

SoundWave

Whitehaven, Cumbria

Noise Impact Assessment

18 July 2023

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1.0 EXECUTIVE SUMMARY

1.1 Introduction

Max Fordham LLP (MFLLP) has been appointed by BEC (British Energy Coast) Development to provide a noise impact assessment in relation to the re-use of the former Bus Station Warehouse in Whitehaven, Cumbria.

This Noise Impact Assessment report is to form part of the planning submission package addressing the impact of the proposed development on the surrounding area based on the results of a baseline on-site noise survey.

The report takes into consideration the following aspects:

- Reviewing policies and relevant standards (Section 2.0)
- Undertaking a noise survey on site (Section 3.0)
- Assessing activity noise levels (Section 4.0)
- Providing sound insulation requirement for the building envelope (Section 5.0)
- Assessing plant noise impact with initial advice regarding noise level limits and mitigation measures (Section 6.0)
- Assessing activity noise impact (Section 7.0)

A glossary of acoustic terminology used is included in Appendix 9.0.

1.2 Policies and Standards

Acoustic policies and standards which we understand to be relevant to this project are given below:

- National policies - National Planning Practice Guidance (NPPG) and Noise Policy Statement for England (NPSE) 2010
- Copeland Local Plan and Core Strategy document
- Copeland Local Development Framework, Whitehaven Town Centre and Harbourside – SPD – September 2012
- British Standards: BS 8233:2014 and BS 4142:2014

1.3 Noise Survey

Attended and unattended noise measurements were taken on site to assess typical environmental noise levels.

Short term (attended) noise monitoring level were undertaken on Monday 27th February 2023, and a long term (unattended) noise survey has been undertaken 27th – 28th February 2023.

The representative background noise level has been estimated from the 40th percentile of the $L_{A,90,5min}$ values calculated over the time period of the long-term noise survey. This value will be adopted in relation to BS 4142:2014 when assessing plant noise rating level ($L_{Ar,Tr}$).

1.4 Design Criteria

Building Envelope Design

The level of activity noise break-out should not cause excessive disturbance to existing residential neighboring properties.

The results of the noise survey have been used to inform the required performance of the building envelope.

External Plant Noise Emissions

Good practice would be to design noise emissions such that the rating noise level from all new items of plant equipment results in a “low impact” at nearby noise sensitive receptors when assessed in accordance with the methodology described in BS 4142:2014.

Copeland Borough Council’s planning documents do not provide any specific quantitative requirements for external plant noise level limit.

It is proposed that plant noise should be limited to a rating level $L_{Ar,Tr}$ not exceeding the representative background noise levels L_{A90} from the long-term noise survey at the existing sensitive receptors.

2.0 POLICIES, REGULATION AND STANDARDS

Acoustic policies and standards which we understand to be relevant to this project are set out below and described in the remainder of this section:

- National Planning Practice Guidance (NPPG)
- Noise Policy Statement for England (NPSE) 2010
- Copeland Local Plan 2021-2038, Publication Draft, January 2022
- Copeland Local Plan 2023-2028, Core Strategy and Management Policies DPD, December 2013
- Copeland Local Development Framework, Whitehaven Town Centre and Harbourside – SPD – September 2012
- British Standards relating to noise control

2.1 National Policies

National Planning Practice Guidance (2014)

The National Planning Practice Guidance (PPG) is a web-based resource that replaced previous planning guidance, and supports the National Planning Policy Framework, providing clarity on the practical application of the policy.

The PPG advises that noise needs to be considered when new developments may create additional noise and when new developments would be sensitive to the prevailing acoustic environment. It also acknowledges that neither the NPSE nor the NPPF expects noise to be considered in isolation, separately from the economic, social and other environmental dimensions of the Proposed Development.

The PPG also outlines considerations for local authorities as part of the planning process:

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

Planning Policy Guidance and National Planning Policy Framework

Planning Policy Guidance Note 24 (PPG24), which was generally used for overall guidance to planners regarding environmental noise, particularly for residential sites, was replaced in March 2012 by the more general advice given in the National Planning Policy Framework, with the most recent update being July 2018.

The National Planning Policy Framework (2021) states that planning policies and decisions should contribute to and enhance the natural and local environment by “preventing new and existing development from contributing to, being put at unacceptable risk from, or being adversely affected by, unacceptable levels of soil, air, water or noise pollution or land instability”. Furthermore, it states that planning policies and decisions should:

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

- identify and protect tranquil areas which have remained relatively undisturbed by noise and are prized for their recreational and amenity value for this reason;
- 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.

Noise Policy Statement for England (2010)

The Noise Policy Statement for England (2010) (NPSE) sets out the government’s long term noise policy, to “promote good health and a good quality of life through the effective management of noise within the context of policy on sustainable development”.

The National Planning Policy Framework document also refers to the Noise Policy Statement for England (March 2010) which cites (in the Explanatory Notes section) the following aims:

- Avoid significant adverse impacts on health and quality of life from environmental, neighbour and neighbourhood noise within the context of Government policy on sustainable development.
- Mitigate and minimise adverse impacts on health and quality of life from environmental, neighbour and neighbourhood noise within the context of Government policy on sustainable development.
- Where possible, contribute to the improvement of health and quality of life through the effective management and control of environmental, neighbour and neighbourhood noise within the context of Government policy on sustainable development.

More recently, the government’s Planning Practice Guidance pages have been published with advice of various issues, including noise (<https://www.gov.uk/guidance/noise--2>).

The advice (March 2014, latest update July 2019) includes the use of ‘Lowest observed adverse effect level’ (LOAEL) and ‘Significant observed adverse effect level’ (SOAEL), and explores how actions such as a requirement for noise mitigation, or prevention of a development, might be assessed with respect to whether noise levels are considered above these LOAEL and SOAEL thresholds according the following definitions:

- No Observed Effect Level (NOEL) – Noise can be heard but not cause any change in behaviour, attitude or other physiological response. Below this level, no detectable effect on health and quality of life due to noise can be established.
- Lowest Observed Adverse Effect Level (LOAEL) – Noise can be heard and causes small changes in behaviour, attitude or other physiological response; where there is not alternative ventilation, it causes keeping windows closed for some of the time because of the noise. Potential for some reported sleep disturbance. Affects the acoustic character of the area such that there is a small actual or perceived change in the quality of life.

- Significant Observed Adverse Effect Level (SOAEL) – the noise causes a material change in behaviour, attitude or other physiological response, such as avoiding certain activities during periods of intrusion; where there is no alternative ventilation, it causes keeping the windows closed most of the time because on the noise. Potential for sleep disturbance resulting in difficulty in getting sleep, premature awakening and difficulty in getting back to sleep. Quality of life diminished due to change in acoustic character of the area.

Although the word ‘level’ is used here, this does not mean that the effects can only be defined in terms of a single value of noise exposure. In some circumstances adverse effects are defined in terms of a combination of more than one factor such as noise exposure, the number of occurrences of the noise in a given time period, the duration of the noise and the time of day the noise occurs.

However, neither these Planning Practice Guidance pages, nor the National Planning Policy Framework or Noise Policy Statement for England documents, provide quantitative advice such as the use of absolute noise limits.

Thus, authorities still generally interpret and express national and local non-quantitative policies by issuing quantitative noise-related planning conditions.

2.2 Local Policies

The town of Whitehaven is administrated by the Copeland Borough Council, where the following local policies refer to.

No particular reference to noise pollution has been found in the Copland policies. Here below are included extra information related to the proposed development.

Copeland Local Plan 2021-2038, Publication Draft, January 2022

This is the Publication Draft of the Local Plan which sets out Copeland Council’s preferred policies.


The Local Plan will become a key part of the borough’s Development Plan, replacing, and superseding, the current Copeland Local Plan 2013- 2028 Core Strategy and Development Management Policies, (the Core Strategy), which was adopted in December 2013, and Saved Policies.

