PEAK acoustics

Noise Impact Assessment

Client:	Matthew Blatchford – Millbrook Building Consultancy
Site:	148 Bicester Heritage, Buckingham Road, Bicester, OX26 5HA
Reference No.	TB2911226NR
Revision:	0.0
Date of Issue:	15/12/2022

Project Consultant

T. Brown BSc (Hons) MIOA
Acoustic Consultant
tom@acousticsurveys.co.uk

Proofing Consultant

J. Parrott BEng (Hons) AMIOA
Acoustic Consultant
jack@acousticsurveys.co.uk

Email: sales@acousticsurveys.co.uk | **Office** 0330 043 1764
Web: www.acousticsurveys.co.uk
Peak Acoustics Ltd, Silk Point, Queen's Avenue, Macclesfield, SK10 2BB

Executive Summary

A Noise Impact Assessment has been undertaken for the proposed installation of external plant and HVAC systems at 148 Bicester heritage. The equipment will be used in conjunction with the activities of the business and for the heating and cooling of the site.

The nearest or most-affected Noise Sensitive Receptors (NSRs) were identified as the houses on Pine Close that are in closest proximity or most exposed to noise from the proposed sources. Reception points in calculations included ground and 1st-floor windows.

Using the measured background noise survey data, a representative night-time background sound level of 35dB was derived for the assessment.

Measurements of the prevailing background noise climate were undertaken from 6th – 7th December 2022 at a location representative of the identified Noise Sensitive Receptors (NSRs).

Acoustic modelling software, SoundPLAN, was utilised to calculate external sound propagation from the site using ISO-9613-2 - *Attenuation of sound during propagation outdoors.* Data from manufacturers specifications has been used to model noise sources where available. Adapted spectrums for similar units have been used where direct data was not available.

A BS4142:2014 Initial Impact Assessment of the predicted noise levels at NSR 1 indicated the potential for an *'Adverse Impact',* with Rating Levels up to 6 dB above the representative night-time background sound level.

A further Contextual Assessment was undertaken where noise levels from the site have been assessed to the existing noise climate along with other relevant factors and it is deemed necessary for the predicted noise impact to be reduced.

Mitigation has been recommended by installing a silencer into the HVAC system. Based on comments from the HVAC system installer this will reduce the noise output of the system by 4 dB.

Additional mitigation is possible via the use of acoustic fencing around the external condenser units in replacement of the 'hit-and-miss' fencing currently in plans. Further assessment of the noise impact with both mitigation recommendations installed achieves a '*Low Impact*' in accordance with BS4142, corresponding to the achievement of *'NOEL – No Observed Effect Level'* in the NPSE.

Contents

Tables

Figures

1. Introduction

Overview

A Noise Impact Assessment has been undertaken at 148 Bicester Heritage (hereafter referred to as 'the site') in relation to the external plant associated with the proposed change of use to D1 (education) use.

Details of the proposed external plant equipment have been provided by the applicant and are listed below:

- 2 x PURY-EP400YNW-A1 – Condenser Units.
- Zero Petroleum HVAC system extract.
- Zero Petroleum HVAC system inlet.

Manufacturer technical data sheets with noise level data for the proposed plant have been sourced and are given in **Appendix G.**

Some of the equipment will be mounted externally within an enclosure and some will be mounted internally and ducted outside.

The external plant equipment is associated with the air conditioning and heating of the site and the internal plant is part of a bespoke HVAC system to be used as part of the business.

An assessment of the proposed plant equipment is to be undertaken to determine whether nearby residents are likely to suffer a loss of amenity as a result of noise from the proposed systems. Mitigation will be given should any potential loss of amenity be indicated.

Scope & Objectives

The scope of the noise assessment can be summarized as follows:

- Baseline sound monitoring survey to evaluate the prevailing background sound levels at the Noise Sensitive Receptor ('NSR') in accordance with BS7445 - *'Description and Measurement of Environmental Noise'*;

- Detailed sound modelling, acoustic calculations and analysis to predict sound levels at the NSR using industry-standard acoustic modelling software 'SoundPLAN'. This software uses ISO-9613-2 - *Attenuation of sound during propagation outdoors;*

- A contextual assessment for the suitability of the site, in accordance with relevant standards in respect of sound from the proposed sources; and

- Recommendation of mitigation measures where necessary, to comply with the requirements of the National Planning Policy Framework (2019), Noise Policy for England (2010) and British Standard BS 4142:2014+A1:2019 – Methods for rating and assessing industrial and commercial sound.

- Planning condition 15 of the decision document provided by the client states the following:

'Prior to the units hereby approved being first occupied all mechanical plant or machinery to be installed within the relevant building shall be identified and assessed in accordance with BS4142:2014 and the report submitted to the Local Planning Authority for approval. Where the approved assessment identifies the need for any mitigation or acoustic enclosure full details should be agreed with the Local Planning Authority and put in place prior to the first occupation of the building.

Reason: To ensure the creation of a satisfactory environment free from intrusive levels of noise in accordance with Saved Policy ENV1 of the Cherwell Local Plan 1996.'

Further to the above, planning note 6 also states:

"In respect of condition 15 above, all mechanical plant or machinery should be assessed to ensure noise is not a problem at nearby noise sensitive receptors. Ideally there should be no increase on existing background levels when assessed as a rating level."

- Further information on the legislation can be found in **Appendix I.**

2. Environmental Noise Survey

Measurement Methodology

To establish the existing environmental noise levels on site, a noise survey was conducted from the 6th – 7th of December 2022 between 12:40 pm and 12:35 pm. Measurements of $L_{Aeq,T}$ and $L_{A90,T}$ were logged in 5-minute intervals in accordance with BS7445 - *'Description and Measurement of Environmental Noise'*.

The unattended monitoring location (M1) was positioned at a height of approximately 1.7 metres. The M1 monitoring location was chosen to obtain a background noise level representative of the NSR which is a similar distance from the A4421 and A4095 roundabout on the opposite side.

The monitoring position is deemed representative of sound levels at 'NSR 1' during the typical operational periods of the proposed development.

Further detail of the measurement along with site pictures are given in **Appendix A.**

Measurements were obtained using Class 1 instrumentation. Full equipment details are given in **Appendix B**.

Equipment was calibrated before and after use and no significant drift occurred during measurements. Up-to-date calibration certification can be provided upon request. Full calibration details are provided in **Appendix C**

Daytime temperatures during the survey were noted as between 3 - 4°C with wind speeds typically between 3 - 5m/s; deemed suitable for conducting environmental noise monitoring. Detailed meteorological information can be found in **Appendix D.**

The site, proposed noise source and NSR locations are shown in **Figure 1.**

Figure 1: Site, Source & NSR Locations - https://google.co.uk/maps

Site Boundary (Approx.)

Background Monitoring Location M1 (Approx)

Noise Sensitive Receptor (NSR)

Site Description

The site is an industrial building within the Bicester Heritage estate. The South and West boundaries of the site are adjacent to Skimmingdish Lane and A4421 road and roundabout. To the Northeast, East and Southeast of the site, there are multiple other industrial and commercial units and the wider industrial estate. The estate specialises in automotive and classic / heritage vehicles and associated businesses. There are multiple engineering and mechanical-based uses in close proximity to the site.

Context and Subjective Noise Climate

Noise Source	Description	Time of Observation	Photo
Road & Roundabout	Busy main road with cars, vans and trucks passing the site.	Constant during the site visit	
Construction Work	Construction work at front of the building. Noise from machinery and plant in operation	Constant during the site visit	
Cherry Picker/roof works	Works were being undertaken to the roof of the site via a Cherry Picker.	Intermittent during the site visit	

Table 1*: Subjective Summary of Noise Sources*

Non-Representative Noise Sources

Under normal circumstances, the noise from construction works and cherry picker would not be present. These sources were only operational during the daytime hours and away from the M1 measurement position. The sources did not operate throughout the night-time period.

