGROUND SOUND SURVEY

In order to establish the background sound environment in the locality of the Development, a sound survey was undertaken within the Development site boundary, at a location considered to be representative of the background sound level at nearby dwellings. The position of the monitoring location was discussed and agreed with the EHO prior to commencement of the survey.

The monitoring equipment consisted of a Type 1 sound level meter, calibrated to UKAS standards and housed in an all-weather case with long-life batteries. The microphone was positioned at a height of approximately 1.4 m above ground level, within a suitable proprietary windshield. A weather station was also installed on site, to enable any unrepresentative periods of heavy rainfall or wind speeds[2] > 5 ms^{-1} to be excluded from the subsequent data analysis. The sound level meter was field-calibrated at the start and end of the survey period; no significant calibration drift was found.

Noise monitoring was undertaken continuously between 3:30 pm on the 30th of November and 10:40 am on the 4th of December 2015. Various time indices were

[2] 5 ms^{-1} is the maximum wind speed suitable for background noise monitoring in terms of BS4142.

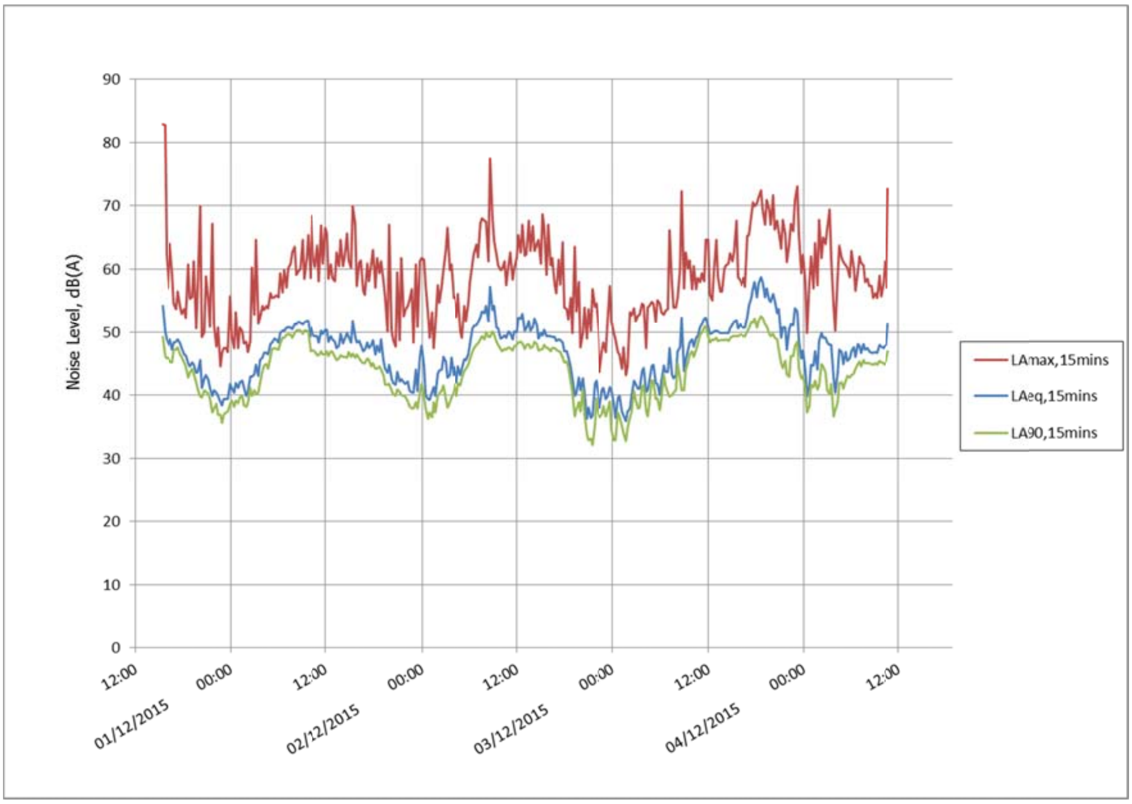
measured by the equipment during the survey period, including $L_{Aeq,15min}$, $L_{A90,15min}$ and $L_{Amax,15min}$.