Planning decisions must be made in accordance with the Development Plan unless material considerations indicate otherwise.

The Local Plan defines the Town of Whitehaven as the main focus for retail and leisure growth in the borough. To do so, Policy R3PU provides a list of opportunities to enhance the development in Whitehaven; these include retail and leisure spaces.

Section 6.4 - Design and Construction (Policy DS6PU) addresses how the Council strongly encourages developers to meet high design standards to create quality places, possibly with a flexible and adaptable design, including the use of existing buildings wherever practicable and deliverable in order to create opportunities that encourage social interaction; with the attention of good quality design aiming to mitigate any form of external pollution, including noise through good layout and appropriate noise control strategies.

Policy DS6PU: Design and Development Standards



The Council will expect all new development to meet high-quality standards of design. This means that developments must:

- a) Make use of existing buildings on site wherever practicable and deliverable, unless they have a negative impact upon the street scene;
- b) Create and enhance locally distinctive places which are sympathetic to the surrounding context of the built, historic and natural environment and local landscape character;
- c) Use good quality building materials that reflects local character and vernacular, sourced locally where possible;
- d) Contribute towards good health and well-being by incorporating high quality, inclusive and useful open spaces and providing high levels of residential amenity;
- e) Create layouts that encourage walking and cycling based on Active Design principles and connect the development to existing walking and cycling routes where possible;
- f) Provide safe, accessible and convenient pedestrian routes and allow for the safe access and manoeuvring of refuse and recycling vehicles;

- g) Adopt dementia friendly design principles where possible and take the needs of people with disabilities into consideration;
- h) Create opportunities that encourage social interaction;
- i) Be built to an appropriate density that enables effective use of land, whilst maintaining suitable levels of amenity;
- j) Be of flexible and adaptable design;
- k) Incorporate measures to design out crime and reduce the fear of crime, taking into consideration secured by design principles;
- l) Be laid out in a way that maximises solar gain to internal spaces to promote energy efficiency and sustainable solutions;
- m) Uses appropriate levels and types of external lighting that does not create light pollution and helps maintain dark skies;
- n) Mitigates noise pollution through good layout, design and appropriate screening; and
- o) Addresses land contamination and land stability issues with appropriate remediation measures

Applications for major development proposals should produce and include a Sustainable Construction Management Plan as part of their applications.

Copeland Local Plan 2023-2028, Core Strategy and Management Policies DPD, December 2013

This document provides the Council’s policies and proposals for the following:

Core Strategy: Deals with the big strategic planning issues facing the Borough setting out an over-arching Vision, priority Objectives, development principles and a series of high-level spatial policies. It includes a Monitoring Framework showing responsibilities for implementation and targets to measure progress over the plan period. The other main section sets out how the policies will be implemented on the ground within the 6 Locality Areas that make up the Borough.

The whole development strategy must be informed and underpinned by principles which move the Borough towards greater sustainability in environmental, economic and social terms, illustrated in Policy ST1 – ST3.

As far as the development of Town Centre (which includes Whitehaven) is concerned, Policy ER7 set out the strategic approach towards development in town centres (ER8 only for Whitehaven) and other service areas, identifying the focus and key actions required.

Policy ER8 – Whitehaven Town Centre

In Whitehaven town centre, development will be encouraged which:

- A** Responds to and consolidates the status of Whitehaven as the first and most complete post-mediaeval planned town in the country
- B** Improves the links and re-establishes the connectivity between the town centre and the Harbour
- C** Enhances the retail function of ground floor premises (see also Policies DM6A and DM7 and the designation of a Retail “Primary Frontages Area” – Policy DM6B)
- D** Diversifies the ‘offer’ within the town centre, and improves the evening and night time economy
- E** Improves Whitehaven’s tourism offer, particularly in relation to serviced accommodation, improved visitor facilities and access to the coast
- F** Enhances the key gateway sites and approaches into the town, wherever practicable providing car parking for both the development itself and the town centre
- G** Creates a series of new and improved public spaces to establish stronger visual links and better access between the town centre and Harbour
- H** Improves the integration of new and existing development into the urban grain
- I** Maintains high standards of design consistent with the setting of a Conservation Area of national significance
- J** Diversifies the range of residential accommodation in the town centre, including the conversion and re-use of vacant floors over shops
- K** Improves the integration and prestige of public transport in the town centre
- L** Improves the range of activities available to local residents and visitors
- M** Incorporates strategic redevelopment schemes in relation to Policy ST3 and improvements to the public realm and traffic environments

The Whitehaven Town Centre boundary will be redrawn to reflect the anticipated growth and development within the area.

Any development proposed in Whitehaven Town Centre should also accord with Policies DM6 and DM7.

A new Supplementary Planning Document (SPD) is being prepared to provide design guidance for new development in the town centre and harbourside areas.

Copeland Local Development Framework, Whitehaven Town Centre and Harbourside – SPD – September 2012

Whitehaven town centre and harbourside development is identified as a spatial initiative of importance to the West Cumbria sub area.

This Supplementary Planning Document (SPD) is being prepared to guide future development in Whitehaven Town Centre and Harbourside areas providing design guidance for the development of Regeneration Priority Sites identified in the Borough Council’s Adopted Local Plan and Core Strategy and other supporting background documents, and any other sites which come forward during the Core Strategy period.

The vision and objectives stated in the document aim to improve and enhance the qualities of the town by offering a wide range of independent shops, facilities and attractions within an exceptional historic environment, preserving its unique heritage and celebrating the new development in the most sustainable approach, in partnership with private sector investors and developers if needed.

2.3 British Standards

British Standard 8233:2014

British Standard 8233:2014 – *Guidance on sound insulation and noise reduction for buildings* (BS 8233)¹ provides guidance on internal ambient noise levels from sources such as traffic and mechanical services that should be applied inside the building.

Based on the specific type of building, section 7 of the Standard provides a range of noise level that are considered acceptable.

However, the designer should select a level appropriate for the particular circumstances.

Typical indoor ambient noise level criteria are reported in Table 1.

Activity	design Range
Restaurant	40-55 dB $L_{Aeq,T}$
Night club	40-45 dB $L_{Aeq,T}$
Ball room, banqueting hall	35-40 dB $L_{Aeq,T}$

Table 1: Indoor ambient noise levels for different type of spaces (from BS 8233:2014 - Table 2)

British Standard 4142:2014

British Standard 4142:2014 - *Methods for rating and assessing industrial and commercial sound* sets the methodology for rating and assessing sound of an industrial and commercial nature, which includes sound from fixed installations such as mechanical and electrical plant and equipment.

In BS 4142:2014, a noise rating is determined and compared with the existing local background sound level based on several more cumulative acoustic feature corrections to apply where appropriate. For example if the noise includes a distinguishable tone, impulse, intermittency or other readily distinguishable sound characteristic, then additional *cumulative* penalties individually ranging from 0 to 9 dB may be applied depending on the type of noise.

BS 4142:2014 seeks to determine a “representative” background sound level, stating that “...the objective is not simply to ascertain a lowest measured background sound level, but rather to quantify what is typical during particular time periods”.

The assessment of the impact depends upon the margin by which the rating level of the specific sound source exceeds the background sound level (i.e. as before) but also promotes a consideration of the context in which the sound occurs when making an assessment. BS 4142:2014 states that an initial estimate of the impact of the specific sound is made by subtracting the measured background sound level from the rating level, while considering the following points:

- a) Typically, the greater this difference, the greater the magnitude of the impact.
- b) A difference of around +10 dB or more is likely to be an indication of a significant adverse impact, depending on the context.
- c) A difference of around +5 dB is likely to be an indication of an adverse impact, depending on the context.
- d) 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.