Noise Sensitive Receptors

NSRs for the purposes of the noise impact assessment are the nearest or most affected residential buildings & dwellings. Noise impact is not assessed for surrounding commercial & industrial buildings within the Bicester Heritage Estate.

The nearest or most-affected Noise Sensitive Receptor (NSR 1) was identified as No. 40 Pine Close to the West of the site on the opposite side of the roundabout. The closest habitable room windows and closest site boundary of this receptor will be considered as specific reception points in calculations.

3. Environmental Noise Survey Results

Measurement Results

The condenser units and HVAC systems are to serve the site and therefore have the potential to operate at any time of day or night.

The day and night-time background sound levels from measurement M1 are summarised below.

Measurement	Date(s)	Period	$L_{Aeq,T}$	$L_{A90,T}$
M1	6th & 7th December 2022	Daytime 16hr (07:00 – 23:00)	65	58
	6th – 7th December 2022	Night-time 8hr (23:00 – 07:00)	58	35

Table 2*: M1 Background Noise Survey Results*

A full-time history of the survey data is shown in **Appendix E.**

For the derivation of a representative night-time background sound level, the data from the whole night-time period (23:00 – 07:00) has been statistically analysed. A graph is provided below.

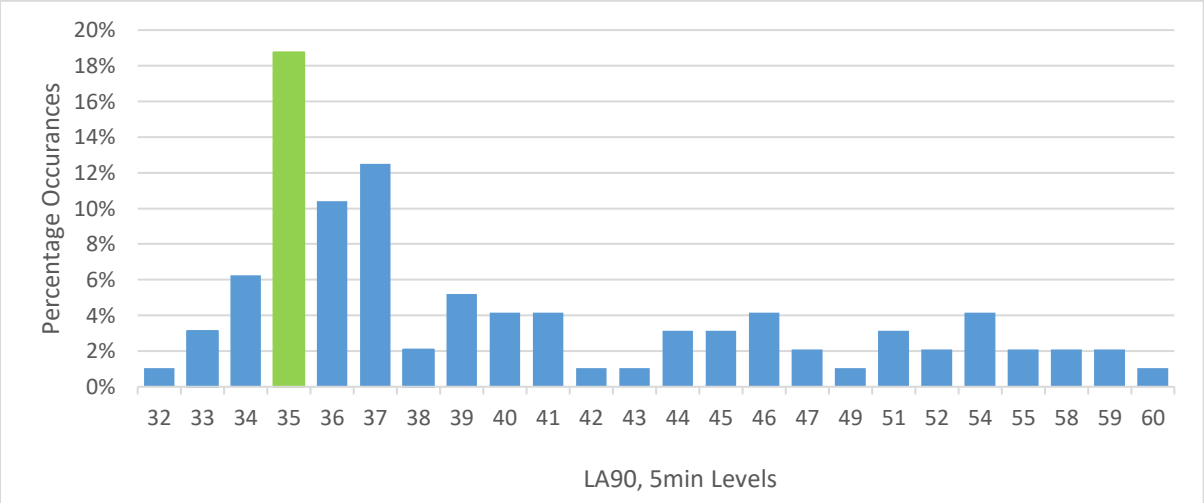


Figure 2: M1 Background Statistical Analysis

From the statistical analysis of the M1 measurement, **35 dB L_{A90}** has been selected as the representative background sound level for the BS4142:2014 assessment at the NSR location.

4. BS4142:2014 Initial Impact Assessment

Noise Modelling

External sound propagation from the site has been calculated using industry-standard acoustic modelling software 'SoundPLAN'. This software uses ISO-9613-2 - *Attenuation of sound during propagation outdoors* and the model takes into account the following key factors:

- *Aerial Imagery & Terrain Data sourced from Google Maps/Elevations*
- *Geometric divergence of sound*
- *Atmospheric absorption of sound*
- *Ground absorption*
- *A light downwind correction toward the NSRs*
- *Surrounding structures and objects which may reflect or block sound toward the NSRs*
- *The height of the NSRs (i.e., First/second-floor reception point)*
- *Operational schedule of equipment*

The following input parameters were used in the noise model:

Parameter	Input
Reflection Order	3
Ground Absorption Factors	G = 0.5 (Mixed Ground)
Air pressure	1013.3 mbar
Relative Humidity	70.0 %
Temperature	10.0°C

Table 3*: Calculation Input Parameters*

Source Noise Levels – External Condenser Units

Details of the proposed external plant have been provided by the applicant, and include

- *2 x externally mounted condenser units – Mitsubishi – PURY-EP400YNW-A1*

Manufacturer technical data sheets for the externally mounted condensers with noise level data were sourced and are given in **Appendix G**.

Spectral sound level data from the manufacturer's documentation is provided in table 4, below:

Unit	Para.	63	125	250	500	1k	2k	4k	8k	dBA	Height above Terrain
PURY – EP400YNW-A1	Lp	*81*	70	70	68	62	59	54	49	69	1m

Table 4*: Condenser Unit Noise Levels*

The given Sound Pressure Level was then used to calculate the Sound Power Level of each of the sources for the noise model using 'SoundPLAN'. The 'SoundPLAN' calculation window is displayed in the Figure below.

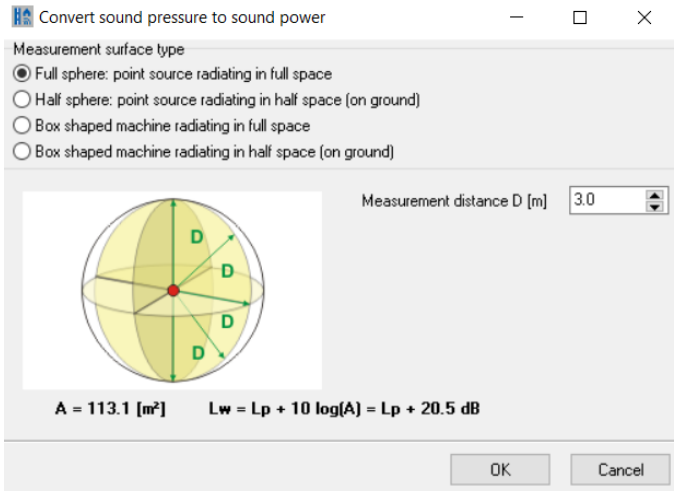


Figure 3: SoundPLAN Sound Pressure to Sound Power Calculation

Details of the noise sources that have been modelled in 'SoundPLAN' are given below.

Source No.	Source	Parameter	Noise Level, dBA	Height above Ground *(m)*
1	*PURY-EP400YNW-A1*	*LwA*	80	1

Table 5: Modelled Source Noise Levels

Source Noise Levels – Zero Petroleum HVAC system

The HVAC system installers 'Fumetec' has stated the following concerning the noise output of the HVAC system.

> *"Predicted noise level for the fan unit and discharge stack on the proposed installation of new fume cupboards and extraction system*
>
> *Fan unit mounted internally 64dB*
>
> *Discharge exit noise at approximately 6.0 mts from ground level estimate 58dB"*

Based on this information the following assumptions have been made to enable the calculation of the noise sources:

- The system produces a sound pressure level of 58dB from the ductwork termination point when measured at 6 meters.
- The fan unit surrounding mounted inside a room and measured at a distance of 1m produces a sound pressure level of 64dB.

Spectrum data is not available for the proposed system and so spectrum data from a comparable fan unit will be adapted to match the levels stated by 'Fumetec'. The following fan unit has been selected from which the noise output spectrum will be adapted:

- Systemair MUB 062 630D4 Multibox

Manufacturer technical data sheets for the comparable fan unit are given in **Appendix G**.

Sound Power Level – Ductwork Termination

Using SoundPlan, the single-figure sound pressure level of 58dB at 6 meters has been used to calculate the single-figure sound power level at the ductwork termination to be 85dB Lw.

The sound power spectrum for the Systemair unit has then been adapted to match the overall sound power output at the ductwork termination.