Survey record sheets showing the grid reference, photographs and specific details of the monitoring location, along with the calibration certificate for the noise monitoring equipment deployed on site can be found in Appendix 1. Figure 1 shows the background sound monitoring location, and an overview of the local area.

5.1 Background Sound Survey Data Analysis

Chart 1 provides a summary of the sound levels measured during the survey period, detailing $L_{Aeq,15min}$, $L_{A90,15min}$ and $L_{Amax,15min}$ sound levels. As can be seen, background noise levels exhibit a typical diurnal pattern, with the quietest background levels found around midnight.

Chart 1: Background Sound Survey Time History



Weather conditions during the survey period were generally suitable for noise monitoring, with wind speeds less than 5 ms^{-1} throughout the survey period. However, some periods were found to be unsuitable due to rainfall. Such periods were identified and excluded from the data analysis process.

In determining the representative background sound level for the purposes of the assessment, BS4142:2014 advises against the assumption that this can be determined from the minimum or average measured value but that it should account for the range of measured avlues.

In light of this, Charts 2 and 3 present a statistical analysis of $L_{A90,15min}$ background noise levels recorded for daytime and night-time periods, along with the percentage of periods for which they occurred. It should be noted that the data set from which Charts 2 and 3 were derived excludes periods of rainfall as described above.