¹ BSI Group, BS 8233:2014 – Guidance on sound insulation and noise reduction for buildings (2014)

3.0 ENVIRONMENTAL NOISE

3.1 Site Context

Existing Site

The site is located to the north of the town of Whitehaven, approx. 150 m from the train station, on a land characterised by steep sloping topography. The subject site sits at the bottom of the hilly area, on New Road, and enclosed by Wellington Row behind.

The surroundings are characterised by the presence of clusters of residential areas and local retail/commercial space, as well as the Grade II* listed St James’ Church. Aerial view of the area is given in Figure 1.

The Bus Station

The Bus Station Warehouse is single story building, constructed of brickwork in English bond. Used since the 1930s, the development had fallen into disuse. The land and the former bus station depot was acquired by BEC in 2015. Part of the development has been already reconverted into a hybrid space which can be hired by local companies for work, education and socialising purposes.

The Warehouse

Currently not in use, the former warehouse has a steel truss pitch roof with profile metal sheet covering and solid concrete floors, part of which is covered in ceramic tiles. The structure has access through doors at the front, side, and a large roller shutter at the front. The roof does not appear to be in good condition, and it will be replaced with a new structure.

Figure 2 and Figure 3 show the proposed building from the outside; indoor pictures are given in Appendix 9.3.

The proposal suggested by BEC, is to transform the Warehouse into a welcoming multipurpose space accessible to the community for hosting live performance events and social gatherings, plus additional spaces like offices, recording studio and rehearsal spaces made out from shipping containers for the SoundWave music charity group.

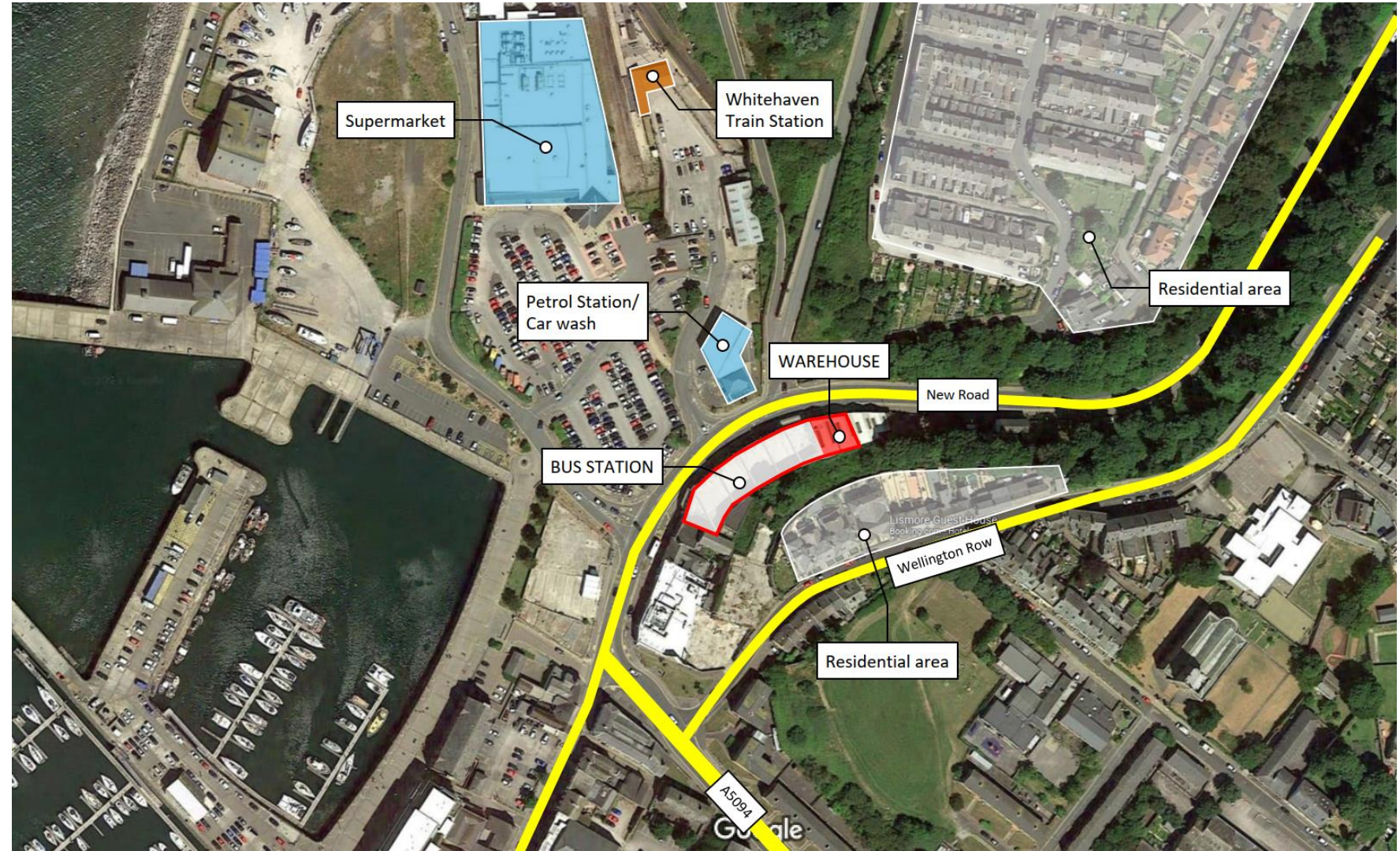


Figure 1: aerial view of the area. Outlined in red the BEC acquisition with the BUS STATION and the WAREHOUSE developments.



Figure 2 Street view of the former Warehouse from New Road



Figure 3: View of the former Warehouse from the parking area to the West

3.2 Noise Survey

The noise and vibration environment around and within the site has been measured to record the following parameters:

- The external *ambient* mean noise levels to give an indication of what the acoustic performance the façade will need to appropriately control the break-in of external noise.
- The external *background* sound noise levels to give an indication of the typical lowest noise levels likely to be experienced at the site. These are used to set plant noise limits at the nearest sensitive receptors in accordance with the approach described by BS4142.

Methodology

A noise survey was conducted on Monday the 27th of February 2023 comprising with short (attended) noise measurements. Then, a long-term (unattended) noise survey was conducted from the night of the 27th until the next morning. Measurements were recorded on consecutive 5-minute measurement periods.

Weather Conditions

Weather conditions were favourable for the noise survey, with no rain and low wind speeds (<5m/s).

Noise Sources

The noise source identified is road traffic noise on New Road (A5094).

Measuring Equipment

The measurement was made with a Norsonic 140 precision sound level analyser. This equipment complies with BS EN IEC 61672 class 1. The meter uses a Norsonic 1225 free-field response microphone and NOR 1209 microphone pre-amplifier. A field calibration of the sound level meter has been made before and at the end of the measurement with a Norsonic 1251 portable sound calibrator (complying with BS EN IEC 60942 class 1).

No relevant drift was observed before and after the calibration.

Details of the monitoring equipment used are given in Appendix 9.2.

Measurement Locations

Locations (L1 and L2 in Figure 4) were chosen to be representative of the noise climate on both sides of the proposed development.

- Location L1 (in front of the Warehouse) has been chosen to evaluate noise levels due to traffic noise from New Road impacting the main façade of the actual development (see Figure 5).
- Location L2 at the external patio of Lismore Guest house has been chosen to investigate night-time noise levels at the closest sensitive receptor (see Figure 6).