Sound Power Level – Fan within the ductwork

From the site plans, the ductwork is shown to be 600mm diameter circular ducting with a single 90-degree bend. The vertical length of the ductwork is measured at 2m, it is assumed an additional 2m of ductwork joins the to the fan internally giving a total of 4m of ductwork with a single 90-degree bend. This information has been used to calculate the in-duct sound power of the fan unit.

Sound Power Level – Fan surround

It is understood that the air inlet of the HVAC system will be mounted internally with airflow via louvred wooden doors on the Southeast façade.

'Fumetec' have stated the sound pressure level of the fan unit mounted internally to be 64dB. This is assumed to have been measured at a distance of 1m, which equates to a sound power level of 75dB Lw. The surround-radiated sound power level spectrum taken from the Systemair fan unit data has been used to calculate the internal spectrum sound power from the proposed fan surround.

The calculated sound power spectrum will be used to model an area source on the Southeast façade assuming a worst-case scenario where the louvred wooden doors are standing open.

Sound Power Spectrums

The calculated sound power spectrums are provided in **Table 6** below:

Unit	Para.	63	125	250	500	1k	2k	4k	8k	dBA	Height above Terrain
HVAC Fan in-duct	Lw	90	100	95	93	92	87	84	79	**96**	-
Ductwork Termination	Lw	80	94	88	83	78	72	69	64	**85**	5m
Fan Surround - Internal	Lw	61	75	60	53	53	50	43	35	**61**	-
PURY-EP400YNW-A1	Lw	92	80	80	79	73	70	65	60	**80**	1m

Table 6 - Calculated Sound Power Spectrums

To account for a worst-case scenario, all sources will be modelled to be running for the entire 24-hour period.

Specific Sound Levels

The Specific Sound Level is denoted L_{As} and is the A-weighted, equivalent noise level at the NSR locations. Specific Sound Levels have been calculated from the noise model and the levels at the worst affected floors of receptors are given below.

Location	Specific Sound Level, dB L_{As}
NSR 1 (1F)	38

Table 7*: Specific Sound Levels*

Rating Levels

In accordance with BS4142, the Specific Sound Levels may be corrected for characteristics that make the sound more noticeable at the NSR location such as tonality, impulsivity and intermittency. Section 9.2 of BS4142:2014 gives commentary on these characteristics and appropriate penalties:

> ***"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."

Based on the actual or predicted frequency spectrums for the units to be installed and the general character of noise from air handling units and condensers, tonality and impulsivity are not likely to be an issue. As the condenser units are likely to operate depending on heating/cooling requirements, there could be an intermittent element to their operation. This is also true of the Zero Petroleum extract system and so a 3dB rating penalty will be applied.

The resultant Rating Levels are summarised below:

Location	Specific Sound Level, dB L_{As}	Total BS4142 Character Corrections	Rating Level, dB L_{Ar}
NSR 1	38	+ 3	41

Table 8*: Rating Levels*

Rating Levels Vs Background

The Rating Levels are to be compared to the representative background sound level to determine the noise impact in accordance with BS4142.

A Sound Rating Level at or below the background noise level is indicative of Low Impact;

A Sound Rating Level that exceeds the background noise level by around +5dB is likely an indication of Adverse Impact, depending on the context;

A Sound Rating Level that exceeds the background noise level by around +10dB is likely an indication of Significant Adverse Impact, depending on the context;

The indicated noise impact at the identified Noise Sensitive Receptors is summarised below:

Location	Rating Level, dB L_{ar}	Background Sound Level, dB L_{A90}	Difference, dB	Noise Impact
NSR 1	41	35	+6	*Adverse Impact*

Table 9*: Noise Impact*

The noise impact at the nearest sensitive receptor position is indicative of an '*Adverse Impact*' in accordance with BS4142:2014.

5. BS4142:2014 Contextual Assessment

Aspects of absolute level

The comparison of the predicted noise level received at the NSR to the background level shows a marginal '*Adverse Impact*'. It is noted that while the 35dB background noise level figure is the most common single figure measured during the night-time period (19%) it is also true that the noise level was 40dB or higher for 40% of the night-time period which would result in a '*Low Impact*' outcome.

Aspects of character

The character of noise produced by the new proposed sources is broadband 'white' noise and is similar to aerodynamic road noise which is the primary noise source in the area. It is therefore unlikely that the operation of the new sources will be subjectively noticeable.

Aspects of the receptor

The noise levels received by the nearest sensitive receptor, even with rating levels applied, are well under WHO guidelines for external amenity noise.

Given the location of the receptor on the opposite side of the roundabout to the Bicester Heritage estate, it is likely to be accustomed to noise from other existing industrial and commercial uses in the area. This would contextually lower the impact of the proposed sources.

Assuming a 10dB reduction through an open window, the noise level received within the nearest receptor from the proposed sources would be within internal guidelines for bedroom noise levels overnight and so would be unlikely to give rise to complaints.

Contextual recommendations

Based on the information used to carry out the assessment, it is considered that the noise impact is likely to be marginal, however, it is recommended that noise levels be reduced where possible to ensure that noise impact is low.

6. Mitigation

The Zero Petroleum extract system ductwork termination is the loudest proposed noise source at the site. For the initial impact assessment, this was modelled as an unsilenced system.

Silencer on Zero Petroleum Extract System

The information provided by 'Fumetec' regarding the extract ductwork sound output states:

> *"if attenuation was fitted on the discharge side, this would reduce by 4dB"*

The predicted noise impact at NSR 1 based on the incorporation of a silencer achieving a 4dB reduction on the Zero Petroleum extract system is given below:

Location	Rating Level, dB L_{ar}	Background Sound Level, dB L_{A90}	Difference, dB	Noise Impact
NSR 1	39	35	+ 4	*Low Impact*

Table 10 - Mitigated Noise Impact (Silencer)

If deemed necessary, a further reduction could be achieved via changing the hit & miss fencing currently proposed around the external condenser units to acoustic fencing at a height of 2m. With the recommended acoustic fence the following outcome is achieved:

Location	Rating Level, dB L_{ar}	Background Sound Level, dB L_{A90}	Difference, dB	Noise Impact
NSR 1	37	35	+ 2	*Low Impact*

Table 11: Mitigated Noise Impact (Silencer & Acoustic Fencing)

The recommended mitigation measures still predict noise levels at the NSR to be above the existing background noise level, however the silencing of the extract system would move the predicted impact from being 'adverse' to 'low' and the enclosure of the condenser units would further move the impact from being considered marginally below 'adverse' to marginally above the background level.

7. Conclusion

A Noise Impact Assessment has been undertaken at 148 Bicester Heritage, Bicester, OX26 5HA in relation to the proposed installation of external plant and HVAC system.

Measurements of the background noise climate were undertaken from 6th – 7th December 2022 at a position deemed representative of the identified Noise Sensitive Receptors (NSRs).

The nearest and most-affected Noise Sensitive Receptors were identified as dwellings on Pine Close to the West of the site.

A BS4142:2014 Initial Impact Assessment of the predicted night-time noise impact indicated the potential for an *'Adverse Impact'* at the NSR location, with Rating Levels up to 6 dB above the representative 35dB background sound level.

A further Contextual Assessment was undertaken where noise levels from the site have been assessed to the existing noise climate along with other relevant factors and it is deemed that mitigation should be included to reduce the noise impact as much as possible.

Mitigation is recommended in the form of adding a silencer to the Zero Petroleum HVAC ductwork, stated by the installer to provide a 4dB reduction leading to a '*Low Impact'* outcome in BS4142:2014 and corresponding to achievement *'NOEL – No Observed Effect Level'* in the NPSE.

Additional mitigation has also been recommended in the form replacing the 'hit-and-miss' fence around the condenser units with a 2m acoustic fence which would lower the noise impact by a further 2 dB.

8. Uncertainty

The background monitoring equipment is subject to a 1dB error margin, however, calibration before and after measurements allows the drift within the margin to be monitored and thus demonstrates that minimal drift occurred throughout the measurements.