Chart 2: Background Sound Survey Statistical Analysis – Daytime

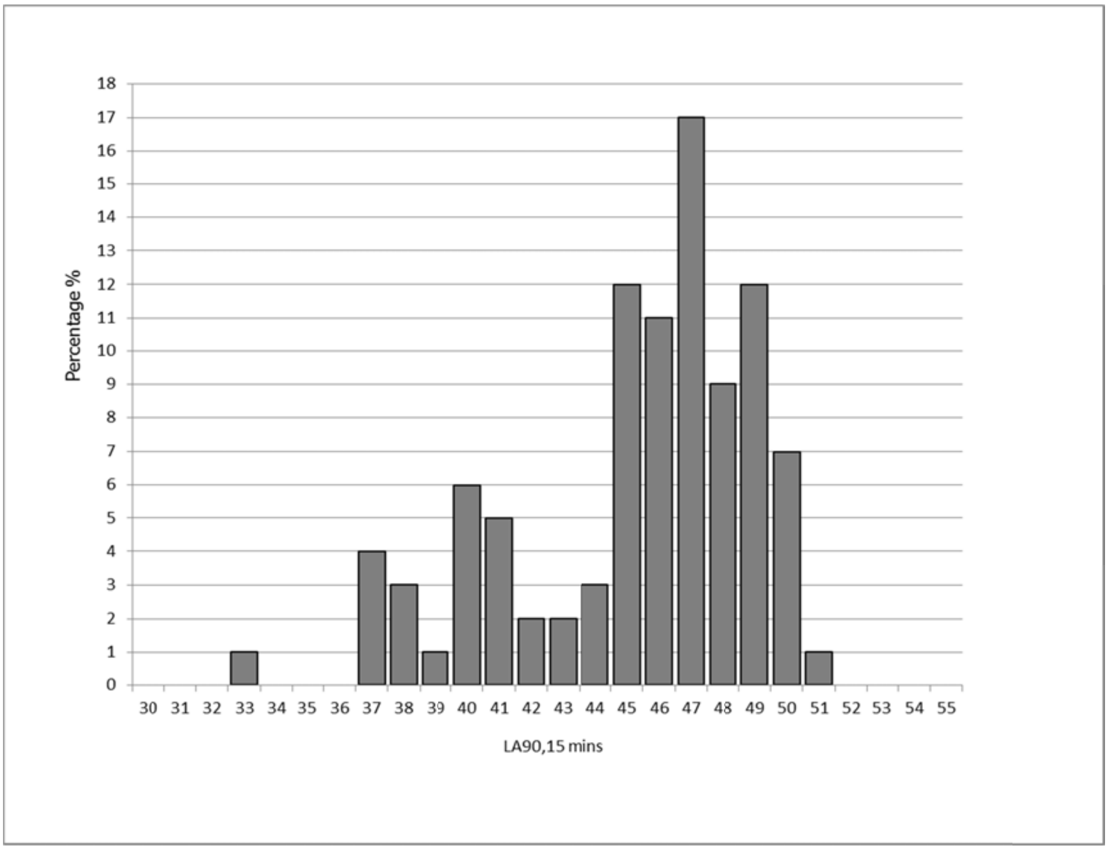
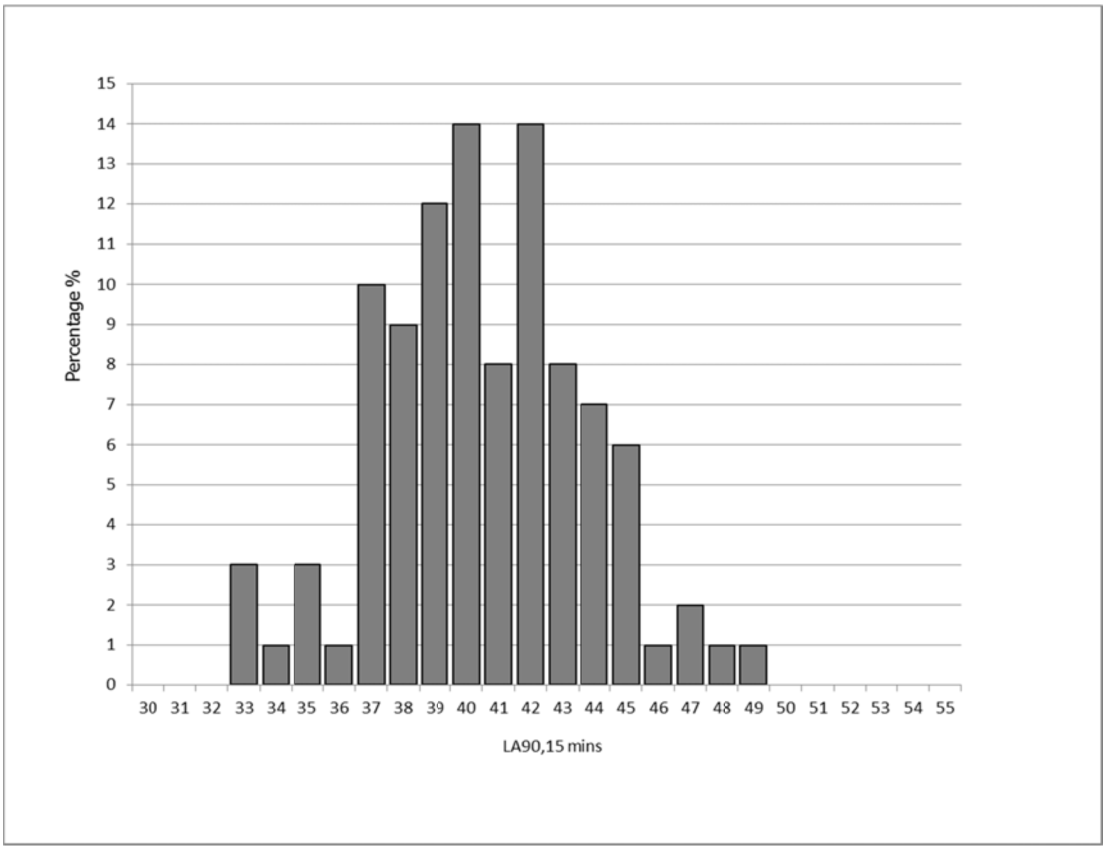


Chart 3: Background Sound Survey Statistical Analysis – Night-time



5.2 Representative Background Sound Levels

A key element of BS4142:2014 is that the specific context of both the Development and the locality should be taken into consideration. As the operating times of the Development are not known at this stage, it is assumed that the Development has the potential to operate at any time.

5.2.1 Daytime

For the range of data shown in Chart 1 above, it is considered that the most commonly occurring (the mode average) value of 47 dB, L_{A90} is not an appropriate representation of the daytime background sound level, as a substantial proportion of the measurement periods identified lower levels. Taking this into account, it is considered that the arithmetic average (mean average) of 45 dB, L_{A90} is an appropriate representative daytime background noise level for the purposes of this assessment.