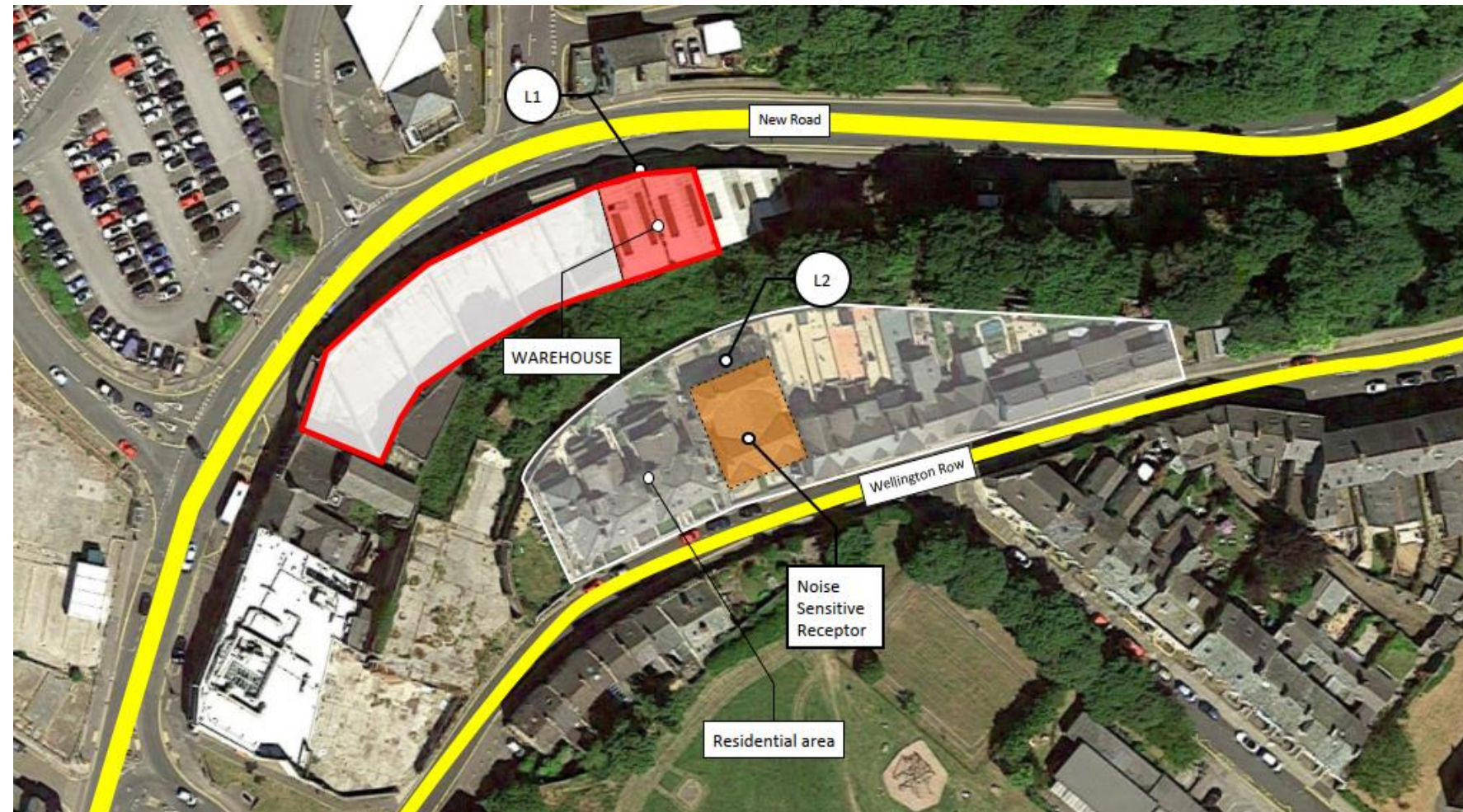


Figure 4: Identification of the survey locations (L1 and L2) and the closest sensitive receptor (Lismore Guest House)



Figure 5: Location L1 on New Road



Figure 6: Location L2 on Lismore Guest House external patio

3.3 Noise Survey Results

Results of the short, and long-term noise survey are given in Tables 2 and 3. The L_{Aeq} , L_{AFmax} , and $L_{AF90,5min}$ parameters have been presented.

Location L1 - Short-term Noise Survey

The attended noise survey set up at location L1 comprised with 3 short measurements to assess traffic noise level at the Warehouse at different time periods.

As noise measurements at location L1 have been taken in close proximity to the warehouse façade, a correction of -3 dB has been applied to account for the sound reflection from the façade.

Table 2 shows the overall results, which include the facade correction (values are rounded to the nearest integer number).

Measurement Location	Date Time	Duration T	$L_{Aeq,T}$ (dB)	$L_{AF,max,5min}$ (dB) ^[1]	$L_{AF90,5min}$ (dB) ^[2]
L1 - New Road	27/03/2023 14:10-15:10	60 min	69	84	50
	27/03/2023 17:00-17:30	30 min	70	86	57
	27/03/202 20:30-21:00	30 min	67	85	40

^[1] the 90th percentile value of the of the noise levels recorded during the time of the survey
^[2] the representative value of the noise levels recorded during the time of the survey

Table 2: Summary of the free-field noise levels from the survey undertaken at Location L1

Location L2 - Long-term Noise Survey

Noise measurements were continuously recorded in a 'free-field' condition from Monday 27/03/2023 to Tuesday 28/03/2023, for approx. 12 hours.

The survey has been undertaken at the external patio of the Lismore Guest House property, which is deemed to be the nearest (and likely quietest) noise sensitive receptor for the proposed development. The other closest sensitive receptor (Bransty House on the opposite side of New Road) is more affected by traffic noise than Location L2. As such, it is considered a conservative assumption to use the background noise level measured at L2.

To assess the representative background noise level, it has been chosen the 40th percentile of the L_{A90} values calculated over the time period of the survey. Based on experience of similar sites the 40th percentile has been used as the representative background noise level.

Table 3 shows the overall results from the long-term noise survey (values are rounded to the nearest integer number).

Measurement Location	Time period	Duration T	$L_{Aeq,T}$ (dB)	$L_{AF,max,5min}$ (dB) ^[1]	$L_{AF90,5min}$ (dB) ^[2]
L2 – Lismore Guest House external patio	Evening 19:00-23:00	1.5 hours	51	73	36
	Night 23:00–7:00	8 hours	50	65	33
	Day time 07:00-19:00	2 hours	60	74	50

^[1] the 90th percentile value of the of the noise levels recorded during the time of the survey
^[2] the representative value of the noise levels recorded during the time of the survey

Table 3: Summary of the noise levels from the survey undertaken at Location L2

Noise data of the survey at Location L2 is given in Appendix 9.4.

4.0 ACTIVITY NOISE

Musical events may involve relatively high noise levels and break-out from the building should be controlled to reduce the risk of noise disturbance to local residents.

4.1 Activity Noise Survey

Methodology

A social event held on Monday 27th of February 2023 at the Peddler Restaurant organised by BEC in collaboration with SoundWave has been monitored to assess activity noise levels that are expected to take place at the Warehouse, such as amplified music performances.

The survey has been conducted by leaving the noise monitoring equipment recording continuously for about 90 minutes (18.30-20:00) encompassing activity such as amplified music performances (singing) alternating with general conversation.

4.2 Activity Noise Results

Noise levels from the event are plotted in Figure 7; outlined in red are the three main events happened in the following order:

- 18:30-18:40: Singing performance (amplified)
- 19:00-19:20 pm: Choir performance (not amplified)
- 19:25-19:35 pm: Singing performance (amplified)

As shown in the graph, amplified music can reach levels in the range of 80-100 dBA, while only 70-80 dBA have been recorded for a non-amplified performance (i.e. choir). The background noise was given by general conversation and is in the range of 60-70 dBA. The highest noise level that has been recorded was 85dB ($L_{Aeq,T}$) from the amplified singing performance.

As summary of the key metrics is given in Table 4.

Whilst it is possible that some activities within the proposed building may be louder than those measured here, a noise level of 85dB is used here as a basis for assessing the potential impact from activity noise.

