



Orbit Investments (Properties) Limited

55 King Street, Manchester

Noise Assessment

18826848/01 – May 2023

Move Forward with Confidence

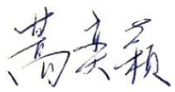


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Executive Summary

Bureau Veritas was instructed by Orbit Investments (Properties) Limited to undertake an environmental noise assessment to support the planning application for 'elevation alteration to provide ventilation louvres to replace existing windows together with the installation of roof plant equipment and associated enclosure' at 55 King Street, Manchester.

An assessment has been carried out in accordance with the guidance within BS4142:2014+A1:2019 'Methods for rating and assessing industrial and commercial sound'.

To establish the current levels of ambient and background sound level at the nearest residential receptors, a long-term noise monitoring survey was undertaken in May 2023. Existing ambient noise levels at the nearest residential receptors are dominated by traffic noise from the King Street. Traffic noise from other local roads was audible during lulls of traffic noise from King Street. Birdsong and tree rustling were also audible but quiet.

A computational noise model was assembled and populated with noise emission data of the sound sources. Standard noise propagation calculations were used to predict site operational noise levels at the nearest noise sensitive receptors.

The assessment concludes that the noise impacts of the site operation would be below the Lowest Observed Adverse Effect Level. No further noise mitigation measures are required.

1 Introduction

- 1.1 Bureau Veritas was instructed by Orbit Investments (Properties) Limited to undertake an environmental noise assessment to support the planning application for 'elevation alteration to provide ventilation louvres to replace existing windows together with the installation of roof plant equipment and associated enclosure' at 55 King Street, Manchester.
- 1.2 The purpose of this assessment is to provide an indication of its potential impacts on sensitive receptors off site in terms of noise, based on current guidance and best practice.
- 1.3 The report also details the baseline noise surveys, assessment methods used, and mitigation measures if required.
- 1.4 A glossary of acoustic terminology is included in **Appendix One**.

2 Site location

- 2.1 The plant units are to be installed on the building roof of 55 King Street in the city centre of Manchester. The site is located in a commercial area. King Street runs south of the building. Cheapside runs immediately west of the building, whilst Chapel Walks and Marsden Street run to the north of the building. The building is mainly surrounded by multi-story office buildings, with Abbey College, Manchester approximately 10 m to the west of the building and Pam Mall Medical approximately 8 m to the east of the building.
- 2.2 The site location is shown in **Appendix Two**.
- 2.3 It is understood that there are very few noise-sensitive properties close to the proposed development; the closest is believed to be residential dwellings located above the Diesel clothes shop on the junction of King Street and Cross Street and the Gotham Hotel at 100 King Street to the east of the site on the corner of King Street and Spring Gardens. Therefore, the nearest noise sensitive receptors are the two residential receptors, Abbey College Manchester and Pam Mall Medical adjacent, the locations of which are shown in **Appendix Two**.

3 Details of Development

- 3.1 On the building roof, there will be 2no. Reversible Air Source Heat Pump (ASHP) and 27no. VRV units. The plant units are within a fully louvred enclosure wall at 3.1 m high. The louvre enclosure is made of AHE "Louvre-lock" external weather louvres, that are manufactured from plastic coated galvanise steel (ALUZINK) using a unique interlocking assembly process.
 - 3.2 The plant unit layout and the location of the weather louvre are shown in **Appendix Three**.
 - 3.3 The roof top plants will run during daytime to serve the office floors when the offices are in use (typically 08:00 – 18:00). The roof plants are linked to the ground floor retail and basement leisure operators, and will run in accordance with their operational hours, which are typically from 06:30 – 23:00.
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4 Criteria for Assessment

4.1 The ASHPs are the sources considered in the noise assessment. The relevant guidance documents are listed below:

- National Planning Policy Framework (NPPF) 2021; and the supplementary Planning Practice Guidance for Noise (PPG(N)) Dec 2014;
- British Standard 4142: 2014, “Methods for rating and assessing industrial and commercial sound” (BS4142);
- Heat Pumps – Professional Advice Note (2022);
- British Standard 8233: 2014, “Guidance on sound insulation and noise reduction for buildings”, and
- ISO 9613-2:1996 ‘Acoustics – Attenuation of Sound during Propagation Outdoors – Part 2: General Method of Calculation’

Planning Policy

National Planning Policy Framework, 2021

4.2 The Revised NPPF (July 2021) sets out the Government’s planning policies for England. It 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 soil, air, water or noise pollution or land instability. Development should, wherever possible, help to improve local environmental conditions such as air and water quality, taking into account relevant information such as river basin management plans; and ...”*

4.3 It goes on to state:

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

- a) *mitigate and reduce to a minimum potential adverse impacts resulting from noise from new development – and avoid noise giving rise to significant adverse impacts on health and the quality of life [NPSE – see below];*
- b) *identify and protect tranquil areas which have remained relatively undisturbed by noise and are prized for their recreational and amenity value for this reason; and...*”

4.4 The terms ‘significant adverse impact’ and other adverse impacts are defined in the explanatory notes of the ‘Noise Policy Statement for England (NPSE)’, which states:

There are two established concepts from toxicology that are currently being applied to noise impacts, for example, by the World Health Organisation. They are:

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

LOAEL – Lowest Observed Adverse Effect Level

This is the level above which adverse effects on health and quality of life can be detected.

Extending these concepts for the purpose of this NPSE leads to the concept of a significant observed adverse effect level.

SOAEL – Significant Observed Adverse Effect Level

This is the level above which significant adverse effects on health and quality of life occur

- 4.5 It should be noted that specific noise limits for LOAEL and SOAEL have not yet been specifically defined, and would be specific to different sectors. However, guidance from other acoustic standards may be employed to determine suitable levels within the overall principle of the NPPF.
- 4.6 The Planning Practice Guidance for Noise (PPGN) provides further detail about how the effects of noise can be categorised. Table 4.1 summarises the noise exposure hierarchy.

