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**Noise Impact Assessment
For Additional Power Generation to an
Existing Reserve Power Plant (RPP) Facility**

At

**Miners Road
Llay
Wrexham**

For

Sirius Planning Ltd

Report No.: R18.0506/DRK

Noise & Vibration Consultants Ltd

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A handwritten signature in black ink, appearing to read 'D R Kettlewell', is written over a light grey background.

Date: 9th May 2018

Summary

1. Sirius Planning is proposing to submit a planning application to extend the consented Reserve Power Plant ("RPP") at Miners Road, Llay in Wrexham.
2. At the request of Sirius Planning Ltd, Noise & Vibration Consultants Ltd ("NVC") were originally commissioned to undertake a noise impact assessment to assess the impact and advise (where appropriate) on any noise mitigation measures to meet planning guidance and noise standards for a RPP Facility. Following planning consent for the Site, additional power generation is being proposed to expand the site to include a further 6 generating sets to generate a further 9.95MW of power.
3. Following a study of the local area to the proposed site, the nearest sensitive residential receptors were determined. Noise monitoring was carried out over a weekend period to determine the lowest likely representative background sound levels.
4. The RPP site would only operate during peak power demand when back-up power may be required.
5. Site operational noise has been calculated using noise data for the generators. The assessment has used ISO9613-2 prediction methodology and CadnaA noise modelling software for producing noise contours of the highest likely generated noise with all plant operating (including the approved plant).
6. An assessment of the resultant impacts has been undertaken by applying noise limits determined by appropriate standards for noise (i.e. BS4142: 2014, WHO guidance and BS8233: 2014).

Conclusions

7. Following analysis of noise survey results our conclusions are as follows:
 - (i) The results of baseline noise monitoring over a weekend monitoring period at two locations (in areas providing a representative assessment of background sound level) in the vicinity of sensitive receptors indicate that representative background sound levels between 0700-2300 hours at the monitoring positions vary between 39dB LA90 and 48dB LA90. During night-time periods the background levels vary between 30dB LA90 and 35dB LA90.
 - (ii) The predicted noise contribution from the application site using ISO9613-2 methodology and CadnaA noise modelling software with assumed noise mitigation measures show rating noise levels from site to range between 25dB and 27dB LAeq during maximum site operations. The cumulative assessment of noise from consented plant and proposed additional generator sets shows noise levels from site to range between 29dB and 30dB LAeq during maximum site operations.

- (iii) The BS4142 assessment shows that with appropriate mitigation the site can be designed to comply with relevant noise guidance and standards. The impact at other receptor positions would be lower than that predicted for the chosen receptors.
 - (iv) In terms of absolute level the predicted highest noise contributions from the proposed site operations are shown to be well below residual sound levels and therefore in context noise levels would not be significant.
 - (v) Absolute levels are below WHO guidelines for general daytime amenity levels, night-time levels for sleep disturbance and internal room design criteria according to BS8233: 2014 assuming windows open.
 - (vi) Noise levels at the commercial offices are not considered to be significant in absolute terms when considering the residual noise from the industrial estate and the short term occasional operation of the facility. Noise levels from the development would be within BS8233: 2014 guidance for noise levels within offices with an open window.
 - (vii) Noise from construction activities would not be significant and best practice would be applied according to BS5228 to minimise noise and vibration.
8. The assessment concludes that the site, including consented and proposed plant, can be designed to operate such that it complies with all appropriate and relevant noise standards and guidance.

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1.0 INTRODUCTION

- 1.1 Sirius Planning Ltd are proposing to submit a planning application to extend the consented RPP facility to add an additional generating capacity of 9.95MW at Miners Road, Llay, North Wales. The application proposal will include the use of 6 additional gas generator sets and 3 Battery Storage Units that will provide emergency electricity to support the National Grid. RPP provides balance and stability to the National Grid system during such specific and unexpected periods of high demand or system constraints.
- 1.2 RPP is a contracted balancing service, whereby the service provider, in this case the operator, is required to make the generating plant available to generate power at specific times during certain periods in the week.
- 1.3 The facility will accommodate 6 additional individual containerised generator sets and 3 Battery Storage units with associated radiator/coolers and exhaust systems and supporting infrastructure. This will complement the consented 5 generator sets complete with two Battery Storage units and associated plant and infrastructure.
- 1.4 At the request of Sirius Planning Ltd, Noise & Vibration Consultants Ltd ("NVC") were originally commissioned to undertake a noise impact assessment to assess the impact and advise (where appropriate) on any noise mitigation measures to meet planning guidance and noise standards for a RPP facility. Following planning consent for the Site, additional power generation is being proposed to expand the site to include a further 6 generating sets to generate a total of 19.95MW of power.
- 1.5 Following examination of the site location, the nearest sensitive residential receptors were determined and an appropriate methodology adopted.
- 1.6 The study benefits from a baseline noise survey carried out during a weekend period to determine the lowest likely representative background sound levels in the vicinity of nearest sensitive receptors to the proposed development.

Sources of Information

- 1.7 Information used in this assessment has been obtained from the following sources:
 - Ordnance Survey maps of the local area;
 - Information relating to the site layout was provided by Sirius Planning Ltd;
 - BS 7445: 2003 Description and measurement of environmental noise;
 - BS4142: 2014 'Methods for rating and assessing industrial and commercial sound';
 - Guidelines for Community Noise – World Health Organisation: April 1999;
 - BS8233: 2014 'Guidance on sound insulation and noise reduction for buildings';
 - Noise Policy Statement for England (NPSE) – March 2010: Department for Communities and Local Government: National Planning Policy Framework: March 2012;
 - BS5228-1: 2009+A1:2014 'Code of practice for noise control on construction and open sites'; and
 - NVC Noise Impact Assessment report ref. R17.0902/DRK dated 20th September 2017.

Assessment Methodology

1.8 The aim of the survey was to provide information and advice on the following:

- provide information on the additional generator sets and battery cooling fan operating noise levels;
- provide information on the cumulative operating noise levels from the consented and proposed generator sets, battery storage units, transformers and gas kiosk;
- provide information on background and residual sound levels at the nearest sensitive receptors during the most sensitive periods of proposed operation; and
- advise on any operations that are shown to exceed appropriate and relevant noise criteria and where appropriate provide recommendations for further mitigation.

1.9 Appendix 1 provides details of technical terms within the report, for ease of reference. There is also a chart showing typical everyday noise levels to assist in understanding the subjective level of noise in terms of decibels.

1.10 The development would consist of the following components:

- 6 gas generator sets in acoustic containers;
- 3 battery storage units;
- Lube Oil Containers;
- Transformers; and
- Associated Cabling.

2.0 SITE DESCRIPTION

2.1 Location

- 2.1.1 The proposed development is located at on an existing industrial estate on Miners Road, Llay in North Wales circa 900m to the north of Llay town centre. The application site lies approximately at National Grid Reference SJ 332417 356363. The site is within the administrative boundary of Wrexham County Borough Council.
- 2.1.2 The site is situated on an existing plot off Miners Road Industrial Estate to the north of the town of Llay and which is currently consented to include 5 gas powered generators, 2 battery storage units and associated transformers and supporting plant. The proposed development includes for the installation and operation of 6 additional generators, 3 battery storage units with associated transformers and supporting plant. The area is generally rural in nature with isolated residential properties to the south and north east directions from Site and the main residential development located further to the south at the northern edge of Llay.
- 2.1.3 At certain times of the day electrical demand out strips supply and National Grid needs access to sources of extra power, by way of either generation or demand reduction.
- 2.1.4 Access to the site would be from direct access onto Miners Road via the existing industrial estate access junction east of the Site onto Rackery Lane.

2.2 Site Noise Sources

- 2.2.1 In terms of noise generated by this type of development, the assessment has considered the following activities:
- (i) Noise during the construction period, which would take a month or two to complete.
 - (ii) Noise from the cumulative operation of the enclosed generator and battery storage units, transformers and gas kiosk.

2.3 Site Operations

- 2.3.1 By its very nature being able to provide power at short notice, the plant will run only for short periods of time, with long dormant phases between operating times.
- 2.3.2 It is proposed that the additional power generation for the RPP facility would have a capacity to generate 9.95MW at any one time to provide balancing services to National Grid to ensure the future security of the country's electricity supply. The electricity generated will be produced by gas powered generator sets with electricity storage capacity provided within supplementary batteries. The facility will provide power to the local network distribution in a short space of time when demand is greater than available supply.

2.4 Nearest Receptors

- 2.4.1 Following a detailed study of the site and surrounding area, the nearest sensitive receptors identified are detailed below:

Receptors A: The residential receptors located south of the site off Llay Road and are approximately 270m from the generator set compound boundary. The quarry landform on intervening land between the receptors and site provides a significant screen as it rises steeply from the rear of the properties towards the site.

Receptors B: The nearest residential receptor northeast of the site are those located off Rackery Lane at a distance of approximately 430m to the generator set compound boundary.

Receptor C: The nearest commercial receptors are located adjacent to the site to the west off Miners Road. The distance from the nearest office to the generator set compound is approximately 20m.

- 2.4.2 There are other receptors located at greater distance than the above in similar directions, which are shown on the noise map but as the impact would be lower are not included in the assessment. The nearest sensitive receptor positions are indicated on Figure 1 together with the application site position.
- 2.4.3 Figure 2 attached shows the layout of the site.

3.0 NOISE CRITERIA

3.1 Introduction

- 3.1.1 Noise has been defined as sound that is unwanted by the recipient. The effects of noise on the neighbourhood are varied and complicated, including such things as interference with speech communication, disturbance of work, leisure or sleep. A further complicating factor is that in any one neighbourhood some individuals will be more sensitive to noise than others.

General Planning Guidance

- 3.1.2 Within the introduction of Technical Advice Note (Wales) 11: 1997 'Noise' it states:

"This note provides advice on how the planning system can be used to minimise the adverse impact of noise without placing unreasonable restrictions on development or adding unduly to the costs and administrative burdens of business."

- 3.1.3 Technical Advice Note 11 (TAN 11) provides the following information:

- It indicates how noise issues should be handled in development plans and development control;
- outlines ways of mitigating the adverse impact of noise;
- provides specific guidance on noisy and noise-sensitive development;
- introduces the use of noise exposure categories; and
- gives guidance on the use of planning conditions relating to noise.

- 3.1.4 The guidance introduces the concept of Noise Exposure Categories (NEC), which have been derived to assist local planning authorities in their consideration of planning applications for residential development near transport-related noise sources. The NEC procedure is only applicable for the introduction of a new residential development into an area with an existing noise source. At Annex 1, guidance is given for various types of noise sources, which includes road traffic, aircraft and railways.

- 3.1.5 For reference, the recommended noise exposure categories for new dwellings near existing sources are shown below in Table 3.1. Note that these noise categories are based upon measurements taken in an open site (i.e. without any noise attenuating features in place).

- 3.1.6 The level at the boundary of NEC A and NEC B is based on guidance provided by the World Health Organisation (WHO) health criteria from 1980, which states that *"general daytime outdoor noise levels of less than 55dB(A) Leq are desirable to prevent any significant community annoyance"*.

- 3.1.7 The night-time noise level at the boundary of NEC A and NEC B is also based upon the WHO health criteria, stating *"based on limited data available, a level of less than 35dB(A) is recommended to preserve the restorative process of sleep"*.

- 3.1.8 Table 3.1 below provides an interpretation of the NEC categories in terms of granting planning permission.

Table 3.1 NEC Categories

NEC Category	Description	Noise Range $L_{Aeq,T}$ dB
A	Noise need not be considered as a determining factor in granting planning permission, although the noise level at the high end of the category should not be regarded as desirable.	<55dB(A) daytime (16hr) <45dB(A) night-time (8hr) Road, rail and mixed sources
B	Noise should be taken into account when determining planning applications and, where appropriate, conditions imposed to ensure an adequate level of protection.	55-63dB(A) daytime (16hr) 45-57dB(A) night-time (8hr) Road and mixed sources
C	Planning permission should not normally be granted. Where it is considered that permission should be given, for example, because there are no alternative quieter sites available, conditions should be imposed to ensure a commensurate level of protection against noise.	63-72dB(A) daytime (16hr) 57-66dB(A) night-time (8hr) Road and mixed sources

3.1.9 In applying these noise exposure categories, it states:

"Different indices have been used to describe noise from different sources, and limits have been set over different time periods. This has caused confusion, and this advice follows the move towards consistency advocated in BS 7445: 1991 by expressing all noises of $L_{Aeq,T}$. The recommended time periods are 0700-2300 and 2300-0700."