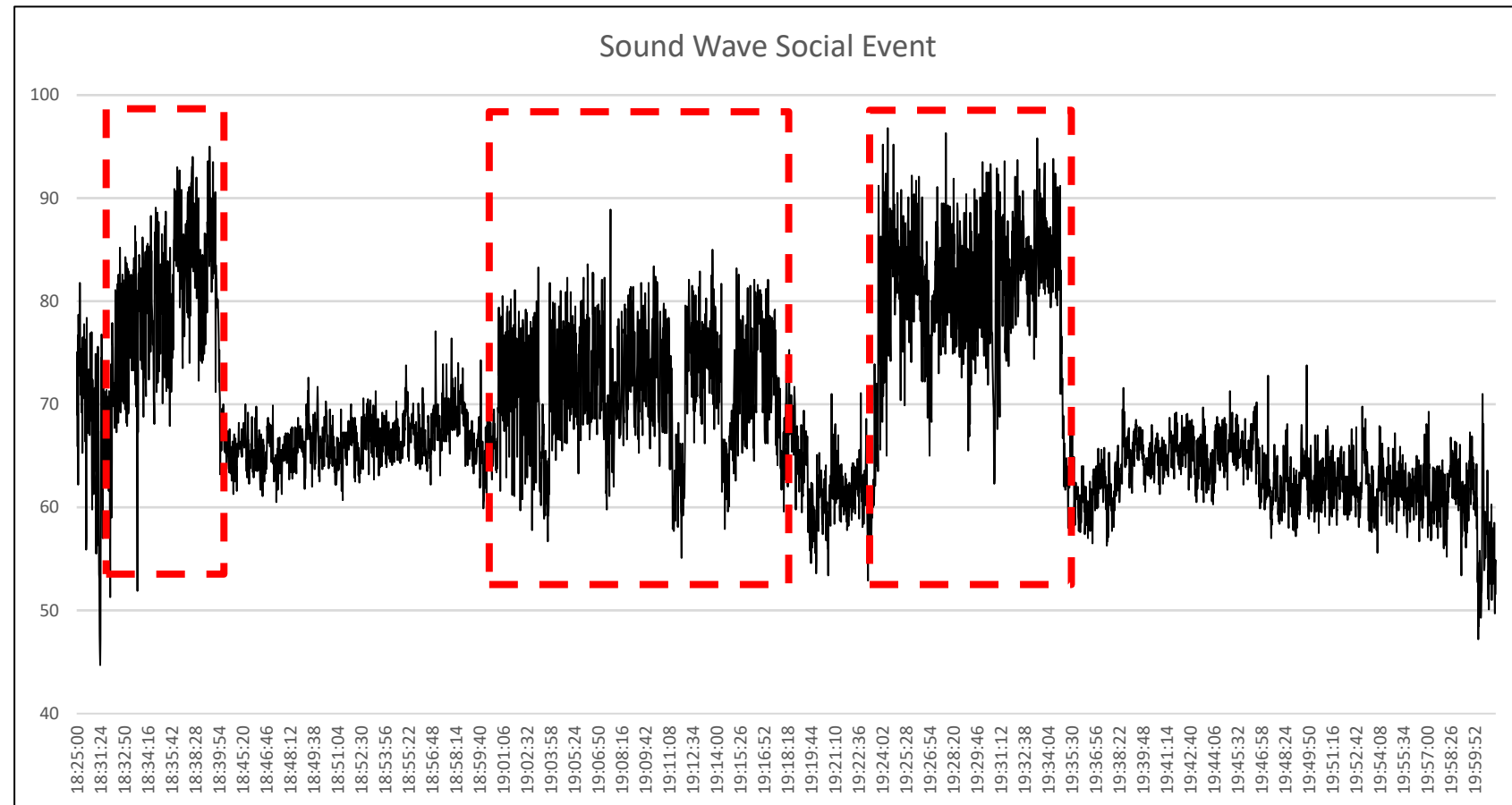


Figure 7: Activity Noise survey graph

Activity	Duration T	$L_{Aeq,T}$ (dB)	$L_{AF,max}$ (dB) ^[1]	L_{Apeak} (dB) ^[2]
Amplified Singing	10 min	84	91	105
Choir	20 min	74	81	99
Amplified Singing	10 min	85	92	107
General conversation	N/A	65	70	89

^[1] the 90th percentile levels collected over the period of the survey
^[2] the maximum noise level recorded over the period of the survey

Table 4: Activity Noise Survey Results

5.0 BUILDING SOUND INSULATION

5.1 Building Envelope

The design of the building envelope needs to provide sufficient sound reduction to control both break-in of external traffic noise as well as the break-out noise from activity within the space to not cause excessive disturbance to neighbours.

Façade

The main building façade and roof should provide at least 45 dB R_w although typical brick constructions are likely to comfortably exceed this.

However, as the brick façade will be retained and currently not in a good condition, it is vital that all gaps and missing parts will be closed and sealed with the same mass as the surrounding structure, otherwise the overall performance of the envelope is unlikely to meet the necessary sound insulation performance.

External Glazing

The main glazed area is on the North façade on New Road. The existing roller shutter will be replaced with a curtain wall glazed area (see Figure 8).

For the glazed elements, it is advised that acoustically laminated double glazing with a minimum sound insulation of 35 dB R_w+C_{tr} is installed.



Figure 8: Proposed North elevation outlined in red; main glazed area on the left

Roof Sound Insulation

It has been understood that the roof will be completely replaced with a new timber trussed structure (600 c/c) with no rooflight.

The proposal for the new roof should include a Kingspan KS1000 roof panel (rated to 46dB R_w) a lining to the underside of the joists comprising a double layer of 15mm plasterboard (see Figure 9) with minimum surface mass of 20kg/m².

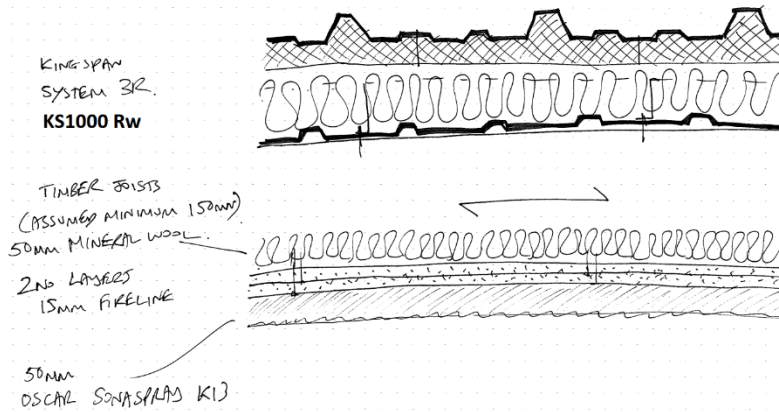


Figure 9: Sketch of the roof build up

6.0 PLANT NOISE ASSESSMENT

6.1 Design Criteria

Plant Noise Level Limit

Plant noise rating limits are defined relative to the measured existing background sound levels. In setting a background level, it is noted that BS 4142:2014 seeks to determine a “representative” background sound level, stating that “...the objective is not simply to ascertain a lowest measured background sound level, but rather to quantify what is typical during particular time periods”.

As such, the background level shall be determined for the period of interest and the measurement time interval must be sufficient to obtain a representative value to give an overall indication of the typical lowest noise levels likely to be experienced at the site.

A definitive method of selecting a representative background sound level is not prescribed in BS 4142:2014, although an example is presented where the modal value is selected from a statistical analysis.

Based on experience of similar sites, a reasonable approach to defining an overall representative value is to consider the 40th percentile value of the L_{AF90} data periods, which generally accounts for potentially unrepresentative high values and untypical events, while usually representing values near the median of the remaining ‘valid’ distribution. Visual interrogation of the statistical distributions is given in Figure 16 in Appendix 9.4.