5.2.2 Night-time

As can be seen from Chart 2, night-time background noise levels are typically around 5 dB lower than daytime levels. This is supported by the arithmetic mean of night-time noise levels of 40 dB, $L_{A90.}$ Furthermore, as 40 dB, L_{A90} is the lower of the two most commonly-occurring values in the dataset, this level is considered to be an appropriate representative sound level for night-time periods.

6 UNCERTAINTY

Uncertainties in the background sound survey were minimised through the steps described in Section 5: Background Sound Survey. The deployment of a weather station allowed any measurement periods affected by high winds or rainfall to be excluded from the subsequent data analysis.

A balanced approach has been taken to the determination of the representative background sound levels. This ensures that the uncertainty associated with the variation in measured background noise levels is accounted for.

7 DISCUSSION

Fixed plant items, such as air handling and cooling units, as well as delivery vehicles are likely to be the main sources of noise from the Development. At this stage of the application, there are no details regarding the location, type, size and operational hours of such items; it is therefore not possible to determine the level of noise impact at this stage. In the absence of such an assessment, noise limits have been derived at the nearby noise sensitive dwellings based on the recommendations in BS4142.

As discussed in Section 4.4 of this report, BS4142 states that the impact of sound from a new development depends upon both the margin by which the rating level exceeds the background sound level and the context in which the sound occurs.

Table 1 details the site-specific rated noise level associated with each BS4142 noise category, based upon the representative L_{A90} background sound levels derived from the background sound survey.

Table 1 – Rated Noise Limit at Nearest Dwelling (33 Carr Lane)

BS4142:2014 Indicative Assessment Category	Site-Specific Rating Level, dB L_{Aeq}	Potential Impact
Daytime (07:00 – 23:00)		
Rating level 10 dB above typical background noise level	55 dB(A) or greater	Indication of a significant adverse impact, dependant on context
Rating level 5 dB above typical background noise level	50 dB(A)	Indication of an adverse effect, dependant on context
Rating level equal to or lower than typical background noise level	45 dB(A) or lower	Indication of the specific sound source having a low impact, dependant on context
Night-time (23:00 – 07:00)		
Rating level 10 dB above typical background noise level	50 dB(A) or greater	Indication of a significant adverse impact, dependant on context
Rating level 5 dB above typical background noise level	45 dB(A)	Indication of an adverse effect, dependant on context
Rating level equal to or lower than typical background noise level	40 dB(A) or lower	Indication of the specific sound source having a low impact, dependant on context

It should be noted that the above criteria provide an indication of impact only; the actual level of impact is dependent on the site specific context, as discussed below;

- The existing background level is typical for a semi-urban environment, and as such the magnitude of impact is likely to be lower than would be found in quieter, rural setting.
- The character of the rated noise from the Development is unlikely to be different from the existing sound due to similar operations already present in the locality. It is therefore considered unlikely that noise from the Development will be distinct from the existing residual sound.
- Due to the existing sound from both the industrial estate, as well as from nearby transport links including the M1 motorway, it is considered that nearby receptors will be less sensitive to a new noise source than would typically be expected.

8 RECOMMENDED NOISE LIMITS

Taking the above discussion into account, it is considered that a noise limit of 5 dB above the representative background level is appropriate for this Development. This equates to a rating level at the boundary of the closest property (33 Carr Lane) of 50 dB, L_{Aeq} between the hours of 07:00 and 23:00, and a rating level of 45 dB, L_{Aeq} at all other times. Such limits are considered to be readily achievable, and appropriate for the scale and type of Development proposed.

Furthermore, the identified noise limits are supported by other guidance, namely the World Health Organisation's *Guidelines for Community Noise*[3], which states that to avoid residents being moderately annoyed during daytime periods, the sound pressure level should not typically exceed 50 dB L_{Aeq}.

[3] Guidelines for Community Noise. World Health Organisation, 1999.

With regard to night-time noise levels, BS 8233:2014[4] states that in order to achieve good sleeping conditions within dwellings, internal sound levels should not exceed 30 dB, L_{Aeq}. It is generally accepted that a window partially open for ventilation provides an attenuation of 15 dB, resulting in an external limit of 45 dB, $L_{Aeq.}$

It should be noted that the suggested noise limits above apply to the Development as a whole (i.e. the combination of noise produced by all four commercial units). Whilst the occupiers of all four units should minimise noise levels as far as practicable, the primary contributor to noise at nearby dwellings will be works undertaken within Unit 1 (the easternmost unit in the proposed Development).