3.1.10 Within the general guidance it states *"where there is a clear need for new residential development in an already noisy area some or all NECs might be increased by up to 3dB(A) above the recommended levels. In other cases, a reduction of up to 3dB(A) may be justified."*

3.1.11 For noisy industrial developments, the guidance refers to BS 4142 – 'Methods for rating and assessing industrial and commercial sound'.

3.2 Relevant Guidance & Standards – Industrial Noise

BS 4142: 2014 'Methods for rating and assessing industrial and commercial sound'

3.2.1 BS 4142: 2014 'Methods for rating and assessing industrial and commercial sound' is based on the measurement of background sound using L_{A90} noise measurements, compared to source noise levels measured in L_{Aeq} units. The differential between the two measurements; once any corrections have been applied for source noise tonality, distinct impulses etc. (i.e. the 'rating' level); determines the likelihood of complaints.

- Typically, the greater this difference, the greater the magnitude of the impact.
- A difference of around +10 dB or more is likely to be an indication of a significant adverse impact, depending on the context.
- A difference of around +5 dB is likely to be an indication of an adverse impact, depending on the context.
- The lower the rating level is relative to the measured background sound level, the less likely it is that the specific sound source will have an adverse impact or a significant adverse impact. 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.

- 3.2.2 In terms of establishing the rating level, corrections for the noise character has to be taken into consideration. These include the following factors:

Tonality

For sound ranging from not tonal to prominently tonal the Joint Nordic Method gives a correction of between 0 dB and +6 dB for tonality. Subjectively, this can be converted to a penalty of 2 dB for a tone which is just perceptible at the noise receptor, 4 dB where it is clearly perceptible, and 6 dB where it is highly perceptible.

Impulsivity

A correction of up to +9 dB can be applied for sound that is highly impulsive, considering both the rapidity of the change in sound level and the overall change in sound level. Subjectively, this can be converted to a penalty of 3 dB for impulsivity which is just perceptible at the noise receptor, 6 dB where it is clearly perceptible, and 9 dB where it is highly perceptible.

Other sound characteristics

Where the specific sound features characteristics that are neither tonal nor impulsive, though otherwise are readily distinctive against the residual acoustic environment, a penalty of 3 dB can be applied.

NOTE 2 Where tonal and impulsive characteristics are present in the specific sound within the same reference period then these two corrections can both be taken into account. If one feature is dominant then it might be appropriate to apply a single correction. Where both features are likely to affect perception and response, the corrections ought normally to be added in a linear fashion.

Intermittency

When the specific sound has identifiable on/off conditions, the specific sound level ought to be representative of the time period of length equal to the reference time interval which contains the greatest total amount of on time. This can necessitate measuring the specific sound over a number of shorter sampling periods that are in combination less than the reference time interval in total, and then calculating the specific sound level for the reference time interval allowing for time when the specific sound is not present. If the intermittency is readily distinctive against the residual acoustic environment, a penalty of 3 dB can be applied.

- 3.2.3 The assessment of noise from the fixed plant at the nearest receptors is considered and our expert opinion is provided below:

- a) In terms of tonality, the proposed mitigation measures that will be required to control noise from the engine and exhaust would be significant and given the existing residual levels relative to background together with the likely operational hours we would not expect any tonal characteristics to be perceptible at the nearest receptor and we would therefore not apply a correction. Noise from the transformers would be so low that they would not be perceptible.
- b) In terms of impulsivity this is unlikely to be a characteristic of generator sets, battery storage units or transformers installations and is therefore not deemed to be applicable.

- c) In terms of intermittency the generators would operate intermittently but unlikely during sensitive hours. Taking into account the level of attenuation required to comply with appropriate and relevant standards for noise, the intermittency is unlikely to be distinctive (due to residual sound levels compared with plant noise contribution).

3.2.4 In conclusion, in view of the noise contribution from the site and mitigation measures proposed we would advise that a noise character penalty is unlikely to be appropriate.

BS8233:2014 'Guidance on sound insulation and noise reduction for buildings'

3.2.5 The British Standard BS8233 provides additional guidance on noise levels within buildings. These are based on the WHO recommendations and the criteria given in BS8233 for unoccupied spaces within residential properties.

3.2.6 The guidance provided in section 7.7 of BS8233 provides recommended internal ambient noise levels for resting, dining and sleeping within residential dwellings. Table 3.1 provides detail of the levels given in the standard.

Table 3.1: BS8233: 2014 Indoor ambient noise levels for dwellings

Activity	Location	07:00 to 23:00	23:00 to 07:00
Resting	Living Room	35 dB $L_{Aeq,16hours}$	-
Dining	Dining room/area	40 dB $L_{Aeq,16hours}$	-
Sleeping (daytime resting)	Bedroom	35 dB $L_{Aeq,16hours}$	30 dB $L_{Aeq,8hours}$
Study & work requiring concentration	Office	35-45dB $L_{Aeq,16hours}$	-

3.2.7 For a partially open window the standard refers to a reduction of approximately 15dB. This would therefore indicate a noise level outside the window of approximately 50dB-55dB $L_{Aeq, 16hours}$ for living rooms/dining rooms during daytime and 45dB $L_{Aeq, 8hours}$ during night-time outside bedrooms. For office environments the external noise level would be in the region of 50-60dB $L_{Aeq, 16hours}$ on the assumption that the office window is open.

World Health Organisation (WHO) Guidelines for Community Noise: April 1999

3.2.8 This document provides further updated information on noise and its effects on the community. The document for noise '*In Dwellings*' states "*The effects of noise in dwellings, typically, are sleep disturbance, annoyance and speech interference. For bedrooms the critical effect is sleep disturbance. Indoor guideline values for bedrooms are 30dB L_{Aeq} for continuous noise and 45dB L_{Amax} for single sound events. Lower noise levels may be disturbing depending upon the nature of the noise source.*"

3.2.9 The WHO document also states "*To enable casual conversation indoors during daytime, the sound level of interfering noise should not exceed 35dB L_{Aeq} . To protect the majority of people from being seriously annoyed during the daytime, the outdoor sound level from steady, continuous noise should not exceed 55dB L_{Aeq} on balconies, terraces and in outdoor living areas. To protect the majority of people from being moderately annoyed during the daytime, the outdoor sound level should not exceed 50dB L_{Aeq} . Where it is practical and feasible, the lower outdoor sound level should be considered the maximum*

desirable sound level for new development."

- 3.2.10 In 2009, the WHO published: 'Night Noise Guidelines for Europe', which it describes as an extension to the WHO 'Guidelines for Community Noise' (1999). It concludes that: *"Considering the scientific evidence on the thresholds of night noise exposure indicated by $L_{night,outside}$ as defined in the Environmental Noise Directive (2002/48/EC), an $L_{night,outside}$ of 40dB should be the target of the night noise guideline (NNG) to protect the public, including the most vulnerable groups such as children, the chronically ill and the elderly. $L_{night,outside}$ value of 55dB is recommended as an interim target for those countries where the NNG cannot be achieved in the short term for various reasons, and where policy-makers choose to adopt a stepwise approach."*

3.3 Survey Techniques

- 3.3.1 The background sound survey has been carried out in accordance with BS4142: 2014.

3.4 Establishing Baseline Sound Level

- 3.4.1 According to BS4142: 2014 in terms of what is defined as the background sound the standard states the following:

8.1.1 Ensure that the measurement time interval is sufficient to obtain a representative value of the background sound level for the period of interest. This should comprise continuous measurements of normally not less than 15 min intervals, which can be contiguous or disaggregated.

8.1.2 The monitoring duration should reflect the range of background sound levels for the period being assessed. In practice, there is no "single" background sound level as this is a fluctuating parameter. However, the background sound level used for the assessment should be representative of the period being assessed.

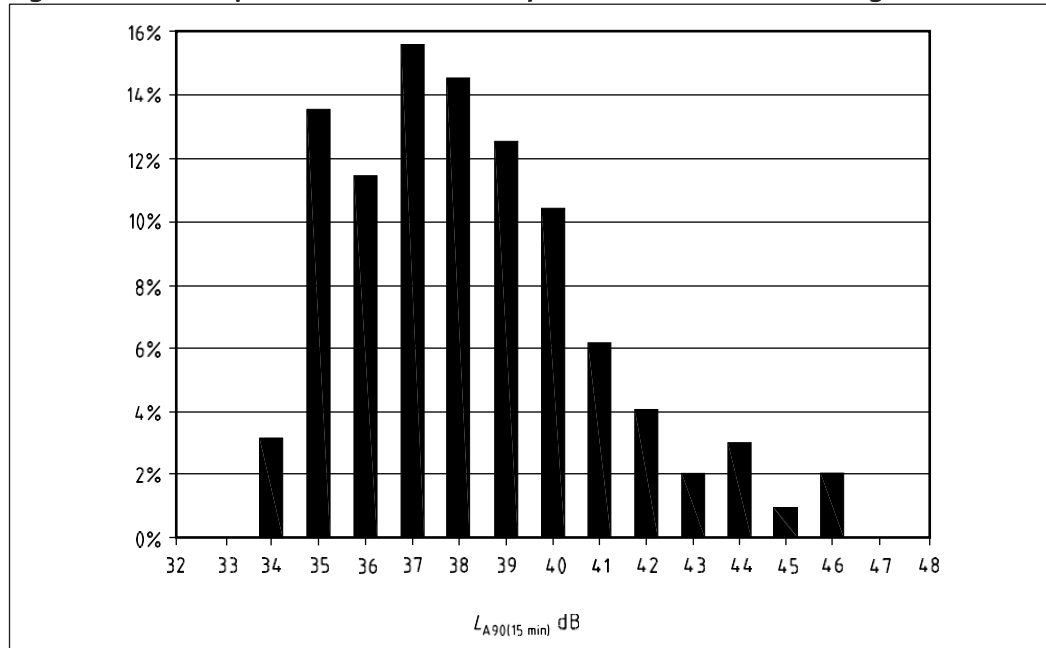
*NOTE 1 To obtain a representative background sound level a series of either sequential or disaggregated measurements ought to be carried out for the period(s) of interest, possibly on more than one occasion. **A representative level ought to account for the range of background sound levels and ought not automatically to be assumed to be either the minimum or modal value.***

NOTE 2 The mean average of a series of measured background sound levels is not numerically equal to the overall period background sound level that would otherwise be obtained by a single measurement spanning individual measurement periods.

NOTE 3 Background sound can be significantly affected by meteorological conditions, particularly where the main sources of residual sound are remote from the assessment location(s).

NOTE 4 Figure 4 shows an example of a statistical analysis of the results of all the measurement periods in order to determine a background sound level. For this distribution of the data an $LA_{90}(15\text{ min})$ of 37 dB was considered to be representative and in this instance was also the most commonly occurring value.

Figure 4 Example of a statistical analysis to determine the background sound level



3.4.2 The above guidance indicates that to establish the background sound level requires the determination of a representative value which is not deemed to be the lowest but under statistical analysis the most common place when measured over a representative time period.

4.0 SOUND SURVEY METHODOLOGY & RESULTS

4.1 Baseline Sound Monitoring (See Appendix 2 & Figure 1)

Instrumentation and Fieldwork Details

- 4.1.1 A detailed environmental baseline sound survey was carried out in the vicinity of the nearest sensitive receptors to determine details of the sound climate to provide representative background sound data. The three locations chosen to establish background sound were as follows:

Position A: South of the site at the rear of properties off Llay Road to give background sound levels for the nearest property in this direction. The location was also chosen away from the effect of the brickwork yard to the east of the properties.

Position B: Northwest of the development in an adjacent field to properties off Rackery Lane and circa 20m distance from the main road to give an indication of baseline levels for properties in this direction.

Position C: West of the development in adjacent car park of industrial units to give an indication of typical noise levels from the industrial estate at commercial offices.