Therefore, noise level measured at all relevant noise-sensitive receptors should be limited to the values given in Table 5. It should be noted that the rating level is the specific level, plus any corrections for tonality, intermittency etc. in accordance with BS4142:2014.

Time period	Measurement duration, T (hours)	Representative background noise level $L_{A90,T}$ (dB)	Proposed Plant noise Rating Level ($L_{eq,Tr}$) at the NSRs
Day time (07:00-23:00)	3.5	40 ^[1]	< 40
Night-time (23:00-07:00)	8	33	< 33

^[1] the 40th percentile $L_{A90,T}$ noise level taken over the evening and day time period of the survey

Table 5: Measured representative background noise level and proposed plant noise rating level

6.2 Plant Noise Level Assessment

Noise Sensitive Receptors

The existing noise sensitive receptors (NSRs) are understood to be the residential properties, as well as the Lismore Guest House, overlooking the warehouse from the hilly area behind (see Figure 10 and Figure 11).



Figure 10: View from New Road with the identification of the NSR on the back

External Plant Noise

The mechanical services strategy for the scheme is still under development, but plant is expected to be located within the external area on the side of the Warehouse, now used as bin store (see Figure 11).

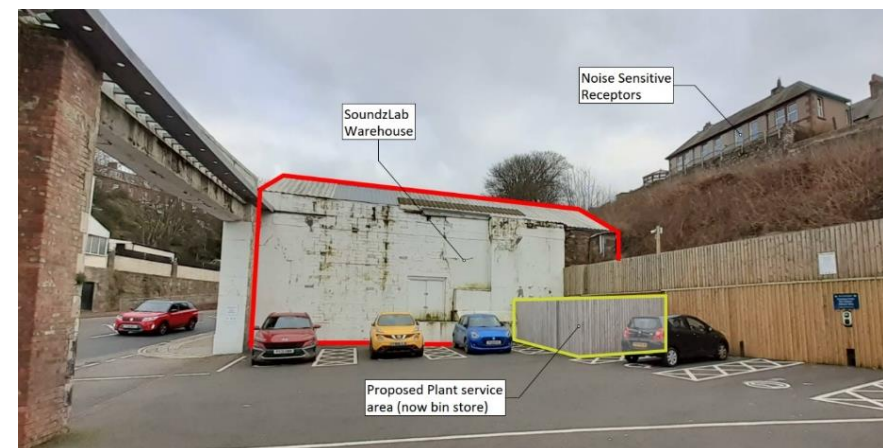


Figure 11: Soundwave Warehouse; identification of the plant area and sensitive receptors

Considering the noise level limit proposed (33 dBA $L_{Ar,T}$ at the closest sensitive receptor façade) and the distance, 20 m on a straight line, between source (the plant) and receiver (the houses behind), the overall plant noise shall not exceed a sound power level of 63 dBA. Should the plant contain any feature corrections, this limit will need to be adjusted accordingly.

Sound emissions at external ventilation exhaust/intakes should not exceed 50dBA at 1m from the grille.

To limit plant noise emission, noise control measures like enclosure/screens may be required. It is important that the screen is designed to be solid and to avoid any direct line of sight between source and receiver. Providing the noise limits are met (i.e. equal or less than the representative pre-existing background noise levels), ‘low adverse impact’ is predicted in accordance with BS4142:2014 as defined by NPSE/PPG.

In addition to the noise, allowance should be made for the mechanical equipment to be mounted on anti-vibration mounts.

7.0 ACTIVITY NOISE IMPACT

7.1 Design Criteria

It has been understood that the Warehouse will only host events during daytime period, defined as 07:00 – 23:00 hours.

BS 8233:2014 guideline gives the following daytime internal noise level limit for habitable spaces:

- Living room: 35 dBA
- Dining room: 40 dBA
- Bedroom: 35 dBA

BS 8233:2014 also provides guidance on desirable noise levels in areas that are intended to be used for external amenity, such as gardens, balcony, and roof gardens. For these spaces it is desirable that the external noise level does not exceed 50 dB $L_{Aeq,T}$ with a level of 55 dB $L_{Aeq,T}$ for noisier environment.

7.2 3D Noise Modelling

Methodology

To assess if activity noise could be source of nuisance at nearby receptors, prediction of the break out noise from the Warehouse was performed using a 3D environmental noise software package.

The two main sensitive receptors identified are as shown in Figure 12.

- The opposite Brantsy House on New Road
- The Lismore Guest House on the back

The site area has been built using publicly available data (Google maps / Earth and the Proposed Development from the architect's drawings).

To simulate break out noise level, an area source has been assigned to the roof and at the main facades of the Warehouse. Area sources are highlighted in red in Figure 12.

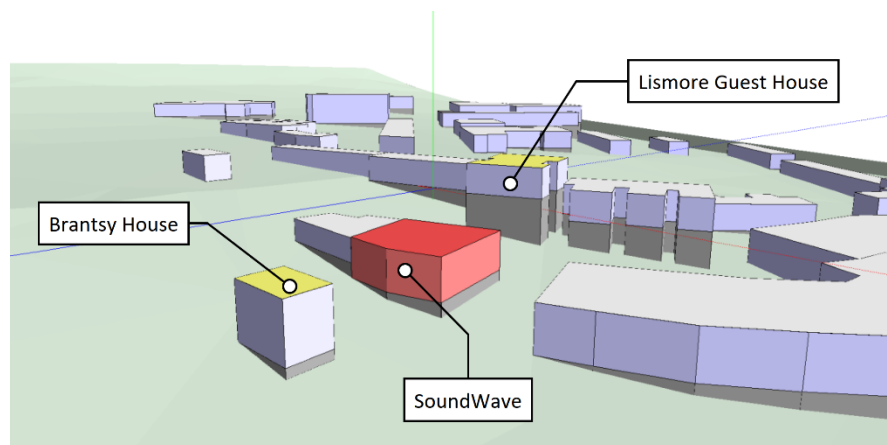


Figure 12: 3D modelling of the site, area source in red, pedestal in grey to adjust the elevation of the building

The area source has been calibrated considering the highest noise level recorded during the activity noise survey, 85dB $L_{Aeq,T}$, on which it has been applied a noise reduction given by the building envelope (walls and roof) with the assumption that noise reduction will be enhanced after the building is renovated.

7.3 Predicted Activity Noise Level

The breakout noise levels incident upon the façades of the identified sensitive receptors are shown in Figure 13.

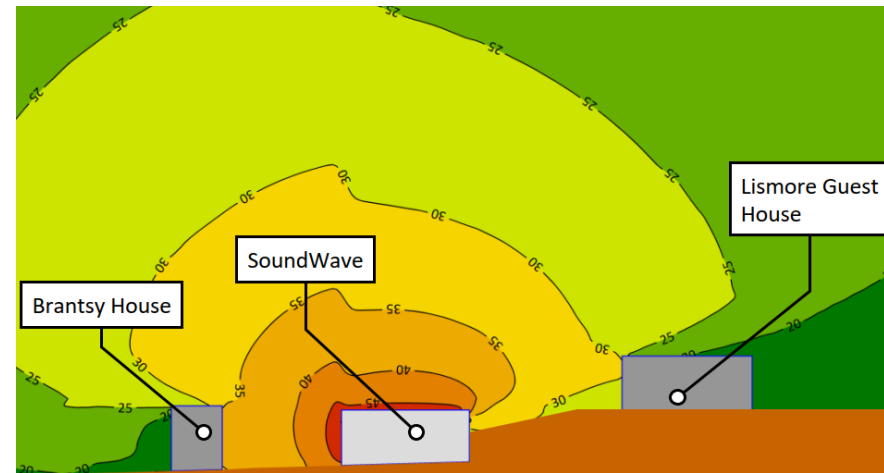


Figure 13: Noise level section showing the different elevation of the two properties

Activity Noise Level at Brantsy House

The breakout noise level incident at the Brantsy House facade is 35 dBA.