The position of Unit 1 is such that the structure itself will act as an acoustic barrier to noisy operations within Units 2-4. This effect, combined with the greater separation distances of units 2-4 to the closest dwelling, will result in noise from these units having a lower impact (assuming similar operations at each unit).

9 CONCLUSION

Arcus was commissioned by Barmston Developments to undertake a noise impact assessment in relation to the development of four commercial units (the Development) at Wentworth Park Industrial Estate, Tankersley.

As the future occupiers of each unit are unknown the assessment has determined appropriate noise limits, which may be applied to the Development through planning condition.

Suggested noise limits consist of a rating level[5] of 50 dB, $L_{Aeq,1hour}$ at the boundary of the closest property (33 Carr Lane) between the hours of 07:00 and 23:00, and a rating level of 45 dB, $L_{Aeq,15min}$ at all other times.

It is considered that, subject to the suggested noise limits being met, the amenity of local residents is unlikely to be adversely impacted, and the Development would therefore be acceptable in terms of noise.

[4] BS8233:2014 Guidance on sound insulation and noise reduction for buildings. British Standards Institute, 2014.

[5] Rating level to be derived in accordance with the methodology presented in BS4142:2014.

10 GLOSSARY OF TERMS

Background Sound: The background sound level is the underlying level of sound present at a particular location for the majority (usually 90%) of a period of time.

Decibel (dB): The decibel is the basic unit of sound measurement. It relates to the cyclical changes in pressure created by the sound and operates on a logarithmic scale, ranging upwards from 0 dB. 0 dB is equivalent to the normal threshold of hearing at a frequency of 1000 Hertz (Hz). Each increase of 3 dB on the scale represents a doubling of the Sound Pressure, and is typically the minimum noticeable change in sound level under typical listening conditions.

dB(A): Environmental sound levels are usually discussed in terms of dB(A). This is known as the A-weighted sound pressure level, and indicates that a correction factor has been applied, which corresponds to the human ear's response to sound across the range of audible frequencies. The ear is most sensitive in the middle range of frequencies (around 1000-3000 Hz), and less sensitive at lower and higher frequencies. The A-weighted sound level is derived by analysing the level of a sound at a range of frequencies and applying a specific correction factor for each frequency before calculating the overall level. In practice this is carried out automatically within sound measuring equipment by the use of electronic filters, which adjust the frequency response of the instrument to mimic that of the ear.

Frequency: The frequency of a sound is equivalent to its pitch in musical terms. The units of frequency are Hertz (Hz), which represents the number of cycles (vibrations) per second.

$L_{A90,t}$: This term is used to represent the A-weighted sound pressure level that is exceeded for 90% of a period of time, t. This is used as a measure of the background sound level.

$L_{Aeq,t}$: This term is known as the A-weighted equivalent continuous sound pressure level for a period of time, t. It is similar to an average, and represents the sound pressure level of a steady sound that has, over a given period, the same energy as the fluctuating sound in question.

L_{AFmax}: The maximum A-weighted sound pressure level measured over a given period, with a fast time weighting.

Noise: a subjective term meaning sound which is undesirable. May refer to both natural (e.g. wind, birdsong etc.) and artificial sounds (traffic, industrial noise, aircraft etc.).

Rating Level: The specific sound level due to operation of the source in question, plus any adjustment for the characteristic features of the sound

Sound pressure (P): The fluctuations in pressure relative to atmospheric pressure, measured in Pascals (Pa).

Sound pressure level (L_p): Sound pressure measured on the decibel scale, relative to a sound pressure of 2×10^{-5} Pa.

Specific Sound Level: equivalent continuous A-weighted sound pressure level produced by the sound source at the assessment location over a given reference time interval.

Time Weighting: Time weightings determine how quickly the sound level meter responds to changes in sound level, and is generally set to 'Fast' or 'Slow'. A fast time weighting resulting in in the sound level meter sampling every 1/8th second: a slow time weighting results in a sample measurement being taken by the sound level meter every 1 second.