- 4.1.2 The sound survey and site inspection was carried out on Friday 1st to Monday 4th September 2017. Static noise measurements were undertaken in areas adjacent to the nearest residential properties to establish representative data on the existing sound climate.
- 4.1.3 The main source of existing sound affecting nearest receptor properties relates to distant and local road traffic travelling along local road network and birdsong.
- 4.1.4 For noise measurements at the nearest sensitive receptor positions the following noise meters were used:

<i>Manufacturer</i>	<i>Description</i>	<i>Type</i>	<i>Serial No.</i>	<i>Calibration Due Date</i>
Norsonic	Precision Integrating sound level meter	118	31992	July 2018
Cirrus	Precision Integrating sound level meter	CR: 171A	G061253	January 2018
Cirrus	Precision Integrating sound level meter	CR: 171A	G066350	March 2018
Cirrus	Electronic Calibrator	CR: 513A	031692	July 2018

- 4.1.5 The following set-up parameters were used on the sound level meters during measurements:

Static Sound Monitoring:

Time Weighting: Fast
Frequency Weighting: 'A'
Measurement Period: 15 minutes or 1 hour

Monitoring Period and Test Details

- 4.1.6 Measurements were recorded over a period of approximately 70 hours. Data logging of L_{Aeq} , L_{A10} , L_{A90} and L_{Amax} were recorded at 15-minute or 1 hour intervals for information on the variation of sound levels (see Appendix 2 for details).
- 4.1.7 The noise meters were mounted on a tripod at a height of between 1.2 to 1.5 metres above ground level and fitted with a wind and rain shield.

Calibration

Calibration setting: 94dB

- 4.1.8 The noise meters were calibrated with the electronic calibrator prior to commencement and on completion of the survey. No significant drift in calibration was observed.

Survey Dates and Personnel

- 4.1.9 Static sound measurement positions (shown on Figure 1) were chosen to establish typical and representative background and ambient sound data at nearest sensitive receptors (see Appendix 2 for detailed information). Mr D R Kettlewell of Noise & Vibration Consultants Limited set up the sound monitoring on Friday 1st September and removed the equipment on Monday 4th September 2017.

Meteorological Conditions

- 4.1.10 Weather details established from local weather stations by the NVC consultant during the period of the surveys, and appear below:

Friday 1st – Saturday 2nd September 2017

- 4.1.11 Dry, scattered cloud, light variable wind (1-4m/s), temp. 11-18degC. Night-time period remained dry, variable cloud, light variable winds (2-3m/s), temp. 8-12degC

Saturday 2nd – Sunday 3rd September 2017

- 4.1.12 The daytime monitoring period was dry, variable cloud, light variable wind (0.5-3m/s), temp. 7-20degC. Night-time remained dry, variable cloud, light SSE winds (1-2m/s), temp. 8-11degC.

Sunday 3rd – Monday 4th September 2017

- 4.1.13 Dry, variable cloud, light rain (1720-1900), light SSE wind (2-3m/s), temp. 12-15degC. During the night-time period it was dry, light mist with light south-south-east winds (2-3m/sec). Temperature 14 to 15deg C.
- 4.1.14 The above climatic conditions were suitable for monitoring environmental noise levels in accordance with advice given in BS4142:2014.

4.2 Results:

Background Sound

- 4.2.1 Background sound measurements taken in the vicinity of the nearest residential sensitive receptors. The results of measurements taken at the fixed monitoring positions at site are presented below in Tables 4.1 to 4.2 with detailed measurements in Appendix 2.

Table 4.1: Average Sound Levels during Daytime periods (0700-2300 hours)

Location	Time Period	LAeq dB	LA10 dB	LA90 dB	Representative LA90 dB	LAmix dB
A. Rear of Llay Road (south)	Daytime	48	50	40	39	58-81
B. Off Rackery Lane (northeast)	Daytime	58	61	44	48	66-91
C. West of site (commercial)	Daytime	59	60	55	n/a	71-73

Table 4.2: Sound Levels during night-time periods (i.e. 2300-0700 hours)

Location	Time Period	LAeq dB	LA10 dB	LA90 dB	Representative LA90 dB	LAmix dB
A. Rear of Llay Road (south)	Night-time	40	41	33	30	51-71
B. Off Rackery Lane (northeast)	Night-time	51	48	37	35	58-85

- 4.2.2 The methodology detailed in the latest version of BS4142: 2014 provides an example of statistical analysis to determine the background sound level (i.e. most common place). Further detail of the measured background sound levels and analysis of representative background sound levels is provided in Appendix 2.
- 4.2.3 The above graphs show that the most common place value for determining background sound levels between 0700-2300 hours at the monitoring positions vary between 39dB LA90 and 48dB LA90. During night-time periods the background levels vary between 30dB LA90 and 35dB LA90.
- 4.2.4 BS4142:2014 indicates that a low impact is likely where the rating level does not exceed the representative background sound level but is dependent on the context. Where the background sound and rating levels are low then the standard would not be as relevant as absolute noise limits. This is stated in section 11 of the standard at Note 2 (1), which states:

"Where the initial estimate of the impact needs to be modified due to the context, take all pertinent factors into consideration, including the following.

1. The absolute level of sound. For a given difference between the rating level and the background sound level, the magnitude of the overall impact might be greater for an acoustic environment where the residual sound level is high than for an acoustic environment where the residual sound level is low.

Where background sound levels and rating levels are low, absolute levels might be as, or more, relevant than the margin by which the rating level exceeds the background. This is especially true at night.

Where residual sound levels are very high, the residual sound might itself result in adverse impacts or significant adverse impacts, and the margin by which the rating level exceeds the background might simply be an indication of the extent to which the specific sound source is likely to make those impacts worse."

- 4.2.5 For night-time periods the most appropriate absolute criteria would relate to sleep disturbance which would be found within the WHO 'Night Noise Guidelines for Europe', which concludes that: *"Considering the scientific evidence on the thresholds of night noise exposure indicated by $L_{night,outside}$ as defined in the Environmental Noise Directive (2002/48/EC), an $L_{night,outside}$ of 40dB should be the target of the night noise guideline (NNG) to protect the public, including the most vulnerable groups such as children, the chronically ill and the elderly. $L_{night,outside}$.*

4.3 Source Noise Levels

- 4.3.1 Section 5.2.3 below details noise levels for the generators, battery storage units, transformers and gas kiosk assumed for the noise prediction calculations.

5.0 NOISE LEVEL PREDICTIONS

5.1 Introduction

- 5.1.1 Noise has been defined as sound, which is undesired by the recipient. The effects of noise on the neighbourhood are varied and complicated, including such things as interference with speech communication, disturbance of work, leisure or sleep. A further complicating factor is that in any one neighbourhood some individuals will be more sensitive to noise than others.
- 5.1.2 A measure that is in general use and is recommended internationally for the description of environmental noise is the equivalent continuous noise level or LAeq parameter.
- 5.1.3 In general, the level of noise in the local environs that arises from a development site will depend on a number of factors. The more significant of which are:-
- (a) The sound power levels (SWL's) of the plant or equipment used on site.
 - (b) The periods of operation of the plant on site.
 - (c) The distance between the source noise and the receiving position.
 - (d) The presence or absence of screening effects due to barriers, or ground absorption.
 - (e) Any reflection effects due to the facades of buildings etc.
- 5.1.4 The empirical noise levels have been used provided by manufacturers of the plant equipment to assist in determining the likely noise contribution at nearest sensitive receptors for comparison with the requirements of BS4142: 2014.

5.2 Prediction Methodology

Operational Noise

- 5.2.1 For site operational noise the assessment used ISO9613-2 prediction modelling and CadnaA software for producing a noise map of the highest likely generated noise during peak noise operations. The Input settings for the noise model include:
- Ground factor (G) = 0.5 (mixed ground absorption)
Temperature = 10degC
Relative humidity = 70%
Receptor height = Assumed to be 4m above ground for operations.
- 5.2.2 The methodology takes into account source position and distance to the nearest sensitive receptors. The noise modelling assumes that all transformers and fast response gas driven generators are in operation and therefore the noise predictions provide an indication of the highest likely noise level.

Source Noise Levels

5.2.3 The plant associated with the proposal is based on the noise levels given below, which are based on manufacturer's noise data.

- a) Transformer noise level 70dB(A) at 1m.
- b) Gas driven generator plant acoustic container provides a noise level of 70dB(A) @ 1m (60dB(A) at 7m).
- c) Cooler Fans (where relevant) located at side of containers at ground level provide a noise level of 70dB(A) @ 1m.

5.2.4 The results of the CadnaA software prediction modelling noise contours for site operations are provided in Appendix 3.

5.3 Results of Noise Predictions

Site Plant Noise Assessment:

5.3.1 Noise levels from plant operating at the development site would be assessed against BS4142: 2014.

Noise Contribution Levels from Additional Generator Sets & Transformers

Table 5.1: Predicted Noise from Plant Operations (with mitigation measures)

Receptor Position (Refer to Figure 1)	Period	Predicted highest rating noise level LAeq(dB)	Representative background sound level LA90 [LAeq] dB	Rating Noise Limit LAeq dB	Excess over limits LAeq dB
R1. Nearest receptors South (Llay Road)	Daytime	26-27	39 [48]	39	-13 to -12
	Night-time	26-27	30 [40]	30-35*	-9 to -3
R2. Nearest receptors Northeast (Rackery Lane)	Daytime	25-26	48 [58]	48	-23 to -22
	Night-time	25-26	35 [51]	41	-10 to -9
R3. Nearest commercial	Daytime	52-58	55 [59]	55-60**	-8 to -2

*Based on BS4142 guidelines for low impact or sleep disturbance limits when taking into account residual sound levels in respect of context. **Based on typical residual sound levels and guidelines for levels within offices in accordance with BS8233: 2014 with an open window.

5.3.2 The results show that the noise contribution from maximum site operations with chosen mitigation measures is below the representative background sound level during the daytime and night-time periods. According to BS4142: 2014 the resultant assessment would conclude that noise from the site would result in a **low impact** (see table 5.2 below for more detailed assessment in accordance with BS4142: 2014).

**Table 5.2: BS4142 Assessment of mitigated noise at Position R1
(all plant running i.e. highest impact) at Night-time**

Results		Relevant	Commentary
Calculated Specific sound level	$L_{Aeq}(15mins) = 27dB$	7.3.6	Specific sound source calculated using ISO9613-2
Background sound level	$L_{A90} = 30dB$	8.1.3 8.2	Measured over weekend period deemed to be representative of the background sound.
Assessment during daytime, reference time interval is 15mins		7.2	
Acoustic feature correction	0dB	9.2	No acoustic feature expected due to site noise contribution and much higher residual sound levels.
Rating level	$(27 + 0) dB = 27dB$	9.2	No significant perceptible noise character predicted
Background sound level	$L_{A90} = 30dB$	8	Modal value determined using weekend background sound periods (2300-0700) providing a robust assessment of baseline.
Excess of rating over background sound level	$(27 - 30) dB = -3dB$	11	
Assessment indicates low impact		11	
Uncertainty	Not significant	10	The excess of the rating level over the background sound level is negative and residual levels are significantly higher (i.e. 40dB L_{Aeq}) and the uncertainty of the measurement does not have any significance to the outcome of the assessment. Appropriate standards used for the calculation. All instruments used Type 1, calibrated and in calibration limits for baseline.

Cumulative Assessment

- 5.3.3 Noise levels from the cumulative effect of all plant operating at the development site is assessed against BS4142: 2014 and includes the generators, battery storage units, transformers and gas kiosk.

Cumulative Noise Contribution Levels from All Plant at Site

Table 5.3: Predicted Noise from Plant Operations (with mitigation measures)

Receptor Position (Refer to Figure 1)	Period	Predicted highest rating noise level $L_{Aeq}(dB)$	Representative background sound level $L_{A90} [L_{Aeq}]$ dB	Rating Noise Limit L_{Aeq} dB	Excess over limits L_{Aeq} dB
R1. Nearest receptors South (Llay Road)	Daytime Night-time	29-30 29-30	39 [48] 30 [40]	39 30-35*	-10 to -9 -1 to 0
R2. Nearest receptors Northeast (Rackery Lane)	Daytime Night-time	28-29 28-29	48 [58] 35 [51]	48 41	-20 to -19 -7 to -6
R3. Nearest commercial	Daytime	54-59	55 [59]	55-60**	-6 to -1

*Based on BS4142 guidelines for low impact or sleep disturbance limits when taking into account residual sound levels in respect of context. **Based on typical residual sound

levels and guidelines for levels within offices in accordance with BS8233: 2014 with an open window.