Uncertainty can arise in the prediction of noise propagation from and around flat reflective surfaces, such as the surrounding structures present on site. This has been reduced to a minimum by utilising an acoustic modelling software that uses the validated method, ISO-9613-2, as described in BS4142.

Uncertainty in the calculated specific sound levels is further reduced by utilising manufacturer-given sound power levels.

It is noted that due to a lack of available information on the Zero Petroleum extract system, spectrum data has been adopted for a comparable unit however if spectrum information becomes available for the actual system in the future, the assessment should be updated accordingly.

APPENDIX A - Measurement Details

Measurement	Kit	Start Date	Start Time	End Date	End Time
M1	A3	06/12/22	12:40	07/12/22	12:35

Table 12: Measurement Dates

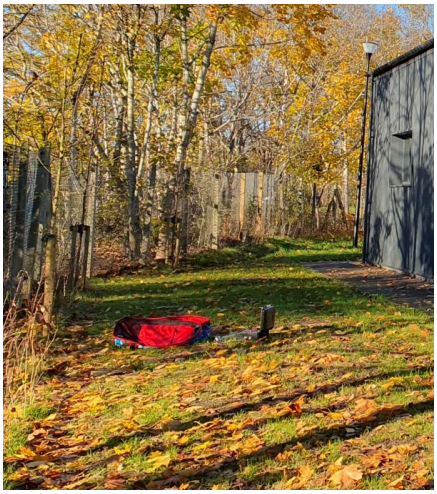



Figure 4: Site Location Measurement Pictures

APPENDIX B - Equipment Details

Kit	Equipment	Make	Model	Class	Serial Number
A3	Sound Meter	Svantek	971	1	41980
A3	Pre-Amp	Svantek	SV18	1	44331
A3	Microphone	ACO	7052E	1	60249
1	Calibrator	Svantek	SV33	1	90273

Table 13: Measurement Equipment Details

APPENDIX C - Calibration Details

Measurement	Calibrator Ref Level (dB)	Deviation Before (dB)	Deviation After (dB)
M1	113.9	0.57	0.62