APPENDIX 1: BACKGROUND SOUND SURVEY RECORD SHEETS AND CALIBRATION CERTIFICATE

Noise Survey Record Sheet – Page 1: Location and Equipment Details

Project No:	2223	**Project Name:**	Wentworth Way
Client:	Wilton Developments	**Installed by:**	MS
Location No (x/y):	1/1	**Location Name:**	On-site
Start Date:	30/11/15	**Start Time:**	3.30 pm

Equipment Details	**Make**	**Model**	**Serial No**	**Last calibration Date**
Sound Level Meter:	Rion	NL-31	00593609	30/10/15
Calibrator:	Rion	NC-74	34104515	27/02/15
Source of Equipment:		Arcus		
Meter Timestamp:		**<u>Start</u>** / End	BST / **<u>GMT</u>**	

GPS grid reference of equipment:	SK 33486,99946
Distance from façade::	Approx. 25 m
Noise sources observed:	Traffic, aircraft overhead (raining during equipment install)
Reason for selection as monitoring location:	Sheltered and secure location within the site boundary, close to nearest residential dwelling (33 Carr Lane). Free-field location.
Any restrictions imposed by landowner / occupier:	No
Additional notes:	Also installed weather station to record wind/rainfall during survey.

Noise Survey Record Sheet – Page 2: Visit Record

Project No	2223	Location No. (x/y):	1/1

Installation:

Date:	30/11/15	Time:	3.30 pm
Filename:	0101	Calibration level:	94.0 dB
Range setting:	20-110 dB	Time weighting:	Fast / Slow
Frequency weighting:	A	Rain gauge installed:	Yes
Notes:			

Final Check:

Date:	04/12/15	Time:	10:45 am
Level pre-calibration:	93.8 dB	Calibration level:	94.0 dB
Notes:			

Noise Survey Record Sheet – Page 3: Photographs of Equipment Location

Project No	2223	Location No. (x/y):	1/1




CERTIFICATE OF CALIBRATION

ISSUED BY AV CALIBRATION

Date of issue 30 October 2015 Certificate N° 08748

UKAS CALIBRATION
0653

AV Calibration
2 Warren Court
Chicksands, Shefford
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Tel: +44 (0)1462 638600
Fax: +44 (0)1462 638601
Email: lab@avcalib.co.uk
www.avcalibration.co.uk

Approved Signatory BBaker

G. Parry [ ] B. Baker [✓]

Acoustics Noise and Vibration Ltd trading as AV Calibration

CLIENT	Arcus Consultancy Services Ltd 1C Swinegate Court East York YO1 8AJ
F.A.O.	Martin Stephenson
ORDER No	17765z1148442 Job No UKAS15/10300/01
DATE OF RECEIPT	28 October 2015
PROCEDURE	AV Calibration Engineer's Handbook section 3: verification of sound level meters to BS 7580:Part 1:1997
IDENTIFICATION	Sound level meter Rion type NL-31 serial No 00593609 connected via a preamplifier type NH-21 serial No 30371 to a half-inch microphone type UC-53A serial No 316137. Associated calibrator Rion type NC-74 serial No 35105087 with a one-inch housing and adapter type NC-74-002 for half-inch microphone.
CALIBRATED ON	30 October 2015
PREVIOUS CALIBRATION	Calibrated on 21 August 2013, Certificate No. 07292 issued by this laboratory.

The sound level meter was set to frequency weighting A and adjusted to read 94.1 dB (corresponding to 94.1 dB at standard atmospheric pressure) in response to the sound calibrator supplied. This reading was derived from the Calibration Certificate No. 08452 supplied by this laboratory and manufacturers' information on the free-field response of the sound level meter .

The sound level meter was then tested, and its overall sensitivity adjusted, in accordance with clause 5 of BS 7580:Part 1:1997 **

The acoustic calibration at 1kHz specified in subclause 5.6.1 of the standard was performed by application of a standard sound calibrator, whilst the tests at 125Hz and 8kHz (subclause 5.6.2) were performed by the electrostatic actuator method.

At the end of the test, the sound calibrator was reapplied to the sound level meter and the meter reading was recorded.

RESULTS

The sound level meter was found to conform to BS 7580:Part 1:1997 ** for a type 1 meter.