- 5.3.4 The results show that the noise contribution from maximum site operations with chosen mitigation measures is below the representative background sound level during the daytime or under highest site noise conditions during night-time no higher than the representative background sound level. According to BS4142: 2014 the resultant assessment would conclude that noise from the site would result in a **low impact** (see table 5.4 below for more detailed assessment in accordance with BS4142: 2014).

**Table 5.4: BS4142 Assessment of mitigated noise at Position R1
(all plant running i.e. highest impact) at Night-time**

Results		Relevant	Commentary
Calculated Specific sound level	$L_{Aeq}(15mins) = 30dB$	7.3.6	Specific sound source calculated using ISO9613-2
Background sound level	$L_{A90} = 30dB$	8.1.3 8.2	Measured over weekend period deemed to be representative of the background sound.
Assessment during daytime, reference time interval is 15mins		7.2	
Acoustic feature correction	0dB	9.2	No acoustic feature expected due to site noise contribution and much higher residual sound levels.
Rating level	$(30 + 0) dB = 30dB$	9.2	No significant perceptible noise character predicted
Background sound level	$L_{A90} = 30dB$	8	Modal value determined using weekend background sound periods (2300-0700) providing a robust assessment of baseline.
Excess of rating over background sound level	$(30 - 30) dB = 0dB$	11	
Assessment indicates low impact		11	
Uncertainty	Not significant	10	The excess of the rating level over the background sound level is zero and residual levels are significantly higher (i.e. 40dB LAeq) and the uncertainty of the measurement does not have any significance to the outcome of the assessment. Appropriate standards used for the calculation. All instruments used Type 1, calibrated and in calibration limits for baseline.

Commercial Development Receptors

- 5.3.5 The commercial offices in proximity to the generator compound have been considered.
- 5.3.6 Predicted noise levels at the office areas are shown to be circa 52dB to 54dB LAeq for the additional units and 58dB LAeq at the nearest receptor windows and therefore acceptable in terms of an absolute noise level.
- 5.3.7 The residual noise levels in the area are around 58dB to 59dB LAeq due to road traffic and industrial noise.

6.0 CONSTRUCTION NOISE

- 6.1 In general, the level of noise in the local environs arising from the construction of a development site will depend on a number of factors.

The most significant of which are as follows:

- The sound power levels (SWL's) or sound pressure levels (SPL's) of the plant or equipment used on site;
- The periods of operation of the plant on site;
- The distance between the source noise and the receiving position;
- The presence or absence of screening effects due to barriers, or ground absorption; and,
- Any reflection effects due to the facades of buildings etc.

Calculation Methodology

- 6.2 The calculation method used in this study for construction noise is based upon theoretical noise propagation theory, which takes into account source position, distance, direction and frequency content in relation to the nearest residential property boundary positions. British Standard BS5228-1: 2009+A1:2014 'Code of practice for noise control on construction and open sites' methodology has been used to estimate construction noise levels at the nearest existing dwellings including source noise levels for construction plant.
- 6.3 Noise levels emanating from the Site due to construction works associated with the proposed development will vary from day to day. In order to give an indication of the probable noise levels generated by the works, a worst-case scenario has been considered for several construction activities, namely soil movement and road construction.

Predicted Noise Levels: Construction

- 6.4 The highest likely noise levels for the proposed development in terms of construction noise are provided below. This is based on calculations for soil movement work, infrastructure, plant installation and general site activities at the closest approach to existing dwellings.
- 6.5 It is difficult to estimate how long this type of activity would last but typically in areas close to the site boundary (i.e. noisiest construction period assessed) this is normally completed in weeks rather than months.
- 6.6 The results of calculations (excluding mitigation measures) are shown below in Table 6.1 which applies the ABC method for noise criteria proposed threshold limits as advised in the Standard (Annex E).

Table 6.1: Noise Predictions for Highest Likely Construction Noise at Nearest Receptors

Receptor Position	Distance to receptor (m)	Activity	Noise Level, dB LAeq1hr	Typical Residual Noise LAeq1hr dB	Total noise (residual + construction) LAeq1hr dB	BS5228 Threshold Value LAeq dB (daytime)
R1) Receptor to south	280-330 280-330 280-330 280-330	Site Preparation General site activities Infrastructure Plant installation	46-47 45-46 44-45 43-45	48	50-51 50 49-50 49-50	65
R2) Receptor to northeast	440-500 440-500 440-500 440-500	Site Preparation General site activities Infrastructure Plant installation	42-43 39-41 41-42 39-40	58	58 58 58 58	65
R3) Commercial receptor	20-80 20-80 20-80 20-80	Site Preparation General site activities Infrastructure Plant installation	62-70 62-69 59-70 59-69	59	64-70 64-69 62-70 62-69	65

Note: Construction noise prediction levels given above do not allow for any site screening or proposed amelioration measures and highest levels predicted assumes that the plant equipment is at its closest approach.

- 6.7 The highest construction noise levels are likely to be created during any initial soil movement and the installation of plant and infrastructure. The results show that during the construction period noise levels at residential receptors would be within threshold levels. At the nearest commercial receptor the noise levels during peak noise periods may exceed the threshold level for short periods. The implementation of best practice measures would assist in minimising noise radiating towards receptors and the threshold proposed by BS5228 would not be exceeded and within acceptable limits for this type of temporary activity.

Mitigation of Construction Period Effects

- 6.8 In accordance with BS 5228 best practical means would be employed to control the noise and vibration generation.
- 6.9 In consideration of the likely highest levels of construction noise, the following approach would be adopted:
- Restriction of construction hours to non-sensitive times of day would normally form part of the planning consent conditions.
 - Community Relations – this is one of the most important aspects of mitigation as providing the nearest sensitive receptors with clear information about the activities that would be taking place and the length of time that any peak noise levels may occur will assist in allaying people's fears. BS 5228 states *"It is suggested that good relations can be developed by keeping people informed of progress and by treating complaints fairly and expeditiously. The person, company or organisation carrying out the work on site should appoint a responsible person to liaise with the public."*
 - Use of broadband type reverse alarms for mobile plant (i.e. avoiding tonal 'beeper' type alarms)

- Consider using a one-way system/turning circles and/or use of a banksman to avoid/reduce the need for reverse alarms.
- Sensible routing of the construction plant to minimise noise relative to the nearest residential properties.
- Careful choice of plant to minimise noise generation (e.g. hire of fixed plant with acoustic enclosures).
- Ensure all plant is regular maintained and correctly fitted with effective silencers / any relevant acoustic hoods etc.
- Maximise distance between any significant noise source and receptor locations.
- Plant switched off when not in use.
- Where practicable, screening of any sensitive property boundaries adjacent to the site boundary where noisy activities are likely to occur. The implementation of boundary screening/hoarding prior to commencement of construction work would comply with best practice. Boundary hoarding to 2m to 3m in height along northern half of the site would typically reduce noise levels by around 5dB(A) to 8dB(A).

7.0 CONCLUSIONS

Conclusions

- 7.1 The proposed additional power generation at the consented RPP Facility at the Miners Road site in Llay, Wrexham has been assessed in terms of noise impact during construction and operational periods. This report has been undertaken to provide technical support to the planning application for the development. Further analysis of the cumulative effect of the consented and proposed extension of the RPP facility has been considered and mitigation measures proposed to comply with relevant noise guidance and standards.
- 7.2 The results of baseline noise monitoring over a weekend monitoring period at two locations (in areas providing a representative assessment of background sound level) in the vicinity of sensitive receptors indicate that representative background sound levels between 0700-2300 hours at the monitoring positions vary between 39dB LA90 and 48dB LA90. During night-time periods the background levels vary between 30dB LA90 and 35dB LA90.
- 7.3 Typical site operating noise levels have been established from empirical library data of typical acoustically treated generator sets, battery storage units and ancillary plant to provide input data for the noise model.

Mitigation Measures to Control Noise

- 7.4 In order to achieve reasonable and appropriate noise contribution levels at the nearest receptors to the site the following example of noise mitigation is provided:
- a) The additional generator sets could be housed within an acoustic enclosure that provides a reduction in noise level for **each** unit with a design level of 70dB(A) @ 1m at maximum load for the site or 60dB(A) @ 7m.
 - b) Generator set radiators/coolers and exhaust systems also designed to a level not exceeding 70dB(A) @ 1m at maximum load.
 - c) The Transformers designed to a level not exceeding 70dB(A) @ 1m at maximum load.

Note: The above example of mitigation is one method of control to comply with appropriate and relevant standards for noise. There may be more than one method of mitigation that provides a comparable result at the sensitive receptors that the developer may wish to adopt. For example, use of local screening techniques or design or choice of plant may result in a slightly different design level at source for the acoustic enclosures.

- 7.5 The predicted noise contribution from the additional power generation at the consented site using ISO9613-2 methodology and CadnaA noise modelling software with assumed noise mitigation measures show rating noise levels from site to range between 25dB and 27dB LAeq during maximum site operations.
- 7.6 The predicted cumulative noise contribution from the consented RPP facility and the additional power generation using ISO9613-2 methodology and CadnaA noise modelling software with assumed noise mitigation measures show rating noise levels from site to range between 28dB and 30dB LAeq during maximum site operations.

- 7.7 The BS4142 assessment shows that with appropriate mitigation the site can be designed to comply with relevant noise guidance and standards. The impact at other receptor positions would be lower than that predicted for the chosen receptors.
- 7.8 In terms of absolute level the predicted highest noise contributions from the proposed site operations are shown to be well below residual sound levels and therefore in context noise levels would not be significant.
- 7.9 Absolute levels are below WHO guidelines for general daytime amenity levels, night-time levels for sleep disturbance and internal room design criteria according to BS8233: 2014 assuming windows open.
- 7.10 The predicted residual noise levels from the site have been calculated based on an example of noise mitigation measures designed to achieve a specific design level. The mitigation strategy to achieve the noise limits may be refined following the detailed design. The design limit would form part of the purchasing specification when the generator supplier is defined.
- 7.11 Noise levels at the nearest commercial offices with the proposed mitigation show noise levels to be approximately 58dB LAeq for the additional units and 59dB LAeq for the consented and proposed development. These levels are not considered to be significant in absolute terms when considering the residual noise from the industrial estate and the short term occasional operation of the facility.
- 7.12 Noise from construction activities would not be significant and best practice would be applied according to BS5228 to minimise noise and vibration.
- 7.13 The assessment concludes that the site can be designed to operate such that it complies with all appropriate and relevant noise standards and guidance.

REFERENCES

BS 7445:2003 Description and measurement of environmental noise.

BS 4142: 2014 `Methods for rating and assessing industrial and commercial sound'

BS 8233:2014 `Guidance on sound insulation and noise reduction for buildings'

Guidelines for Community Noise – World Health Organisation: April 1999

Noise Policy Statement for England (NPSE) – March 2010

Department for Communities and Local Government: National Planning Policy
Framework: March 2012

BS5228-1: 2009+A1:2014 `Code of practice for noise control on construction and
open sites'

ISO 9613-2: 1996 `Acoustics – Attenuation of Sound During Propagation Outdoors'

FIGURES

Figure 1: Noise Measurement Locations, Receptors & Site Position



Figure 2: Draft Layout



Appendix 1

BASIC ACOUSTIC TERMINOLOGY

Sound is produced by mechanical vibration of a surface, which sets up rapid pressure fluctuations in the surrounding air.

Sound Pressure Level is a measurement of the size of these pressure fluctuations. It is expressed in decibels (dB) on a logarithmic scale. Each 3 dB increase in sound pressure level represents a doubling of the sound energy. The threshold of hearing is approximately 0 dB.