Considering that traffic noise level on New Road (monitored at Location L1) are in the region of 70 dBA, activity noise level breakout can be considered marginal in the context.

Activity Noise Level at Lismore Guest House

The breakout noise level incident at the Lismore Guest House is 30 dBA.

In this context, the breakout noise level predicted can be considered adequate either to meet the internal noise level in the bedroom and outside the external patio of the property, as less than 50 dB $L_{Aeq,T}$.

Given the context, the activity noise level at the receptors is considered to be 'low adverse impact' in accordance with NPSE/PPG.

8.0 SUMMARY AND CONCLUSION

Max Fordham LLP (MFLLP) has been appointed by BEC Development to provide a noise impact assessment in relation to the re-use of the former Bus Station Warehouse in a venue for music activities as well as live performance events.

The noise survey included both measurements of the existing noise climate at the site, as well as measurements of similar events by the same charity that will occupy the space.

The results of the noise survey have been used both to assess plant noise level limits and to inform the required performance of the building envelope to control breakout noise level activity at the closest sensitive receptor.

The representative background noise levels have been estimated as per the 40th percentile of the values from the distribution of $L_{A90,5min}$ noise levels recorded during the long-term noise survey, giving the following value:

- 40 dB(A) daytime (07:00 - 23:00)
- 33 dB(A) night-time (23:00 – 07:00)

In absence of specific noise level limit from the local planning documents and given the low noise environment, it is proposed plant noise rating limits ($L_{A,r,Tr}$) not to exceed the representative background noise level when assessed at the noise sensitive receptors with the methodology described in the BS 4142:2014.

Considering the noise level limit proposed, it is expected noise control measures (enclosure/screens) to be applied to the plant equipment. Providing plant noise rating levels are met at the receptor, 'low adverse impact' is predicted i.e. not significant.

Activity noise levels have been predicted based on noise levels from similar activities. The outcomes have shown that break out noise level activity incident upon the sensitive receptors' façades is suitable in the context of meeting the internal and external noise level limits for residential properties as defined in the BS 8233:2014. Therefore, it is considered that activity noise will have 'low adverse impact' at the nearest noise-sensitive receptors and is not significant.

9.0 APPENDIX

9.1 Acoustic Glossary

SOUND PRESSURE LEVEL (SPL), L (dB). The sound level measured on a logarithmic scale, with unit decibel dB. A free-field SPL refers to a level determined far enough from surfaces or facades, apart from the ground, so as not to be influenced by reflections from those surfaces.

A-WEIGHTED SOUND PRESSURE LEVEL (SPL), L_A (dBA). A-weighted SPL values (or noise levels) are weighted in a way that approximates the frequency response of the human ear and allows sound levels to be expressed as a single figure value.

EQUIVALENT CONTINUOUS A-WEIGHTED SPL, L_{Aeq,T} (dBA). Energy weighted average of the A-weighted sound pressure level over a time period, T. The level of a notional continuous sound that would deliver the same A-weighted sound energy as the actual fluctuating sound over the course of the defined time period, T.

MAXIMUM A-WEIGHTED SPL, L_{Amax} (dBA). The maximum A-weighted sound pressure level measured. If not specified, usually assumed to mean L_{AFmax}, i.e. L_{Amax} determined with a ‘fast’ (F) sound level meter time constant of 125 ms.

PERCENTILE NOISE LEVELS L_{A1,T}, L_{A10,T}, L_{A90,T} (dBA). The value of the A-weighted sound pressure level that is exceeded for N% of any given time interval, T. For example L_{A1,T} is the value that is exceeded for 1% of the measurement period. L_{A90,T} is the level that is exceeded for 90% of the measurement period, and is usually used to represent the ambient background noise level.

SOUND REDUCTION INDEX, R (decibels, dB). The sound reduction index of an element such as a wall, floor, door or window describes proportion of incident sound that is not transmitted by that element. R varies with frequency and can be expressed either in terms of the fraction of incident sound energy that is transmitted or in terms of the difference in SPL on either side of the element.

WEIGHTED SOUND REDUCTION INDEX, R_w (decibels, dB). A value calculated from the frequency dependent values of sound reduction index, measured in a laboratory and weighted according to a method described in BS EN ISO 717-1:1997. This allows the sound reduction of an element to be expressed in terms of a single value.

REVERBERATION TIME, RT (seconds). The reverberation time of a space is the time taken for the reverberant sound energy to decay to one millionth of its original intensity (corresponding to a 60 dB reduction in the SPL).

MID-FREQUENCY REVERBERATION TIME, T_{mf} (seconds). The arithmetic average of the reverberation times for the 500 Hz, 1 kHz and 2 kHz octave bands. This quantity is used most often to describe the RT. In BB93, the maximum acceptable T_{mf} is specified.

SOUND LEVEL DIFFERENCE, D (dB). The difference in sound pressure level between rooms on either side of a partition, $D = L_1 - L_2$ (where L₁ and L₂ are

the sound pressure levels on either side of the partition). D varies with sound frequency.

STANDARDIZED LEVEL DIFFERENCE, D_{nT} (dB). The sound level difference of a partition adjusted to account for the difference between the actual receiving room reverberation time and a reference reverberation time.

$$D_{nT} = D + 10 \log_{10}(T/T_0)$$

where T is the actual reverberation time of the receiving room and usually T₀=0.5s (e.g. for residential pre-completion testing), although BB93 (2015) assigns a room’s maximum allowable T_{mf} (i.e. T₀=T_{mf,max}).

WEIGHTED STANDARDIZED LEVEL DIFFERENCE, D_{nT,w} (dB). A value calculated from the frequency dependent values of the standardized level difference, D_{nT}, according to a weighting method described in BS EN ISO 717-1:1997. This allows the sound level difference of an element to be expressed in terms of a single value. Note D_{nT,w} (T=T_{mf,max}) is used in BB93 (2015) which is the same quantity but derived from standardized level difference values which were calculated using T₀=T_{mf,max}.

9.2 Noise Monitoring Equipment

The equipment summarised in Table 6 has been calibrated by a UKAS accredited laboratory in accordance with the laboratory requirements of the United Kingdom Accreditation Service (UKAS) on the dates indicated.

Item	Make	Type	Serial no.	Calibration Intervals	Last Calibrated	Calibration Certificate Number
Class 1 sound level meter	Norsonic	140	1406755	2 years	28/10/2022	U42262/ U42263
Microphone preamplifier	Norsonic	1209	21284	2 years	28/10/2022	U42262/ U42263
Microphone	Norsonic	1225	251518	2 years	28/10/2022	42261
Calibrator	Norsonic	1251	34890	1 year	04/03/2022	U40364