Table 14: Calibration Details

APPENDIX D - Meteorology Details

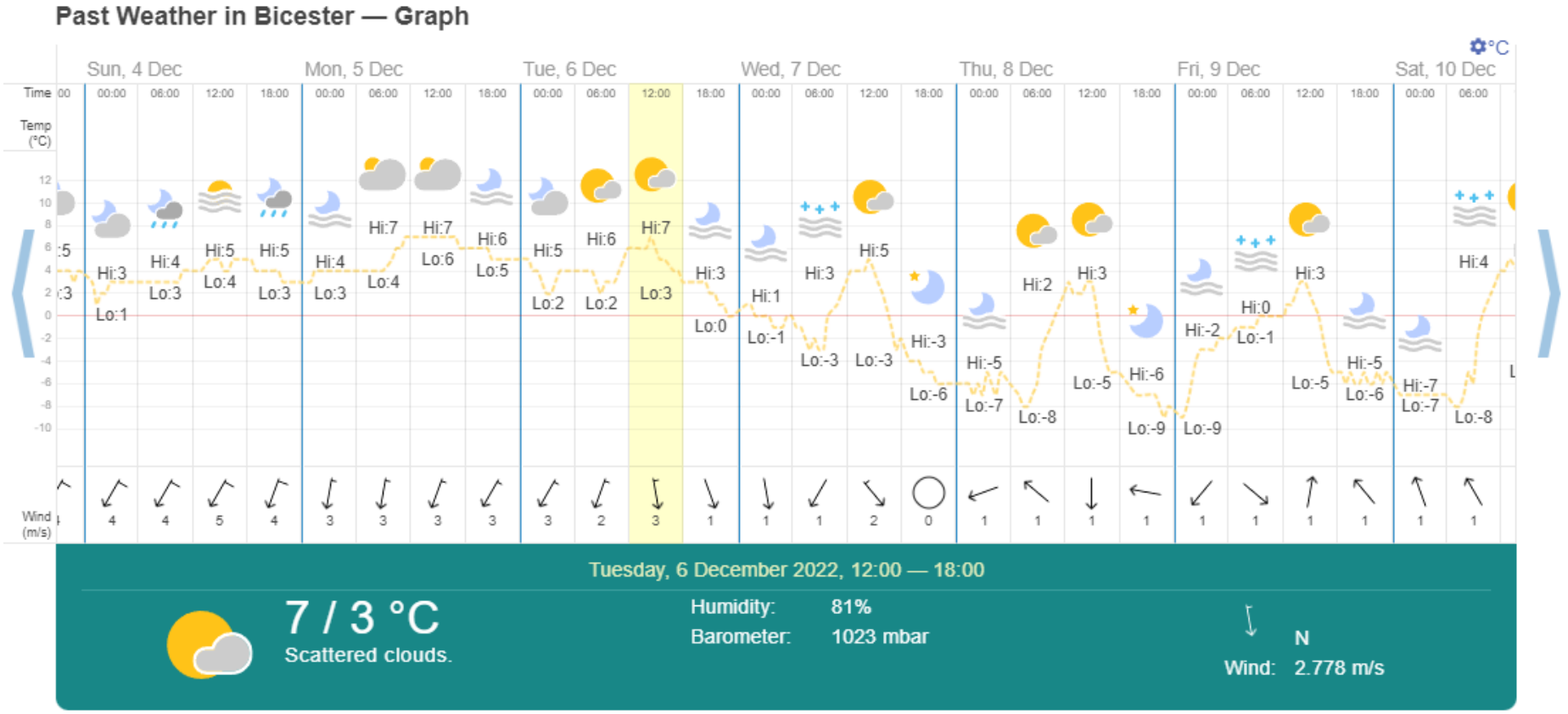


Figure 5 - Meteorological data from www.timeanddate.com/weather

APPENDIX E - Noise Survey Results

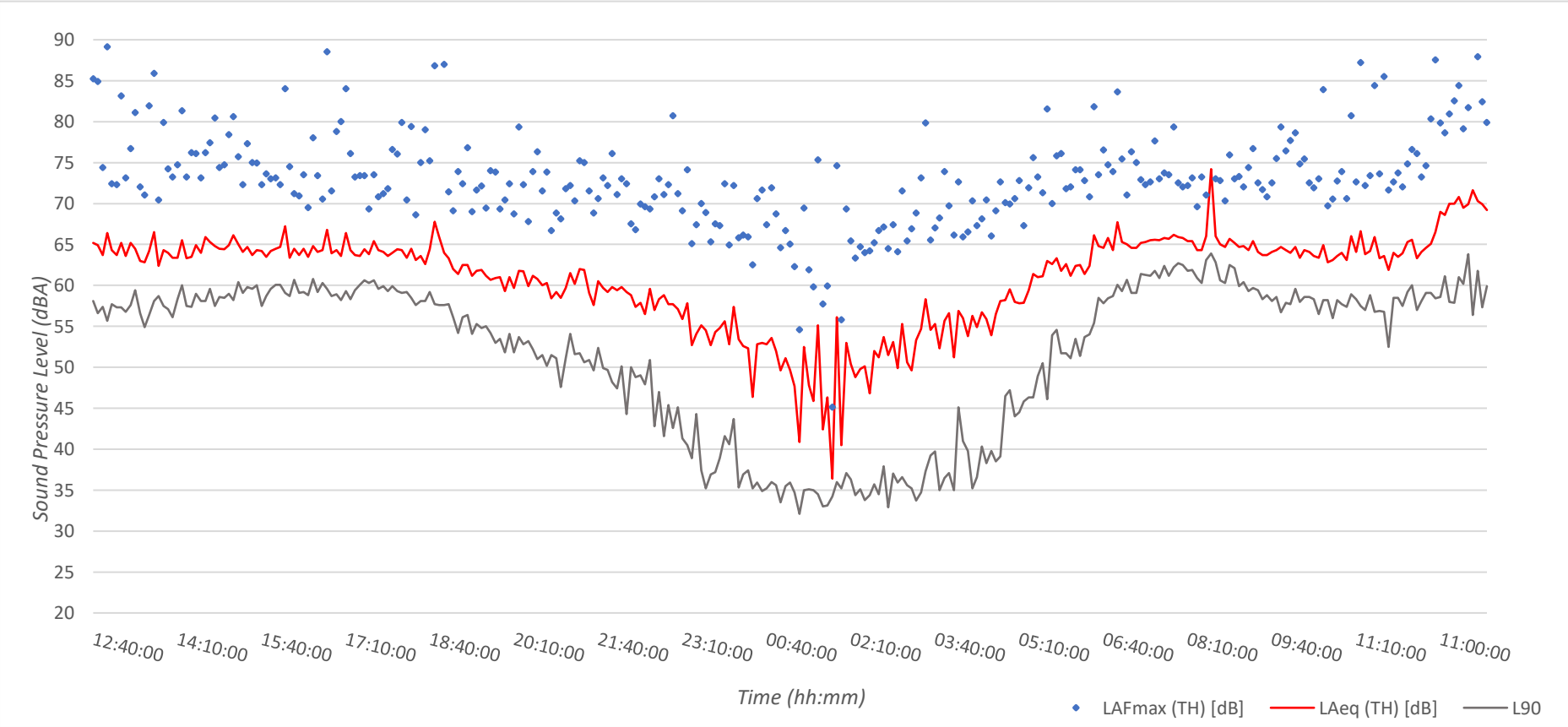


Figure 6 - Measured Background Sound Levels Time History (M1): 6th – 7th December 2022