The rate at which the pressure fluctuations occur determines the pitch or frequency of the sound. The frequency is expressed in Hertz (Hz), that is, cycles per second. The human ear is sensitive to sounds from about 20 Hz to 20,000 Hz. Although sound can be of one discrete frequency - a 'pure tone' - most noises are made up of many different frequencies.

The human ear is more sensitive to some frequencies than others, and modern instruments can measure sound in the same 'subjective' way. This is the basis of the A- weighted sound level dB(A), normally used to assess the effect of noise on people. The dB(A) weighting emphasises or reduces the importance of certain frequencies within the audible range.

Noise Measurement

The measurement of sound pressure level is only really meaningful where the level of noise is constant. In the typical industrial environment noise levels can vary widely and sometimes short duration high levels of noise are interspersed with periods of relative quiet. The most widely used means of 'averaging' the noise over a period of time is the Equivalent Continuous Sound Level. Normally written as L_{Aeq} this value takes into account both the level of noise and the length of time over which it occurs. There are many meters available which are capable of measuring L_{Aeq} by electronic integration over the measurement period.

The L_{Aeq} or A-weighted equivalent continuous noise level is a measure of the total noise energy over a stated time period and includes all the varying noise levels and re- expresses as an 'average', allowing for the length of time for which each noise level was presented.

The L_{An} parameters are defined as the noise levels which are exceeded for n% of the monitoring period, thus, for example, the L_{A90} parameter is the noise level exceeded for 90% of the 15 minute period, i.e. 13.5 minutes. The L_{A50} parameter is the noise level exceeded for 50% of the hourly period, i.e. 30 minutes, etc. The L_{max} parameter is the maximum RMS A-weighted noise level occurring during the measurement period.

The definition in layman's terms is given below for terminology used in the measurement and results obtained during the survey work.

A-weighting: Normal hearing covers the frequency (pitch) range from about 20Hz to 20,000 Hz but sensitivity of the ear is greatest between about 500Hz and 5000Hz. The "A-weighting" is an electrical circuit built into noise meters to mimic this characteristic of the human ear.

Ambient noise: The totally encompassing sound in a given situation at a given time usually composed of sound from many sources near and far.

Attenuation: Noise reduction

Background noise: The general quiet periods of ambient noise when the noise source under investigation is not there.

Decibel (dB): The unit of measurement for sound based on a logarithmic scale. 0dB is the threshold of normal hearing; 140dB is the threshold of pain. A change of 1dB is only detectable under controlled laboratory conditions.

dB(A) [decibel A weighted]: Decibels measured on a sound level meter incorporating a frequency weighting (A weighting) serves to distinguish sounds of different frequency (or pitch) in a similar way to how the human ear responds. Measurements in dB(A) broadly agrees with an individual's assessment of loudness. A change of 3dB(A) is the minimum perceptible under normal everyday conditions, and a change of 10dB(A) corresponds roughly to doubling or halving the loudness of sound.

dB(C): [decibel C weighted]: Frequency weighting which does not alter low frequency octave band levels by very much compared to 'A' weighting. Similar to linear reading (i.e. linear does not alter frequency spectra at all)

Frequency (Hz): The number of sound waves to pass a point in one second.

L_{Aeq}: This is a noise index used to describe the "average" level of a noise that varies with time (T). It allows for the different sensitivities of the human ear to different frequencies (pitch), and averages fluctuating noise levels in a manner which correlates well with human perceptions of loudness.

L_{A10,T}: This noise index gives an indication of the upper limit or peak levels of the fluctuating noise. It is the "A weighted" noise level exceeded for 10 per cent of the specified measurement period (T). e.g. If the measurement period was over 10 hours and the L_{A10} reading was say 60dB, then this means that for 1 hour out of 10 the level went above 60dB.

L_{A90,T}: This noise index gives an indication of the lower limit or levels of the fluctuating noise. It is the "A weighted" noise level exceeded for 90 per cent of the specified measurement period (T). e.g. If the measurement period was over 10 hours and the L_{A90} reading was say 50dB, then this means that for 9 hours out of 10 the level went above 50dB.

L_{Amax}: This is the highest 'A' weighted noise level recorded during a noise measurement period.

Residual noise: The ambient noise remaining at a given position in a given situation when the noise source under investigation is not there.

Specific noise: The noise source under investigation for assessing the likelihood of complaints

Examples of typical noise levels

Source/Activity	Indicative noise level [dB(A)]
Threshold of hearing	0
Rural night-time background	20-40
Quiet bedroom	35
Wind farm at 350m	35-45
Busy road at 5km	35-45
Car at 65km/h at 100m	55
Busy general office	60
Conversation	60
Truck at 50km/h at 100m	65
City Traffic at 5m	75-85
Pneumatic drill at 7m	95
Jet aircraft at 250m	105
Threshold of pain	140

Appendix 2

Baseline Sound Survey Results

Noise Survey Results

Date: Friday 1st September 2017

Location: Miners Road, Llay

Client: Sirius Planning Ltd

Project: CMU Site

Data: **Background Sound Survey: Position 1 Rear of Properties off Llay Road**

Instrumentation: Cirrus 831A Integrating Precision SLM (B15046FF) Calibration due September 2017

Weather Conditions: Dry, scattered cloud, light variable wind (1-4m/s), temp. 11-18degC

Calibration: 94dB

TABLE 1

Start Time	Run Time (hrs.)	LAeq (dB)	LA10 (dB)	LA90 (dB)	LAmix (dB)	Observations
08:00	01:00	49.7	52.3	41.4	73.9	Distant road traffic noise & birdsong
09:00	01:00	50.0	50.9	38.0	73.0	
10:00	01:00	47.1	49.6	37.9	75.5	
11:00	01:00	49.0	50.1	39.0	79.5	
12:00	01:00	51.6	50.4	40.7	80.5	
13:00	01:00	46.8	49.8	39.0	62.9	
14:00	01:00	46.7	50.2	39.5	64.8	
15:00	01:00	47.0	50.4	39.3	58.9	
16:00	01:00	48.3	51.4	42.1	61.8	
17:00	01:00	48.4	51.1	39.5	67.2	
18:00	01:00	45.8	49.7	37.0	58.5	
19:00	01:00	46.5	49.9	37.0	69.1	
20:00	01:00	46.7	48.9	35.2	71.8	
21:00	01:00	44.7	47.6	32.7	71.8	
22:00	01:00	42.3	46.0	32.0	65.1	
Average 0800-2200		47.9	49.9	38.0	59-81	

Noise Survey Results

Date: Friday 1st - Saturday 2nd September 2017

Site: Miners Road, Llay

Client: Sirius Planning Ltd

Project: CMU Site

Data: **Background Sound Survey: Position 1 Rear of Properties off Llay Road**

Instrumentation: Cirrus 831A Integrating Precision SLM (B15046FF) Calibration due September 2017

Weather Conditions: Dry, variable cloud, light variable winds (2-3m/s), temp. 8-12degC

Calibration: 94dB

TABLE 2

Start Time	Run Time (hrs.)	LAeq (dB)	LA10 (dB)	LA90 (dB)	LAmix (dB)	Observations
23:00	01:00	40.6	44.4	31.3	58.5	
00:00	01:00	39.9	43.6	31.0	55.8	
01:00	01:00	35.8	36.5	29.2	57.0	
02:00	01:00	37.0	36.6	29.5	60.5	
03:00	01:00	34.7	32.2	29.6	55.0	
04:00	01:00	35.7	37.0	29.8	53.0	
05:00	01:00	41.1	45.4	31.5	66.2	
06:00	01:00	45.5	48.8	32.8	70.8	
Average 2300-0700		40.2	40.6	30.6	53-71	
Average 0800-2200		47.9	49.9	38.0	59-81	

Noise Survey Results

Date: Saturday 2nd September 2017

Location: Miners Road, Llay

Client: Sirius Planning Ltd

Project: CMU Site

Data: **Background Sound Survey: Position 1 Rear of Properties off Llay Road**

Instrumentation: Cirrus 831A Integrating Precision SLM (B15046FF) Calibration due September 2017

Weather Conditions: Dry, variable cloud, light variable wind (0.5-3m/s), temp. 7-20degC

Calibration: 94dB

TABLE 3

Start Time	Run Time (hrs.)	LAeq (dB)	LA10 (dB)	LA90 (dB)	LAmix (dB)	Observations
07:00	01:00	45.5	49.1	35.3	66.0	
08:00	01:00	45.6	49.4	36.1	69.6	
09:00	01:00	46.8	50.1	36.9	61.5	
10:00	01:00	46.7	50.1	37.4	67.2	
11:00	01:00	46.9	50.2	39.1	65.9	
12:00	01:00	46.7	50.0	38.7	66.2	
13:00	01:00	50.8	51.6	38.5	77.4	
14:00	01:00	47.5	50.2	37.5	67.6	
15:00	01:00	47.8	50.8	37.7	64.6	
16:00	01:00	49.9	52.8	40.9	68.7	
17:00	01:00	49.6	52.3	40.1	66.4	
18:00	01:00	47.9	51.0	39.8	65.7	
19:00	01:00	47.2	50.4	40.2	64.6	
20:00	01:00	46.3	49.8	38.0	64.8	
21:00	01:00	44.2	47.9	35.1	67.1	
22:00	01:00	42.5	46.4	35.6	58.5	
Average 0700-2300		47.4	50.1	37.9	59-77	

Noise Survey Results

Date: Saturday 2nd - Sunday 3rd September 2017

Site: Miners Road, Llay

Client: Sirius Planning Ltd

Project: CMU Site

Data: **Background Sound Survey: Position 1 Rear of Properties off Llay Road**

Instrumentation: Cirrus 831A Integrating Precision SLM (B15046FF) Calibration due September 2017

Weather Conditions: Dry, variable cloud, light SSE winds (1-2m/s), temp. 8-11degC

Calibration: 94dB

TABLE 4

Start Time	Run Time (hrs.)	LAeq (dB)	LA10 (dB)	LA90 (dB)	LAmix (dB)	Observations
23:00	01:00	43.5	47.3	35.8	57.9	
00:00	01:00	41.7	44.5	34.5	63.2	
01:00	01:00	39.0	40.1	34.2	56.9	
02:00	01:00	39.5	41.2	34.0	62.7	
03:00	01:00	36.6	38.3	33.3	51.2	
04:00	01:00	37.3	38.8	33.1	53.8	
05:00	01:00	41.3	43.2	36.8	58.8	
06:00	01:00	43.9	47.0	38.4	61.7	
Average 2300-0700		41.0	42.6	35.0	51-63	
Average 0700-2300		47.4	50.1	37.9	59-77	

Noise Survey Results

Date: Sunday 3rd September 2017

Location: Miners Road, Llay

Client: Sirius Planning Ltd

Project: CMU Site

Data: **Background Sound Survey: Position 1 Rear of Properties off Llay Road**

Instrumentation: Cirrus 831A Integrating Precision SLM (B15046FF) Calibration due September 2017

Weather Conditions: Dry, variable cloud, light rain (1720-1900), light SSE wind (2-3m/s), temp. 12-15degC

Calibration: 94dB

TABLE 5

Start Time	Run Time (hrs.)	LAeq (dB)	LA10 (dB)	LA90 (dB)	LAmix (dB)	Observations
07:00	01:00	49.1	52.7	41.1	72.2	
08:00	01:00	45.4	48.2	41.0	61.1	
09:00	01:00	47.6	50.5	42.8	63.0	
10:00	01:00	50.4	52.7	46.2	64.0	
11:00	01:00	50.5	53.1	45.8	68.8	
12:00	01:00	50.6	53.3	46.0	61.8	
13:00	01:00	53.2	55.5	49.0	64.5	
14:00	01:00	50.7	53.3	46.3	63.6	
15:00	01:00	49.4	52.3	44.7	62.5	
16:00	01:00	49.5	52.3	45.0	64.0	
17:00	01:00	49.8	52.7	44.3	65.1	
18:00	01:00	48.8	51.6	44.6	63.0	
19:00	01:00	47.2	50.5	41.8	63.3	
20:00	01:00	44.5	47.8	39.1	58.6	
21:00	01:00	42.6	45.9	36.9	57.9	
22:00	01:00	40.7	43.0	35.6	59.2	
Average 0700-2300		49.0	51.0	43.1	58-72	