The self-generated noise recorded in the test specified in subclause 5.5.2 was:

9.5 dB (A) 15.2 dB (C) 22.4 dB (Lin)

The sound level meter reading obtained at the end of the test in response to the sound calibrator was 94.1 dB (corresponding to 94.1 dB at standard atmospheric pressure). This reading, corrected for ambient pressure, should be used henceforth to set up the sound level meter for field use.

The expanded level uncertainty of the Laboratory's 1 kHz sound calibrator used during this verification is ± 0.22 dB; that of the calibrator supplied with the sound level meter is ± 0.22 dB.

The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor *k*=2, providing a level of confidence of approximately 95%. The uncertainty evaluation has been carried out in accordance with UKAS requirements.

All measurement data are held at AV Calibration for a period of at least six years.

Typical case reflection factors specified by the manufacturer have been used for this verification.

The reference range, linearity range and primary indicator range specified by the manufacturer have been used. *See note 6 Below.*

The Rion NL-31 sound level meter design has successfully undergone pattern evaluation at Physikalisch-Technische Bundesanstalt (PTB). It was found to meet the requirements of BS EN 60651* and BS EN 60804* and was granted pattern approval as a Type 1 sound level meter.

No component of uncertainty for manufacturer-specified corrections has been included in the uncertainty budget and, in accordance with Amendment No 1 to BS 7580:Part 1:1997 ** the measured values obtained during the verification have not been extended by any measurement uncertainty when assessing conformance to the standard.

NOTES

*1 BS EN 60651:1994 and BS EN 60804:1994 were formerly numbered BS 5969:1981 and BS 6698:1986 respectively.

**2 BS 7580:Part 1:1997 was formerly numbered BS 7580:1992.

3 No suitable microphone frequency response information was supplied with the instrument. It was therefore measured by this laboratory using the electrostatic actuator method. This response in isolation is not UKAS accredited.

4 The instrument was tested with integral software as received.

5 The NL-31 does not have a "max hold" function available when operating with time weighting I. The results recorded for the test of time weighting I are therefore the highest instantaneous reading shown on the display. Whilst these results meet the requirements of the standard, those for response to a single tone burst in particular may give a misleading impression of the accuracy of time weighting I on this instrument.

6 After consultation with the manufacturer and their European agents, it has been established that the specifications given in the standard English-language handbook for the NL-31 are both incomplete and incorrect. An addendum to the handbook based on the PTB tests has been provided by Rion, and this revised specification has been used for the purposes of the present verification. For information, extracts from the addendum have been appended as page 4 of this certificate.

Any opinions or interpretations which may be expressed in these notes are not UKAS Accredited.

BB

The following data supplied by Rion are included for completeness:

Addendum to the NL-31 Instruction Manual

Errata (page 133):

- Total range: 23 to 137 dB(A).
- Linearity range (on 30 - 120 dB reference range): 99 dB (28 to 127).