APPENDIX F - Grid Noise Maps

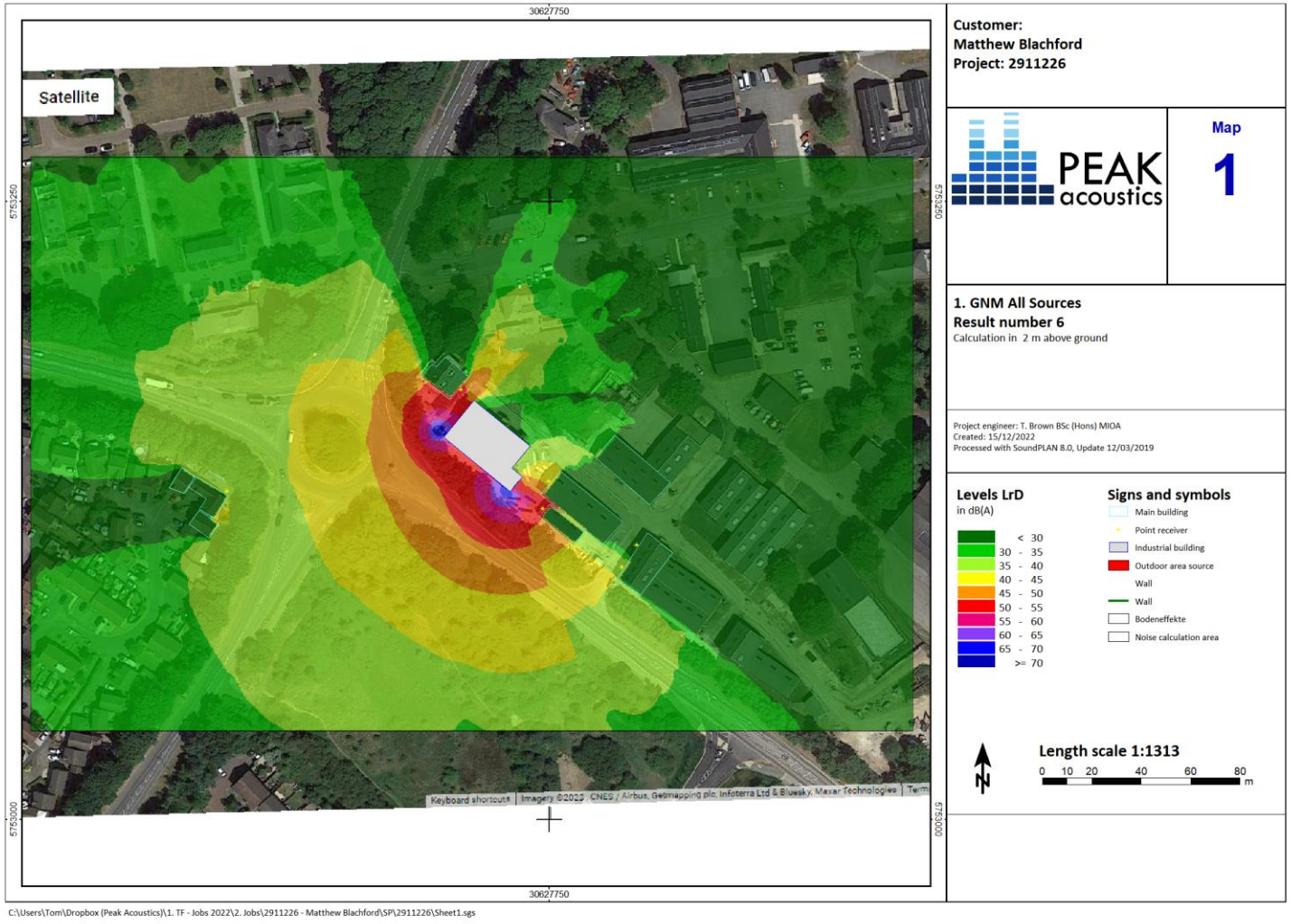


Figure 7: 2D Grid Noise Map of night-time Initial Impact Assessment

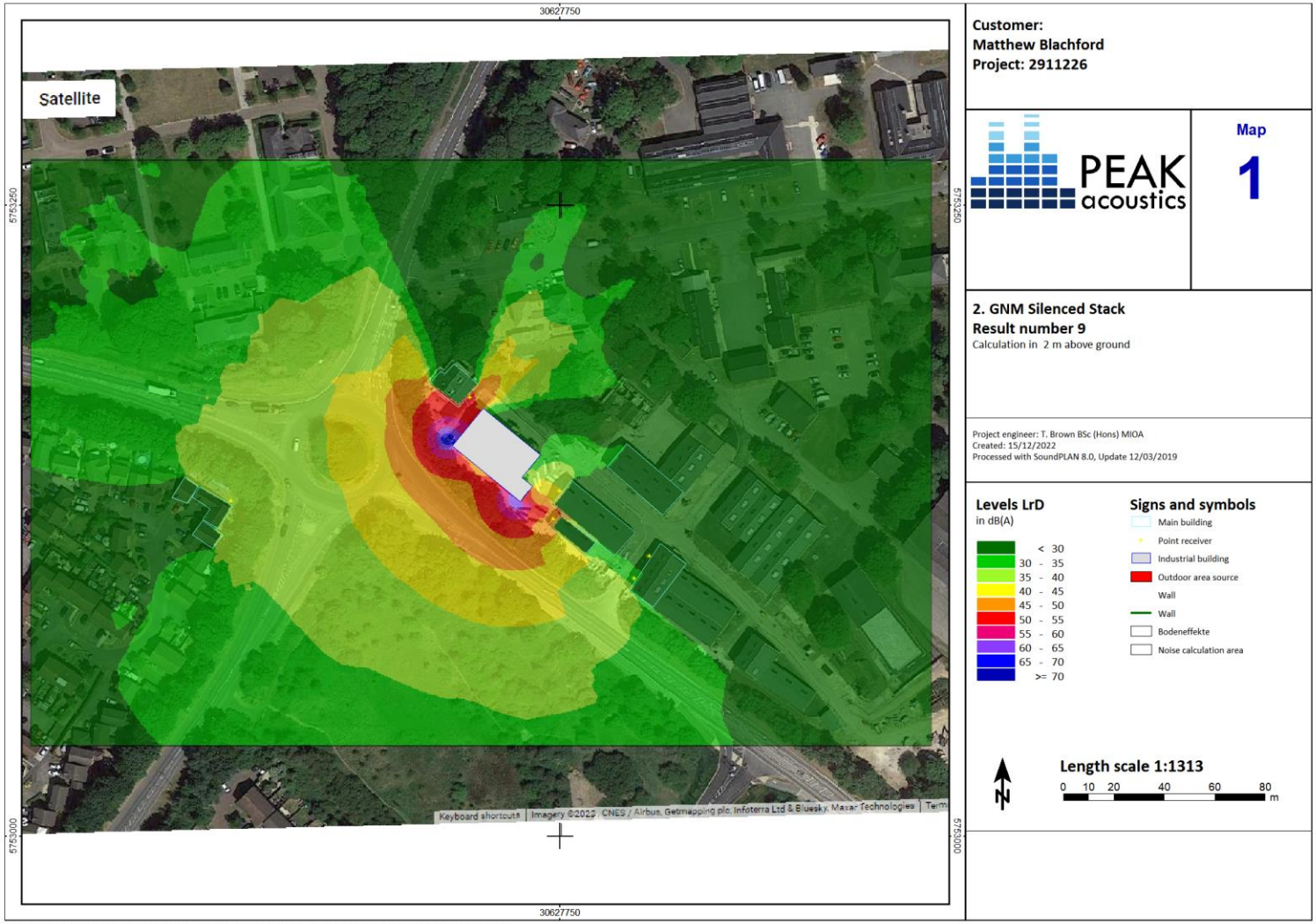


Figure 8 - 2D Grid Noise Map of night-time mitigated impact – silenced extract

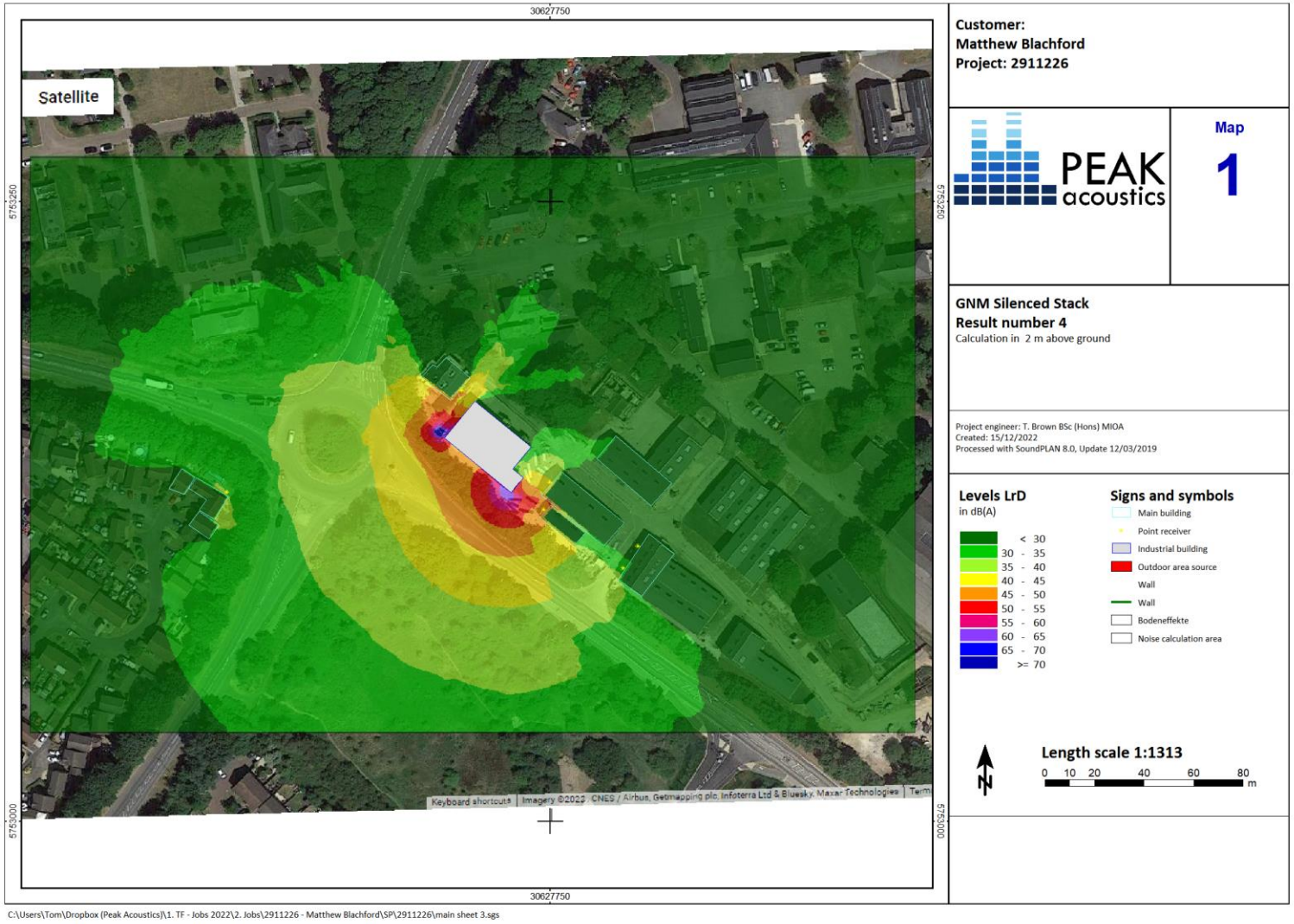
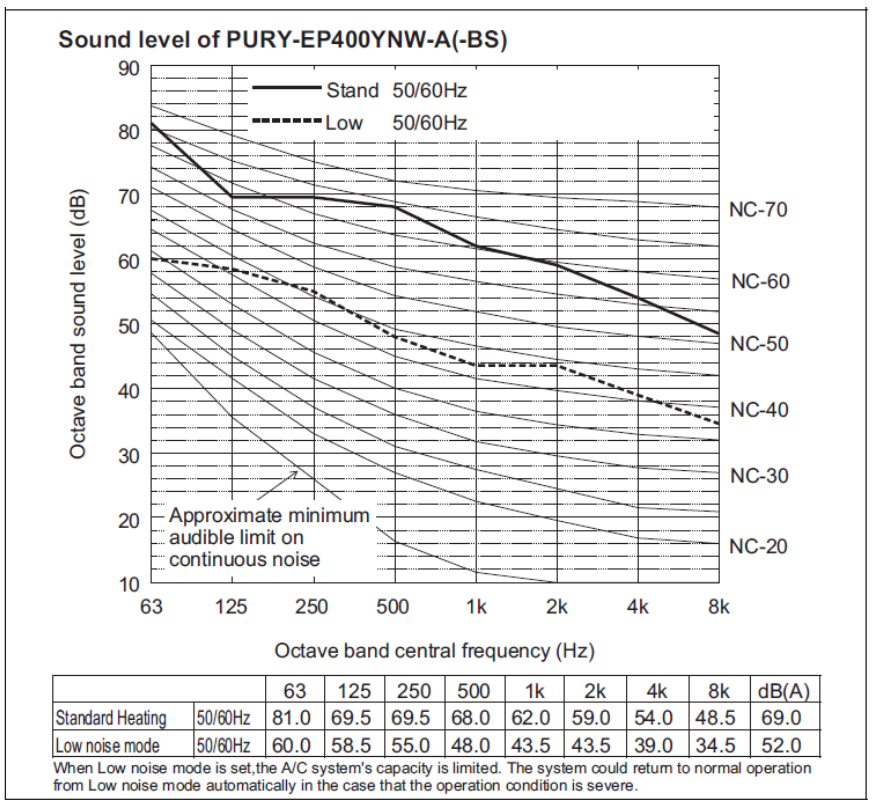