Noise Survey Results

Date: Sunday 3rd - Monday 4th September 2017

Site: Miners Road, Llay

Client: Sirius Planning Ltd

Project: CMU Site

Data: **Background Sound Survey: Position 1 Rear of Properties off Llay Road**

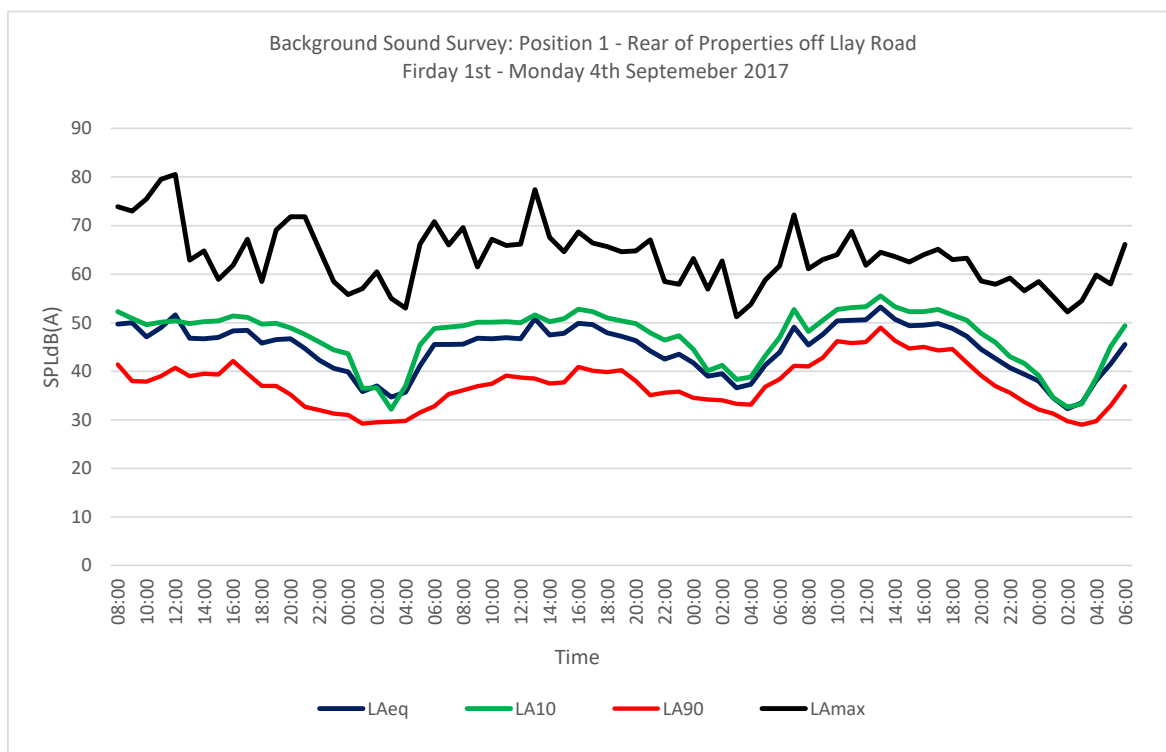
Instrumentation: Cirrus 831A Integrating Precision SLM (B15046FF) Calibration due September 2017

Weather Conditions: Dry, light mist, light SSE winds (2-3m/s), temp. 14-15degC

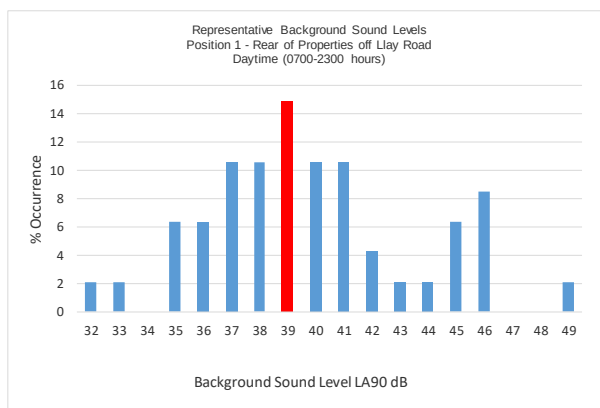
Calibration: 94dB

TABLE 6

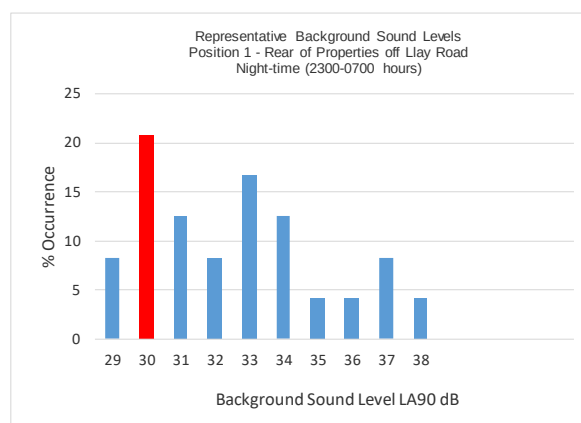
Start Time	Run Time (hrs.)	LAeq (dB)	LA10 (dB)	LA90 (dB)	LAmix (dB)	Observations
23:00	01:00	39.4	41.6	33.7	56.6	
00:00	01:00	38.0	39.1	32.1	58.5	
01:00	01:00	34.5	34.6	31.3	55.4	
02:00	01:00	32.3	32.6	29.7	52.2	
03:00	01:00	33.5	33.3	29.0	54.5	
04:00	01:00	38.1	38.6	29.7	59.8	
05:00	01:00	41.5	45.1	32.9	58.0	
06:00	01:00	45.5	49.4	36.9	66.1	
Average 2300-0800		39.8	39.3	31.9	52-66	
Average 0700-2300		49.0	51.0	43.1	58-72	
Overall Average		40.4	40.7	32.5	51-71	
Overall Average		48.2	50.3	39.7	58-81	



LA90	% Occurrence
32	2.1
33	2.1
34	0
35	6.4
36	6.4
37	10.6
38	10.6
39	14.9
40	10.6
41	10.6
42	4.3
43	2.1
44	2.1
45	6.4
46	8.5
47	0
48	0
49	2.1



LA90	% Occurrence
29	8.3
30	20.8
31	12.5
32	8.3
33	16.7
34	12.5
35	4.2
36	4.2
37	8.3
38	4.2



Noise Survey Results

Date: Friday 1st September 2017

Location: Miners Road, Llay

Client: Sirius Planning Ltd

Project: CMU Site

Data: **Background Sound Survey: Position 2 Properties off Rackery Lane**

Instrumentation: Cirrus 171A Real Time Analyser (G066350) Calibration due March 2018

Weather Conditions: Dry, scattered cloud, light NW-WNW wind (1-4m/s), temp. 11-18degC

Calibration: 94dB

TABLE 7

Start Time	Run Time (mins.)	LAeq (dB)	LA10 (dB)	LA90 (dB)	LAmix (dB)	Observations
08:30	15:00	61.8	65.1	50.2	76.2	Local road traffic noise
08:45	15:00	59.6	63.7	47.6	76.4	
09:00	15:00	59.8	63.7	47.2	74.1	
09:15	15:00	60.3	63.6	46.2	81.6	
09:30	15:00	60.2	63.6	49.6	76.0	
09:45	15:00	60.1	63.6	48.3	75.4	
10:00	15:00	58.9	63.0	45.9	75.5	
10:15	15:00	60.1	63.9	48.4	75.5	
10:30	15:00	59.7	63.6	48.9	72.9	
10:45	15:00	59.8	63.1	47.7	76.6	
11:00	15:00	60.1	63.7	48.9	75.1	
11:15	15:00	59.0	62.6	47.9	75.6	
11:30	15:00	64.7	63.6	49.5	89.6	
11:45	15:00	59.8	63.5	47.5	75.3	
12:00	15:00	59.0	62.9	47.7	75.2	
12:15	15:00	59.5	63.4	47.8	74.2	
12:30	15:00	62.1	64.3	52.7	85.2	
12:45	15:00	59.7	62.7	48.5	76.5	
13:00	15:00	60.5	63.8	51.2	77.4	
13:15	15:00	60.5	63.9	47.9	75.7	
13:30	15:00	60.0	63.7	48.5	75.0	
13:45	15:00	59.4	62.9	49.1	74.1	
14:00	15:00	60.4	63.9	49.3	76.7	
14:15	15:00	60.1	63.7	48.4	76.3	
14:30	15:00	58.6	62.6	45.6	72.7	
14:45	15:00	59.0	62.7	46.6	74.5	
Average 0830-1500		60.3	63.5	48.4	73-90	

Noise Survey Results

Date: Friday 1st September 2017

TABLE 8

Location: Miners Road, Llay

Client: Sirius Planning Ltd

Project: CMU Site

Data: **Background Sound Survey: Position 2 Properties off Rackery Lane**

Instrumentation: Cirrus 171A Real Time Analyser (G066350) Calibration due March 2018

Weather Conditions: Dry, partly cloudy, light variable wind (2-4m/s), temp. 12-18degC

Calibration: 94dB

Start Time	Run Time (mins.)	LAeq (dB)	LA10 (dB)	LA90 (dB)	LAmix (dB)	Observations
15:00	15:00	59.2	63.0	46.7	77.6	
15:15	15:00	60.1	63.9	48.8	73.5	
15:30	15:00	59.2	62.7	50.0	73.5	
15:45	15:00	60.0	63.6	49.7	72.1	
16:00	15:00	61.2	64.7	52.3	72.5	
16:15	15:00	61.2	64.2	51.9	75.3	
16:30	15:00	61.8	64.9	51.9	76.6	
16:45	15:00	61.0	64.3	49.4	77.6	
17:00	15:00	61.2	64.6	51.5	72.5	
17:15	15:00	61.9	64.6	51.4	82.7	
17:30	15:00	60.4	64.2	49.3	71.7	
17:45	15:00	63.4	64.8	50.8	88.0	
18:00	15:00	60.0	63.7	47.9	74.0	
18:15	15:00	59.6	63.6	46.3	76.1	
18:30	15:00	58.9	62.7	47.5	74.6	
18:45	15:00	58.2	62.7	46.1	72.5	
19:00	15:00	59.9	62.9	46.6	85.0	
19:15	15:00	59.5	63.5	44.9	76.0	
19:30	15:00	57.7	62.0	44.5	73.7	
19:45	15:00	58.3	62.6	43.8	74.2	
20:00	15:00	56.0	60.4	42.7	70.2	
20:15	15:00	54.5	59.3	38.2	70.2	
20:30	15:00	55.8	60.2	41.2	71.4	
20:45	15:00	54.4	58.8	38.2	70.0	
21:00	15:00	54.7	59.5	38.8	69.7	
21:15	15:00	53.9	58.8	37.8	68.3	
21:30	15:00	54.0	58.3	35.3	72.3	
21:45	15:00	54.7	58.0	36.6	73.1	
22:00	15:00	54.5	58.4	35.8	72.9	
22:15	15:00	54.3	58.8	38.7	69.6	
22:30	15:00	55.3	59.8	38.5	69.9	
22:45	15:00	52.6	55.8	34.6	68.4	
Average 1500-2300		58.9	61.9	44.6	68-88	

Noise Survey Results

Date: Friday 1st - Saturday 2nd September 2017

Site: Miners Road, Llay

Client: Sirius Planning Ltd

Project: CMU Site

Data: **Background Sound Survey: Position 2 Properties off Rackery Lane**

Instrumentation: Cirrus 171A Real Time Analyser (G066350) Calibration due March 2018

Weather Conditions: Dry, variable cloud, light variable winds (2-3m/s), temp. 8-12degC