Table 6: Noise monitoring equipment

9.3 Survey Pictures (indoor)

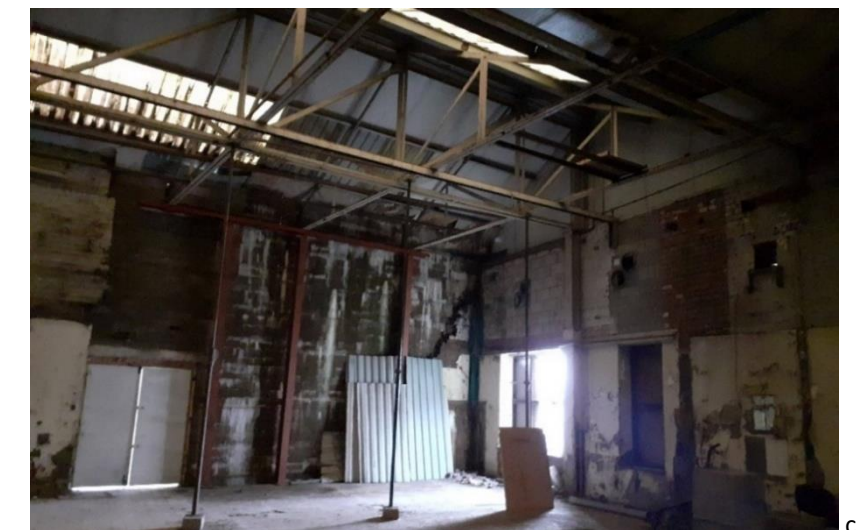


Figure 14 (a,b,c): internal views of the Warehouse

9.4 Noise Survey Data

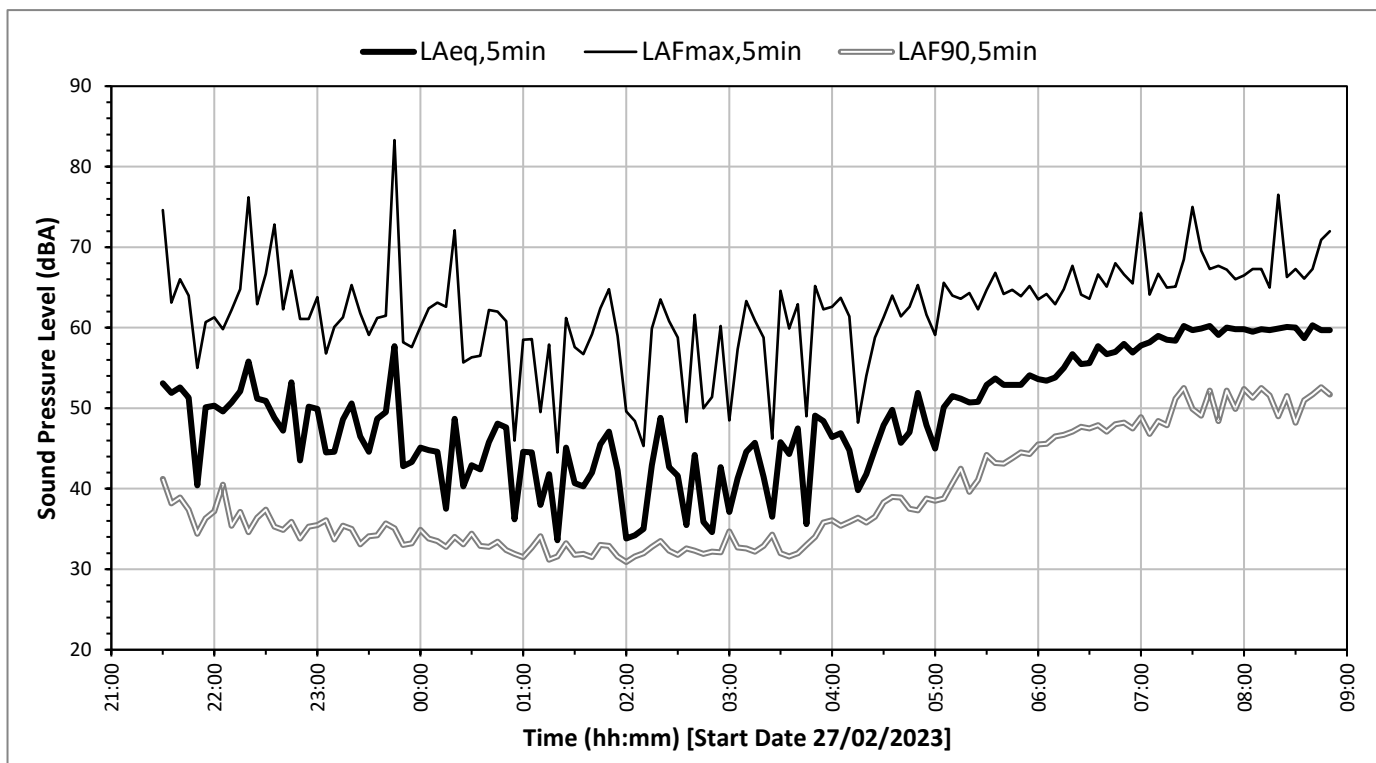


Figure 15: Noise Levels recorded at Location L2 (on the external patio of the Lismore Guest House)

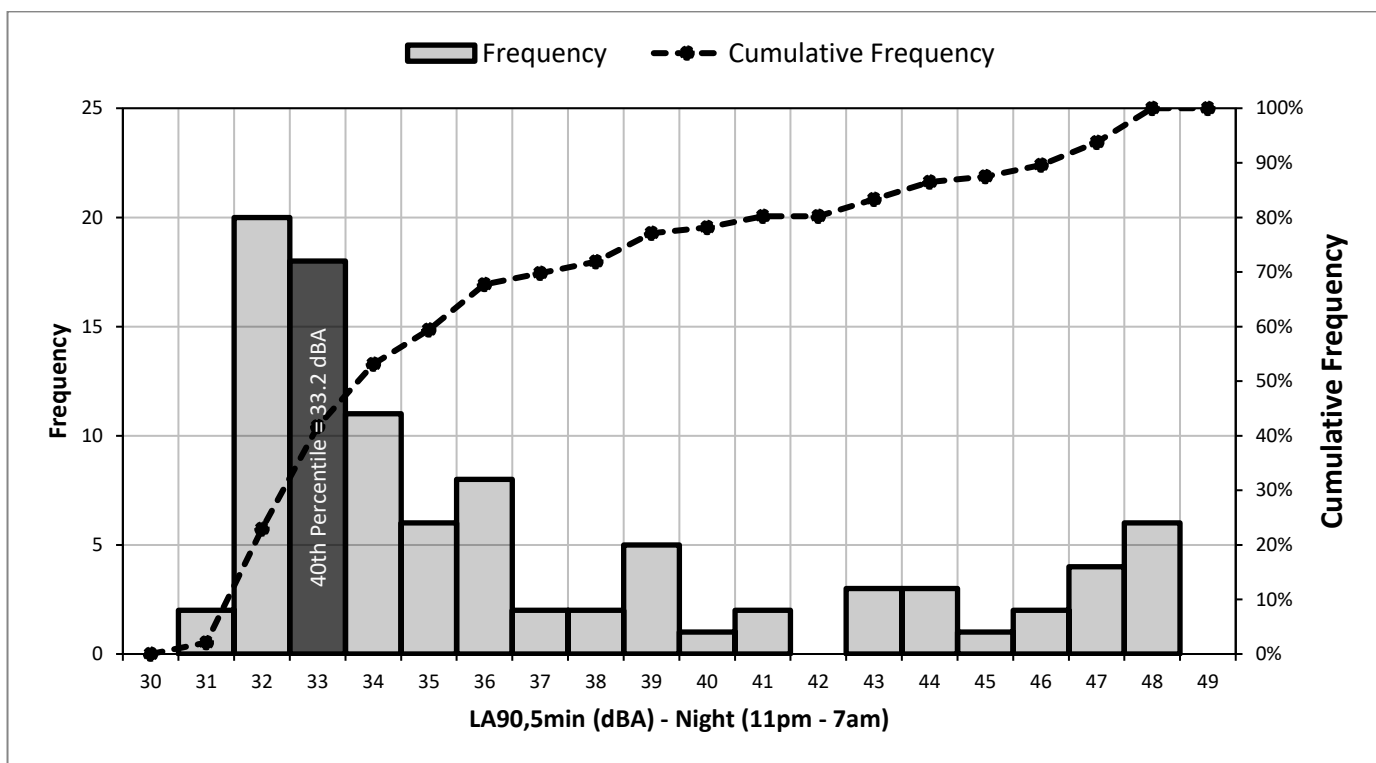


Figure 16: Statistical distribution of the background noise level $L_{A,90,15min}$ at Location L2 (on the external patio of the Lismore Guest House)