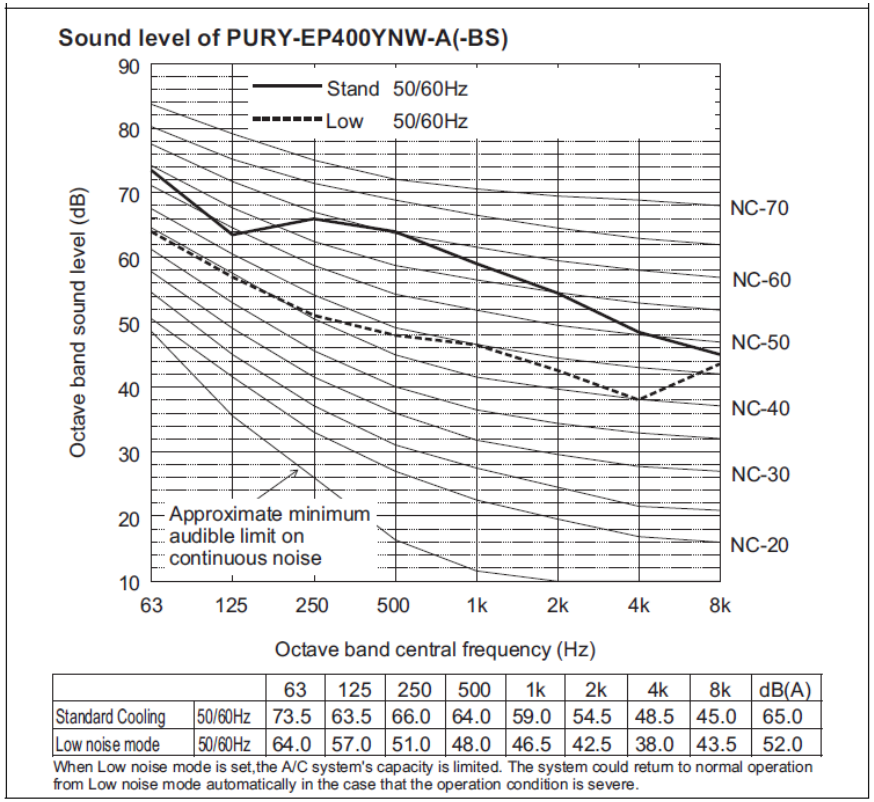
Figure 9 - 2D Grid Noise Map of night-time mitigated impact – silenced extract and enclosed condensers

APPENDIX G - Manufacturer Technical Data Sheets



		63	125	250	500	1k	2k	4k	8k	dB(A)
Standard Heating	50/60Hz	81.0	69.5	69.5	68.0	62.0	59.0	54.0	48.5	69.0
Low noise mode	50/60Hz	60.0	58.5	55.0	48.0	43.5	43.5	39.0	34.5	52.0

When Low noise mode is set,the A/C system's capacity is limited. The system could return to normal operation from Low noise mode automatically in the case that the operation condition is severe.



		63	125	250	500	1k	2k	4k	8k	dB(A)
Standard Cooling	50/60Hz	73.5	63.5	66.0	64.0	59.0	54.5	48.5	45.0	65.0
Low noise mode	50/60Hz	64.0	57.0	51.0	48.0	46.5	42.5	38.0	43.5	52.0

When Low noise mode is set,the A/C system's capacity is limited. The system could return to normal operation from Low noise mode automatically in the case that the operation condition is severe.

Figure 10 - Heating and Cooling mode noise levels for PURY-EP400YNW

systemair

MUB 062 630D4 Multibox

Centrifugal box fan, insulated, flexible outlet
Item number: 235398
Variant: 400V 3~ 50Hz - 90° air flow

- High efficient motor
- Speed-controllable via frequency converter
- Integral cold conductor (PTC)
- Low sound level
- Flexible airflow direction due to removable panels
- Installation in any mounting position
- Easy to maintain and reliable

The MUB fan are equipped with high efficient motors. The MUB fans have an impeller with backward curved blades, manufactured from aluminum. Speed control is only possible by using a frequency converter. Motor protection is done by cold conductors (PTC), which have to be connected to an external motor protection device. The casing consists of an aluminum frame with fiberglass reinforced plastic corners of PA6; highly shock-resistant. The double skin panels are manufactured from galvanized steel with 30 mm mineral wool insulation. To avoid condensation the profile is provided with a separate chamber to fix screws. The Multibox fans are delivered for straight through airflow but can easily be rebuilt due to removable panels. This allows flexible ventilation solutions. The MUB can also be used as extract- or supply air unit in air handling units. Installation in any mounting position is possible.

MUB with additional modules (filters, heaters etc.) are available as air handling units "K025, K042 or K062" on request!

Sound power level		63	125	250	500	1k	2k	4k	8k	Total
Inlet	dB(A)	58	78	81	84	85	82	79	71	90
Outlet	dB(A)	59	79	82	85	87	83	80	72	91
Surrounding	dB(A)	38	62	53	52	55	54	46	36	64
Sound pressure level at 3m (20m² Sabine)	dB(A)	-	-	-	-	-	-	-	-	57
Sound pressure level at 3m free field	dB(A)	-	-	-	-	-	-	-	-	43

Accessories

Figure 11 – Systemair MUB 062 630D4 Specifications

APPENDIX H - Site Plans

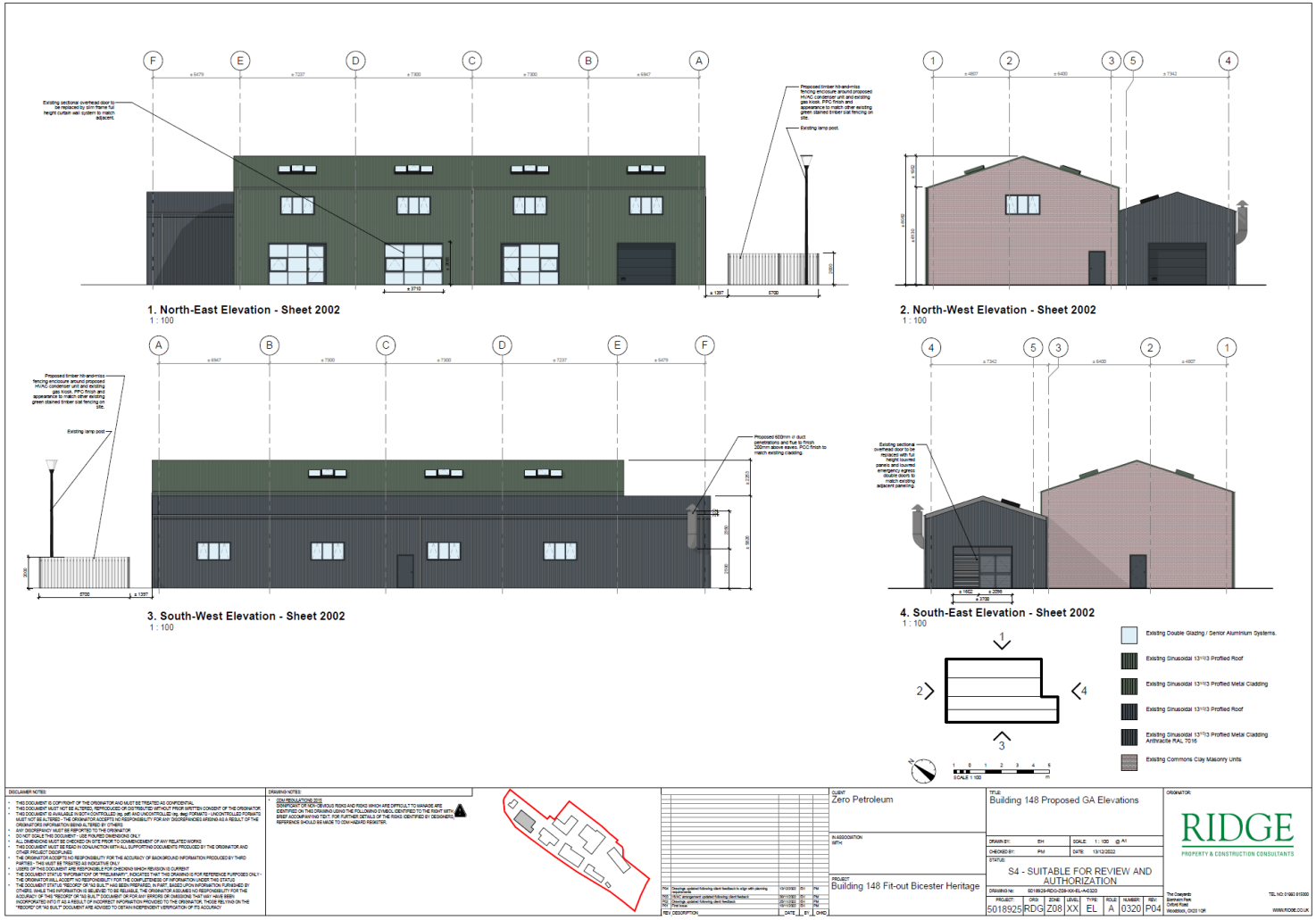


Figure 12: Site Plans Provided by 'Ridge Property & Construction Consultants'