Calibration: 94dB

TABLE 9

Start Time	Run Time (mins.)	LAeq (dB)	LA10 (dB)	LA90 (dB)	LAmix (dB)	Observations
23:00	15:00	53.0	57.0	35.0	69.2	
23:15	15:00	51.8	55.2	34.9	69.6	
23:30	15:00	52.2	56.1	35.3	68.8	
23:45	15:00	51.4	52.8	32.7	72.7	
00:00	15:00	48.3	49.4	31.7	66.8	
00:15	15:00	50.7	53.3	33.3	70.1	
00:30	15:00	51.2	52.4	31.6	71.8	
00:45	15:00	51.5	50.6	32.6	72.9	
01:00	15:00	47.7	49.2	32.4	66.2	
01:15	15:00	50.1	50.4	31.5	68.9	
01:30	15:00	47.2	43.5	30.1	69.6	
01:45	15:00	32.7	34.0	30.3	58.3	
02:00	15:00	46.4	44.1	30.4	66.5	
02:15	15:00	42.1	42.7	30.6	62.5	
02:30	15:00	49.4	47.6	30.2	69.6	
02:45	15:00	47.6	44.3	29.5	70.7	
03:00	15:00	46.5	44.7	29.2	70.0	
03:15	15:00	45.8	37.5	29.7	69.3	
03:30	15:00	46.9	47.0	31.3	66.6	
03:45	15:00	45.3	42.7	31.1	65.9	
04:00	15:00	47.7	46.7	31.2	67.6	
04:15	15:00	49.4	45.6	30.2	75.0	
04:30	15:00	45.1	44.2	33.1	67.9	
04:45	15:00	48.8	46.5	32.3	72.3	
05:00	15:00	50.1	49.8	34.7	69.0	
05:15	15:00	54.3	58.1	36.9	70.9	
05:30	15:00	54.9	59.1	37.9	72.9	
05:45	15:00	53.7	58.1	34.4	68.6	
06:00	15:00	53.2	56.8	37.8	68.3	
06:15	15:00	53.9	57.9	38.5	68.8	
06:30	15:00	54.8	59.5	40.5	70.1	
06:45	15:00	59.3	62.2	42.8	84.6	
Average 2300-0700		51.4	50.0	33.2	58-85	
Average 0700-2300		59.6	62.5	46.2	68-90	

Noise Survey Results

Date: Saturday 2nd September 2017

Location: Miners Road, Llay

Client: Sirius Planning Ltd

Project: CMU Site

Data: **Background Sound Survey: Position 2 Properties off Rackery Lane**

Instrumentation: Cirrus 171A Real Time Analyser (G066350) Calibration due March 2018

Weather Conditions: Dry, variable cloud, light variable wind (0.5-3m/s), temp. 7-18degC

Calibration: 94dB

TABLE 10

Start Time	Run Time (mins.)	LAeq (dB)	LA10 (dB)	LA90 (dB)	LAmix (dB)	Observations
07:00	15:00	57.3	61.6	40.7	74.4	
07:15	15:00	55.6	59.5	39.5	73.3	
07:30	15:00	56.9	60.0	40.2	78.7	
07:45	15:00	57.4	61.9	39.7	79.3	
08:00	15:00	56.0	60.5	38.9	72.7	
08:15	15:00	57.1	61.4	39.1	74.2	
08:30	15:00	57.6	62.2	39.4	71.7	
08:45	15:00	57.8	62.3	39.2	72.6	
09:00	15:00	57.9	62.1	39.5	76.4	
09:15	15:00	56.9	61.6	38.7	72.8	
09:30	15:00	58.0	62.6	39.5	76.9	
09:45	15:00	57.6	62.0	40.9	74.0	
10:00	15:00	56.9	61.3	42.1	70.6	
10:15	15:00	57.8	62.1	40.5	73.7	
10:30	15:00	57.3	61.5	42.1	73.2	
10:45	15:00	57.2	61.5	41.4	71.4	
11:00	15:00	57.5	62.2	42.6	69.5	
11:15	15:00	56.6	61.3	41.5	71.0	
11:30	15:00	57.6	62.2	43.8	71.2	
11:45	15:00	56.6	61.4	42.2	68.0	
12:00	15:00	57.9	61.8	45.2	73.4	
12:15	15:00	58.0	61.9	43.7	71.2	
12:30	15:00	57.8	62.1	42.7	70.1	
12:45	15:00	59.3	62.4	43.4	81.9	
13:00	15:00	60.6	62.8	42.6	86.1	
13:15	15:00	57.1	61.7	43.1	68.4	
13:30	15:00	57.0	61.5	40.4	69.4	
13:45	15:00	58.4	62.7	42.1	74.8	
14:00	15:00	56.4	61.2	40.1	71.5	
14:15	15:00	56.5	61.7	37.1	68.8	
14:30	15:00	57.5	62.2	40.5	72.0	
14:45	15:00	55.4	60.5	38.1	67.5	
Average 0700-1500		57.4	61.7	41.0	68-86	

Noise Survey Results

Date: Saturday 2nd September 2017

TABLE 11

Location: Miners Road, Llay

Client: Sirius Planning Ltd

Project: CMU Site

Data: **Background Sound Survey: Position 2 Properties off Rackery Lane**

Instrumentation: Cirrus 171A Real Time Analyser (G066350) Calibration due March 2018

Weather Conditions: Dry, variable cloud, light variable wind (1.5-3m/s), temp. 12-20degC

Calibration: 94dB

Start Time	Run Time (mins.)	LAeq (dB)	LA10 (dB)	LA90 (dB)	LAmix (dB)	Observations
15:00	15:00	57.3	61.7	38.4	73.1	
15:15	15:00	56.8	61.7	36.8	67.7	
15:30	15:00	57.5	61.6	40.4	74.3	
15:45	15:00	56.6	61.1	41.9	68.8	
16:00	15:00	57.3	61.5	40.5	73.0	
16:15	15:00	56.7	61.3	40.9	69.5	
16:30	15:00	56.8	61.4	40.2	72.6	
16:45	15:00	57.0	61.6	40.7	69.1	
17:00	15:00	57.4	62.1	42.4	70.4	
17:15	15:00	58.1	62.6	42.5	71.1	
17:30	15:00	58.1	61.6	43.7	77.6	
17:45	15:00	57.8	62.3	44.3	70.2	
18:00	15:00	57.6	62.3	44.1	70.6	
18:15	15:00	62.8	62.1	42.1	90.7	
18:30	15:00	56.7	61.1	42.7	70.8	
18:45	15:00	56.3	61.2	41.4	69.0	
19:00	15:00	57.2	61.9	43.8	69.8	
19:15	15:00	57.0	61.1	42.2	76.0	
19:30	15:00	56.3	61.4	42.4	70.1	
19:45	15:00	54.4	59.0	42.9	67.8	
20:00	15:00	56.2	60.6	43.2	72.4	
20:15	15:00	54.7	59.5	40.4	71.5	
20:30	15:00	50.5	53.9	38.8	68.6	
20:45	15:00	51.6	55.8	38.5	67.8	
21:00	15:00	53.2	57.6	38.8	70.9	
21:15	15:00	51.9	56.1	38.8	69.4	
21:30	15:00	52.7	56.8	38.7	68.8	
21:45	15:00	52.3	55.4	38.6	72.9	
22:00	15:00	52.6	55.9	39.3	73.3	
22:15	15:00	52.7	57.5	39.8	67.7	
22:30	15:00	51.8	56.5	39.5	66.4	
22:45	15:00	52.5	56.9	38.6	68.2	
Average 1500-2300		56.3	59.8	40.9	66-91	

Noise Survey Results

Date: Saturday 2nd - Sunday 3rd September 2017

Site: Miners Road, Llay

Client: Sirius Planning Ltd

Project: CMU Site

Data: **Background Sound Survey: Position 2 Properties off Rackery Lane**

Instrumentation: Cirrus 171A Real Time Analyser (G066350) Calibration due March 2018

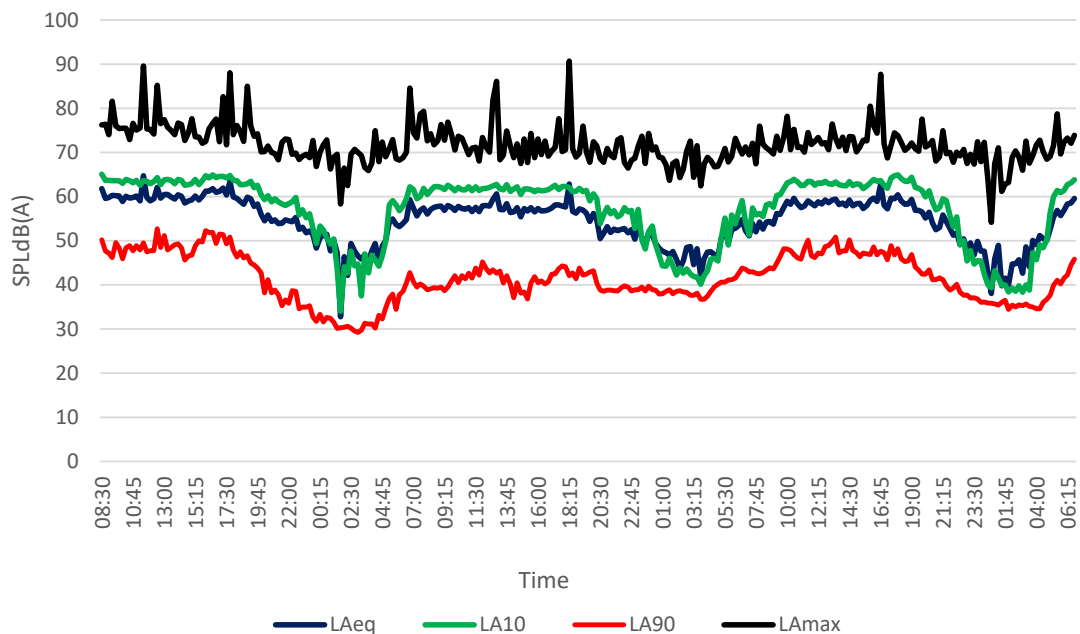
Weather Conditions: Dry, variable cloud, light SSE winds (1-2m/s), temp. 8-11degC

Calibration: 94dB

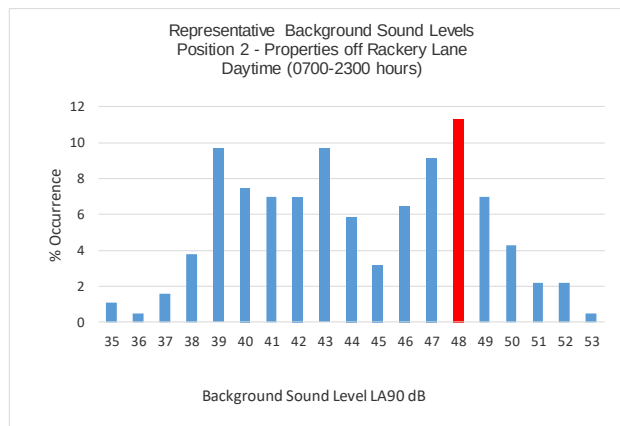
TABLE 12

Start Time	Run Time (mins.)	LAeq (dB)	LA10 (dB)	LA90 (dB)	LAmix (dB)	Observations
23:00	15:00	50.3	52.8	38.9	68.7	
23:15	15:00	53.1	57.1	38.9	71.4	
23:30	15:00	50.7	50.2	39.5	73.7	
23:45	15:00	49.0	48.1	38.6	67.5	
00:00	15:00	51.8	52.1	39.7	74.3	
00:15	15:00	51.2	53.3	38.9	70.6	
00:30	15:00	49.4	49.1	38.8	71.3	
00:45	15:00	48.4	46.7	37.9	69.0	
01:00	15:00	47.6	44.3	38.0	68.8	
01:15	15:00	47.3	44.2	38.5	67.1	
01:30	15:00	46.7	46.0	38.9	63.7	
01:45	15:00	47.5	44.3	38.0	67.5	
02:00	15:00	45.8	42.2	38.5	68.1	
02:15	15:00	43.7	43.8	38.7	64.3	
02:30	15:00	45.4	42.6	38.4	66.2	
02:45	15:00	48.5	43.6	38.3	70.3	
03:00	15:00	48.6	42.5	37.6	72.5	
03:15	15:00	44.6	41.9	37.6	64.4	
03:30	15:00	48.2	41.8	38.1	71.6	
03:45	15:00	42.0	40.1	36.7	62.5	
04:00	15:00	46.0	42.1	36.7	67.4	
04:15	15:00	47.4	43.2	37.4	68.9	
04:30	15:00	47.5	45.8	38.5	68.1	
04:45	15:00	46.8	46.0	39.6	66.7	
05:00	15:00	46.4	45.4	40.1	66.9	
05:15	15:00	50.6	50.6	40.6	68.6	
05:30	15:00	52.1	55.1	40.6	70.9	
05:45	15:00	49.5	49.0	41.1	67.8	
06:00	15:00	52.5	55.8	41.2	69.1	
06:15	15:00	52.8	53.8	41.5	73.2	
06:30	15:00	53.5	56.7	42.6	71.3	
06:45	15:00	54.8	59.1	43.8	69.7	
Average 2300-0700		49.7	47.8	39.1	63-74	
Average 0700-2300		56.9	60.7	40.9	66-91	