Additional information

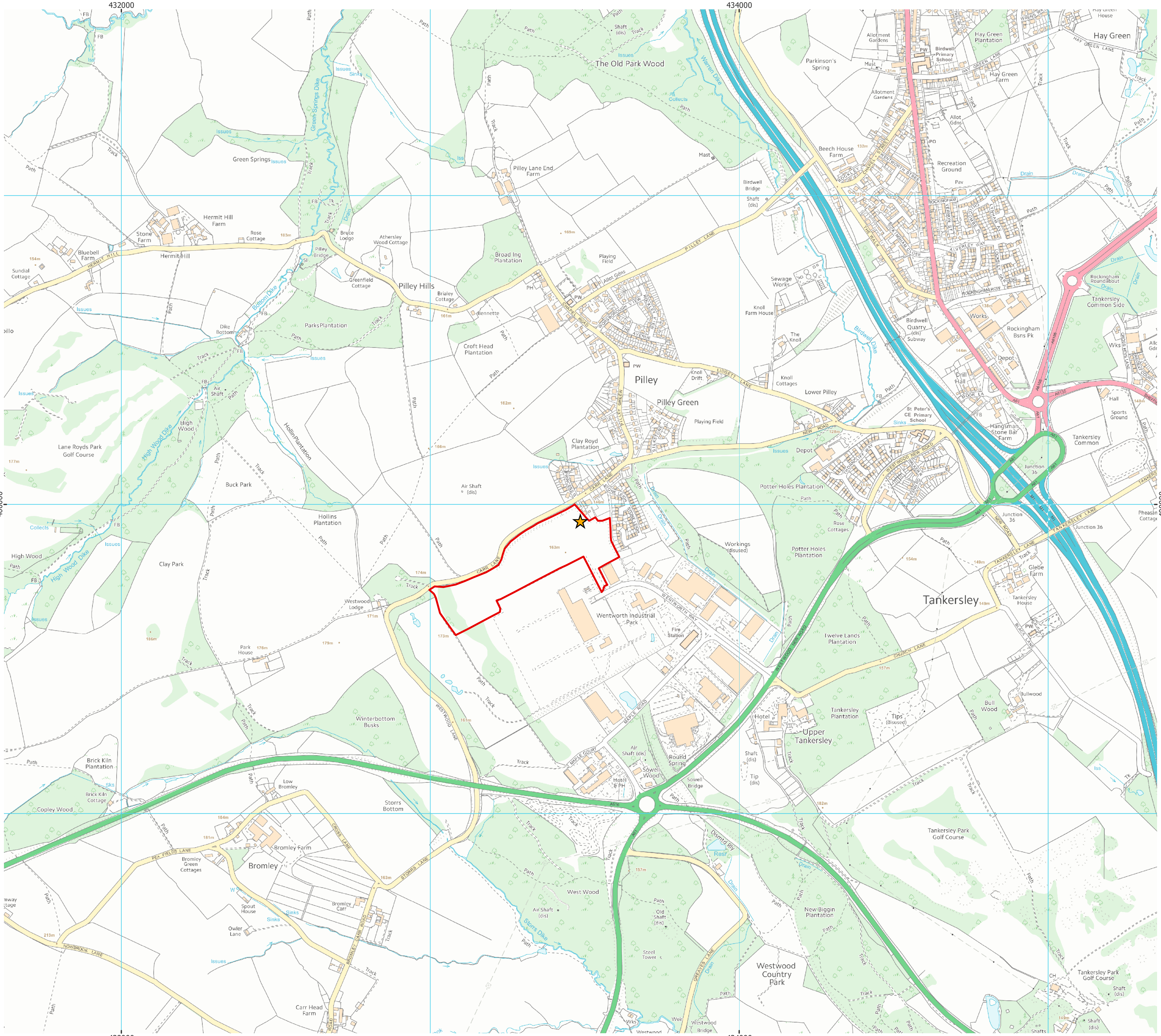
- Primary indicator range (on 30 - 120 dB reference range): 32 - 111 dB, allowing a crest factor of 10 for Impulse time weighting.
- Pulse range: > 63 dB
- Measurement range for various LEVEL settings: See table below.

Measurement ranges				
Measurement range for various "LEVEL" range settings (dB) * Frequency weighting A-, C- and Lin.				
"LEVEL" Setting (dB)	Time weighting			Leq
	Fast/Slow	Impulse	Peak	
20 - 80	23 - 80 **	23 - 70 **	50 - 90	23 - 87 **
20 - 90	23 - 90 **	23 - 80 **	50 - 100	23 - 97 **
20 - 100	23 - 100 **	23 - 90 **	50 - 110	23 - 107 **
20 - 110	23 - 110 **	23 - 100 **	50 - 120	23 - 117 **
30 - 120	28 - 120 **	28 - 110 **	50 - 130	28 - 127 **
40 - 130	38 - 130	38 - 120	50 - 140	38 - 137

* For time weighting Fast and Slow a crest factor 3, and for time weighting Impulse a crest factor 10, is taken into account.
** The lower limit of the measurement range is 30 dB(C) for C-weighting and 35 dB(Lin) for Lin weighting.

END

RB



ARCUS

Development Site Boundary

Background Sound Monitoring Location

1:12,000 Scale @ A3

0 250 500 m

N

Produced: TC
Reviewed: RMc
Approved: AM

Ref: 2223/REP/001

Date: 10/12/2015

Monitoring Location
Figure 1

Wenworth Way
Noise Impact Assessment

N:\Projects\2223 Wentworth Way Landscape\GIS\Document Files\Reports\Noise Impact Assessment\2223_Fig1 Monitoring Location.mxd