APPENDIX I - Legislation, Policy & Guidance

Guidance for the assessment of noise affecting new residential development is given in the National Policy Framework (NPPF). Section 15 of the NPPF states:

> *"174. Planning policies and decisions should contribute to and enhance the natural and local environment by:*
> *E) preventing new and existing development from contributing to, being put at unacceptable risk from, or being adversely affected by, unacceptable levels of…noise pollution."*

Section 185 further states:

> *"Planning policies and decisions should also ensure that new development is appropriate for its location taking into account the likely effects (including cumulative effects) of pollution on health, living conditions and the natural environment, as well as the potential sensitivity of the site or the wider area to impacts that could arise from the development. In doing so they should:*
>
> 1. *Mitigate and reduce to a minimum potential adverse impact resulting from noise from new development – and avoid noise giving rise to significant adverse impacts on health and the quality of life;*
> 2. *Identify and protect tranquil areas which have remained relatively undisturbed by noise and are prized for their recreational and amenity value for this reason."*

Section 187 states:

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

To avoid and mitigate adverse noise effects on health arising from and impacting new development, the NPPF makes reference to NPSE. The Noise Policy Statement for England (NPSE) was published in March 2010 and covers all forms of noise other than occupational noise.

The Noise Policy Statement for England (NPSE) states the following aims in paragraph 2.2.

> **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 detectable 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.*

The NPSE does not define the SOAEL numerically, stating in paragraph 2.22:

> *"It is not possible to have a single objective noise-based measure that defines SOAEL that is applicable to all sources of noise in all situations. Consequently, the SOAEL is likely to be different for different noise sources, for different receptors and at different times. It is acknowledged that further research is required to increase our understanding of what may constitute a significant adverse impact on health and quality of life from noise. However, not having specific SOAEL values in the "NPSE provides the necessary policy flexibility until further evidence and suitable guidance is available."*

There is no local or national guidance on how the three terms should be defined numerically, it is for the assessor to collate and interpret appropriate guidance on noise, such as may be found in British Standards, and correlate the guidance with the concepts of NOEL, LOAEL and SOAEL.

BS4142:2014+A1:2019

The common standard for the assessment of industrial and commercial sound is ***'BS4142 – Methods for rating and assessing industrial and commercial sound'.*** The industrial noise assessment method in BS4142 is based on the difference between the measured 'background sound level' (L_{A90}), and the 'Rating Level' of the industrial source, at a noise-sensitive location (NSR). BS4142:2014 states:

> *"The significance of sound of an industrial and/or commercial nature depends upon both the margin by which the rating level of the specific sound source exceeds the background sound level and the context in which the sound occurs."*

An estimation of the impact of the specific sound can be obtained by the difference between the rating sound level and the background sound level whilst considering the following:

> *"A Sound Rating Level at or below the background noise level is indicative of Low Impact;*
>
> *A Sound Rating Level that exceeds the background noise level by around +5dB is likely an indication of Adverse Impact, depending on the context;*
>
> *A Sound Rating Level that exceeds the background noise level by around +10dB is likely an indication of Significant Adverse Impact, depending on the context;"*

BS4142 further states:

> *"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 negligible impact, depending on the context."*

Achievement of a *Low Impact* in accordance with BS4142 along with a contextual assessment can be deemed to correspond to '*NOEL – No Observed Effect Level*' in the NPSE, as detailed above in Paragraph 2.3.

BS8233:2014

BS8233:2014 - *Guidance on sound insulation and noise reduction for buildings* suggests indoor ambient noise levels for dwellings in Table 4, Section 7.7.2. These are summarised below.

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

BS8233 states that the guideline values given above are for 'noise without character', further stating:

> *"Noise has a specific character if it contains features such as a distinguishable, discrete and continuous tone, is irregular enough to attract attention, or has strong low-frequency content, in which case lower noise limits might be appropriate."*

Table 4 of BS8233 also has accompanying notes that were subject to additions in ProPG. The relevant notes with the additions of ProPG are given below.

> *"NOTE 4 Regular individual noise events (for example, scheduled aircraft or passing trains) can cause sleep disturbance. A guideline value may be set in terms of SEL or LAmax,F, depending on the character and number of events per night. Sporadic noise events could require separate values. In most circumstances in noise sensitive rooms at night (e.g. bedrooms) good acoustic design can be used so that individual noise events do not normally exceed 45dB LAmax,F more than 10 times a night. However, where it is not reasonably practicable to achieve this guideline then the judgement of acceptability will depend not only on the maximum noise levels but also on factors such as the source, number, distribution, predictability and regularity of noise events."*

"NOTE 7 Where development is considered necessary or desirable, despite external noise levels above WHO guidelines, the internal LAeq target levels may be relaxed by up to 5 dB and reasonable internal conditions still achieved."

APPENDIX J - Acoustic Terminology

To aid the understanding of acoustic terminology and the relative difference between noise levels the following background information is provided.

We perceive sound when the ear detects fluctuations in air pressure (sound waves), which are then processed by the brain and perceived as sound. Humans can hear an incredibly wide range of sound intensities ranging from jet engines to fingertips lightly brushing against each other. This range is quantified using a logarithmic scale called the decibel scale (dB). The comfortable range of the decibel scale typically ranges from 0dB (the threshold of hearing) to around 140 dB. Here are some examples of common environments and their typical noise levels.

Noise Level	Environment
0 dB(A)	Threshold of hearing
20 to 30 dB(A)	Quiet bedroom at night
30 to 40 dB(A)	Living room during the day
40 to 50 dB(A)	Typical office
50 to 60 dB(A)	Inside a moving car
60 to 70 dB(A)	Typical high street
100 to 110 dB(A)	Fire alarm at 1 metre away
140 dB(A)	Threshold of pain

Terminology

dB (decibel) – A unit used to quantify the pressure level of sound. Defined as 20 times the logarithm of the ratio between the root-mean-square pressure of a given sound field and a reference pressure level ($2x10^{-5}$ Pa – threshold of hearing).

$L_{Aeq,\,T}$ – The equivalent continuous sound pressure level over a stated period. It quantifies a fluctuating sound level over a given period as the equivalent continuous sound level over which the same amount of acoustic energy is contained over. This is A-weighted in order to assess human perception.

L_{A90} – The sound level exceeded 90% of the time. Typically used to describe background noise the L_{90} is regarded as the 'average minimum level' and quantifies the common sound level of a fluctuating sound field i.e. the sound level that occurs 90% of the time. Alternatively, L_{10} describes the sound level exceeded 10% of the time and therefore quantifies the 'average maximum level' of sound which is often used during the calculation of road traffic noise.

A-Weighting – A standard weighting of the audible frequencies designed to reflect the response of the human ear to noise.

R_w – The Weighted Sound Reduction Index (R_w) is a number used to rate the effectiveness of a soundproofing system or material.