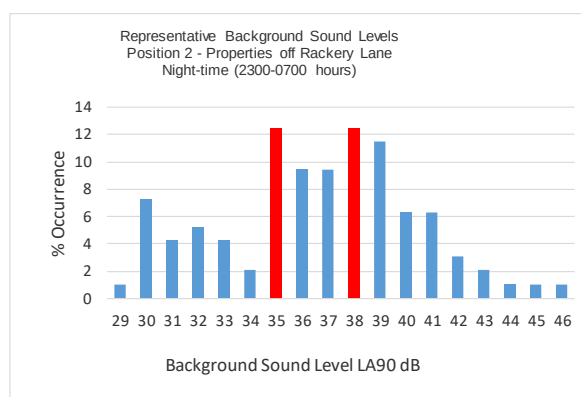
Background Sound Survey: Position 2 - Properties off Rackery Lane
Friday 1st - Monday 4th September 2017



LA90	% Occurrence
35	1.1
36	0.5
37	1.6
38	3.8
39	9.7
40	7.5
41	7
42	7
43	9.7
44	5.9
45	3.2
46	6.5
47	9.1
48	11.3
49	7
50	4.3
51	2.2
52	2.2
53	0.5



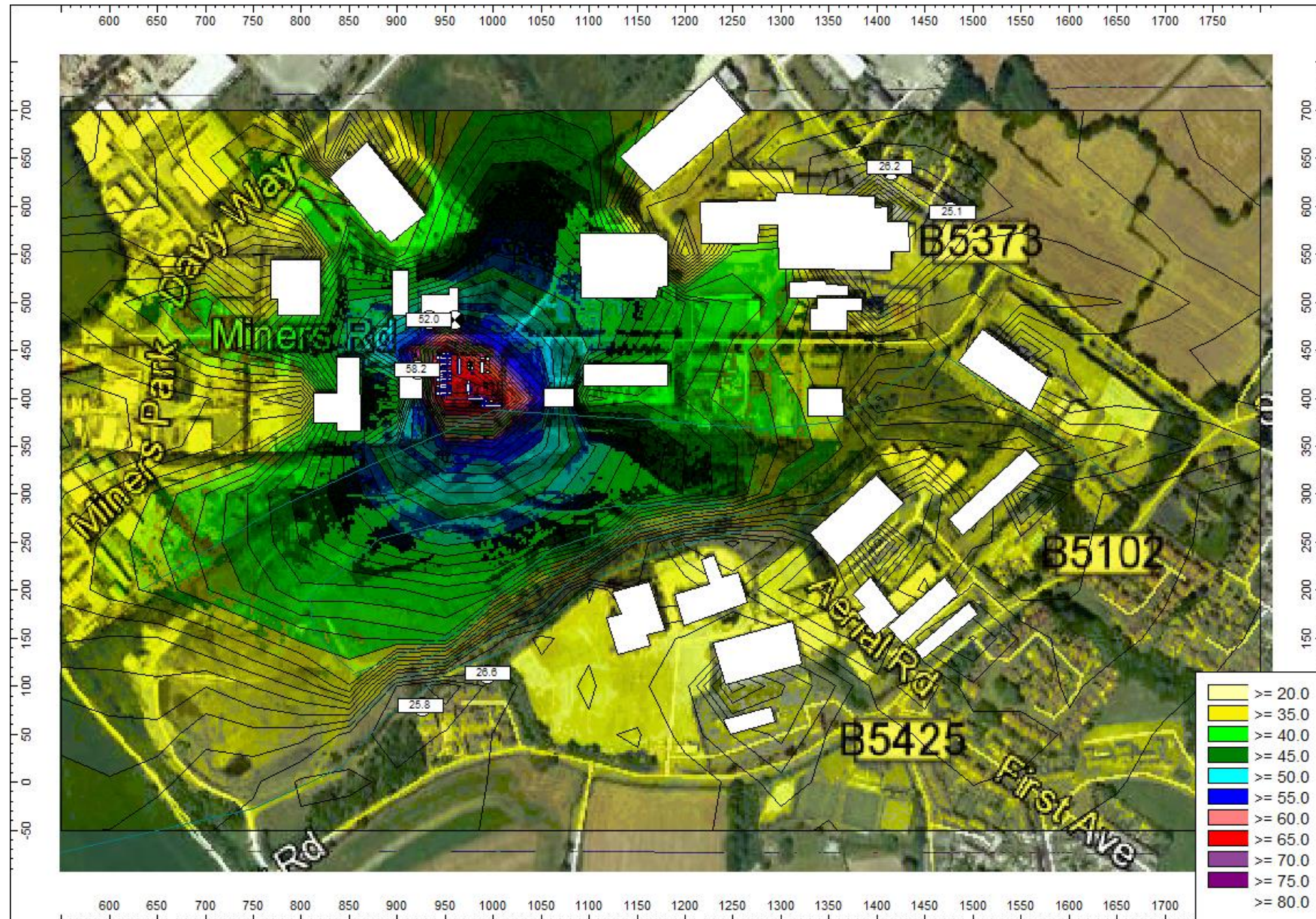
LA90	% Occurrence
29	1
30	7.3
31	4.2
32	5.2
33	4.2
34	2.1
35	12.5
36	9.4
37	9.4
38	12.5
39	11.5
40	6.3
41	6.3
42	3.1
43	2.1
44	1
45	1
46	1



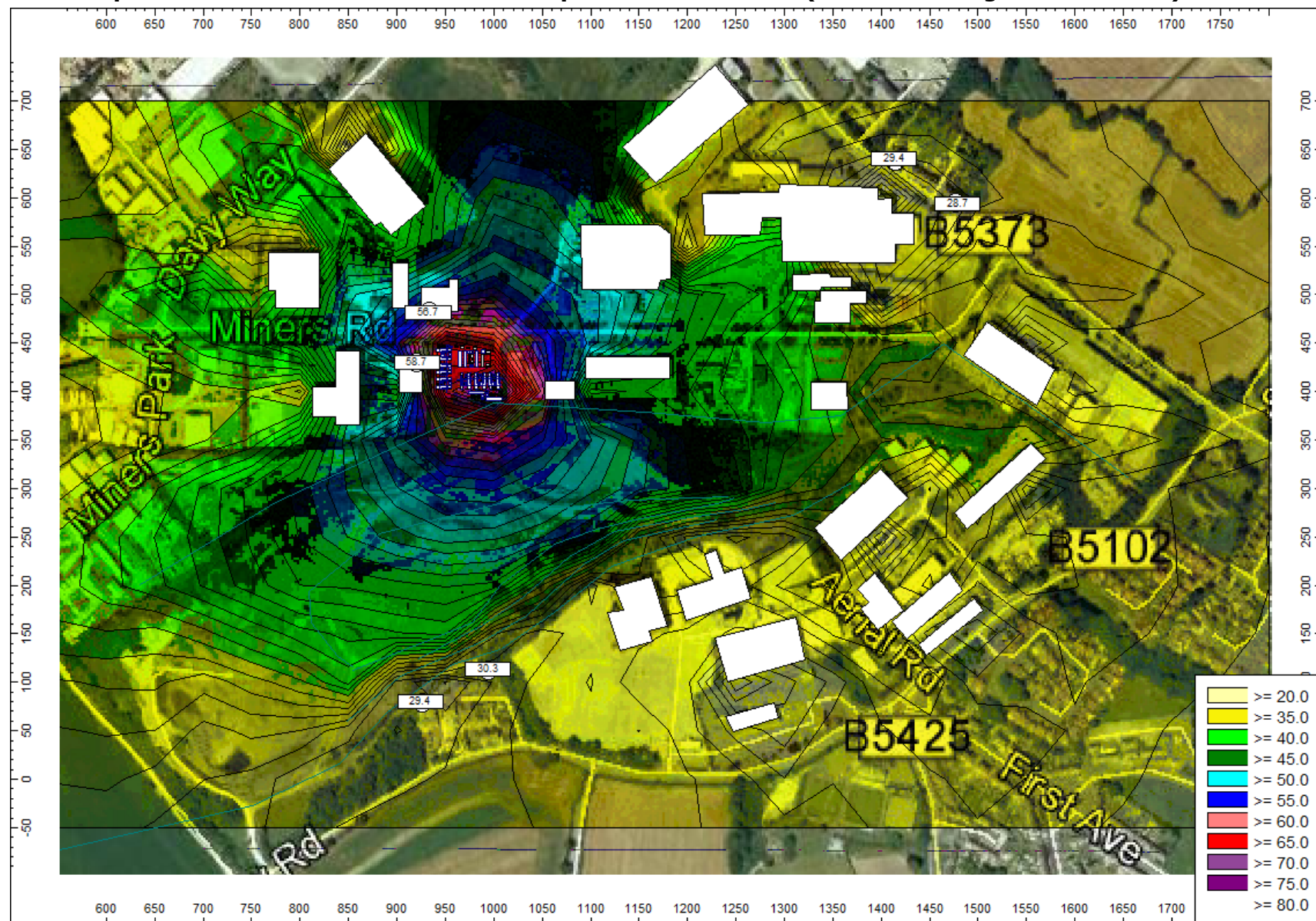
Appendix 3

Noise Mapping Results

Noise Map 1: Noise from additional plant at the CMU site (with noise mitigation measures)



Noise Map 2: Noise from consented & additional plant at the CMU site (with noise mitigation measures)



Appendix 4

Consultant's Experience & Qualifications

**Consultant: Dean Robert Kettlewell - MSc MIOA MAE I.Eng
(Director - Principal Acoustic Consultant)**

Précis

As Director and Principal Acoustic Consultant with Noise & Vibration Consultants Ltd, Dean has over 35 years background experience in a wide range of issues relating to environmental, industrial and commercial noise and vibration assessment. He currently manages corporate and unit specific contracts for:

- Assessment of Environmental & Industrial Noise
- Environmental Noise Impact Assessments
- Expert Witness representation for Deafness and 'Vibration White Finger' Claims
- Integrated Pollution Prevention and Control (IPPC) Applications
- Industrial Noise Assessment and Control
- Planning Issues for Residential and Commercial Development
- Noise at Work Regulations Assessments
- Building Acoustics and Sound Insulation Tests
- Wind Farm Noise Impact Assessments
- Entertainment Noise Assessment and Control
- Architectural Acoustics
- Specialist knowledge in the Design of Noise Control Systems
- Ground borne vibration measurement and assessment
- Project Management of Noise Control Systems
- Hand-arm Vibration Assessments

Relevant Work Experience

Director & Principal Consultant - Noise & Vibration Consultants Ltd	2001- to date
Senior Acoustic Consultant - Vibrock Limited	1998 - 2001
Associate & Principal Acoustic Consultant - John Savidge & Associates	1994 - 1998
Technical Manager – LBJ Limited (Noise Control Division)	1990 - 1994
Technical Engineer/Technical Manager (1988) - Vibac (Noise Control) Ltd	1982 - 1990

Qualifications and Education

M.Sc. Applied Acoustics (Derby University – Distinction)
HNC Electrical & Electronic Engineering
IOA Diploma in Acoustics & Noise Control
IOA Certificate in Law and Administration
Certificate of Competence in Workplace Noise Assessment
Certificate of Competence in Ground Vibration Monitoring

Affiliations: Member of Institute of Acoustics (MIOA)
 Member of Academy of Experts (MAE)
 Member of Association of Noise Consultants (ANC)
 Incorporated Engineer (I.Eng)