Table 4.1: National Planning Practice Guidance Noise Exposure Hierarchy

Perception	Examples of Outcomes	Increasing Effect Level	Action
Not present	No Effect	No Observed Effect	No specific measures required
Present and not intrusive	Noise can be heard, but does not cause any change in behaviour, attitude or other physiological response. Can slightly affect the acoustic character of the area but not such that there is a perceived change in the quality of life	No Observed Adverse Effect	No specific measures required
Lowest Observed Adverse Effect Level			
Present and intrusive	Noise can be heard and causes small changes in behaviour, attitude or other physiological response, e.g. turning up volume of television; speaking more loudly; where there is no alternative ventilation, having to close windows for some of the time because of the noise. Potential for some reported sleep disturbance. Affects the acoustic character of the area such that there is a perceived change in the quality of life.	Observed Adverse Effect	Mitigate and reduce to a minimum
Significant Observed Adverse Effect Level			
Present and disruptive	The noise causes a material change in the behaviour, attitude or other physiological response, e.g. avoiding certain activities during periods of intrusion; where there is no alternative ventilation, having to keep windows closed most of the time because of the noise. Potential for sleep disturbance resulting in difficulty in getting to sleep, premature awakening and difficulty in getting back to sleep. Quality of life diminished due to change in acoustic character of the area	Significant Observed Adverse Effect	Avoid

Perception	Examples of Outcomes	Increasing Effect Level	Action
Present and very disruptive	Extensive and regular changes in the behaviour, attitude or other physiological response and/or an inability to mitigate effect of noise leading to psychological stress, e.g. regular sleep deprivation/awakening; loss of appetite, significant, medically definable harm, e.g. auditory and non-auditory	Unacceptable Adverse Effect	Prevent

British Standard 4142: 2014+A1: 2019 'Methods for rating and assessing industrial and commercial sound'

- 4.7 The Standard provides a method for assessing whether a sound from industrial or commercial premises (e.g. fixed mechanical and electrical (M&E) plant, loading activities etc.) is likely to cause a disturbance to persons living in the vicinity of the site.
- 4.8 BS 4142 assesses potential significance of effect by comparing the 'specific sound level' of an industrial source to the typically representative background sound level (L_{A90}). Certain acoustic features can increase the potential for a sound to attract attention, and therefore increase its relative significance than that expected from a simple comparison between the specific sound level and the background sound level. In particular, BS 4142 identifies noise that contains discrete impulses and/or audible tonal qualities and in these cases recommends that a correction be added to the specific sound level. The specific sound level along with any applicable correction is referred to as the 'rating level'.
- 4.9 The greater the difference between the rating level and the background sound level; the greater the likelihood of complaints. The assessment criteria given by BS 4142 are as follows:
- A difference of +10 dB or more is likely to be an indication of a significant adverse impact, depending on the context.
 - A difference of +5 dB could 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 there will be an 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.
 - Also to take into account the absolute level, risk that it will cause annoyance/interference with everyday activities, context of the sound, frequency and temporal variations to the sound.
- 4.10 During the daytime and evening, BS 4142 requires that sound levels are assessed over 1-hour periods. During the night-time, because sleep disturbance is the important issue and individual sound events are, therefore, more important, sound levels are assessed over 15-minute periods.

British Standard 8233: 2014 Guidance on Sound Insulation and Noise Reduction for Buildings

- 4.11 BS 8233:2014 provides guidance for the control of noise in and around buildings. It is applicable to the design of new buildings, or refurbished buildings undergoing a change of use.

- 4.12 With regards to external sound sources affecting habitable residential spaces, Table 4 of BS 8233:2014 provides guideline values that it is desirable to not exceed during daytime and night-time periods. These guideline values are reproduced in Table 4.2.

Table 4.2: Indoor ambient sound levels for dwellings

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 (daytime resting)	Bedroom	35 dB $L_{Aeq,16hour}$	30 dB $L_{Aeq,8hour}$

- 4.13 For traditional external areas that are used for amenity space, such as gardens and patios, BS8233 states that it is desirable that the external sound level does not exceed 50 dB $L_{Aeq,T}$, with an upper guideline value of 55 dB $L_{Aeq,T}$ which would be acceptable in noisier environments.

Building Bulletin 93: Acoustic design of schools: performance standards (BB93), February 2015

- 4.14 BB93 is the normal method of demonstrating compliance with Approved Document E, Part E4 of the Building Regulations 2010 (as amended). BB93 provides design standards for schools and teaching facilities covering areas such as: indoor ambient noise level; airborne and impact sound insulation between adjacent spaces; reverberation time in teaching and learning spaces; and the control of rain impact noise.
- 4.15 BB93 provides recommended acoustic design criteria for the various aspects of school and teaching facilities. These are summarised in Table 4.3 below.

Table 4.3: Recommended acoustic design criteria (BB93)

Location		Criterion	Recommended sound pressure level dB $L_{Aeq,30min}$
New schools	Inside Classroom	Upper Limit	35
	Inside Staff Room	Upper Limit	40
	Outside premises used for formal and informal teaching	Upper Limit	60
		Possible (will require considerable building envelope sound insulation, screening or barriers)	Up to 70
	Unoccupied playgrounds, playing fields or other outdoor areas	Upper Limit	55
		A minimum of one area suitable for outdoor teaching activities	50 *
	Unoccupied playing fields for teaching sport	Recommended	50 *

Notes: * If this is not possible, acoustic screening should be used to reduce noise in these areas as much as practicable.

ISO 9613-2:1996 'Acoustics – Attenuation of Sound during Propagation Outdoors – Part 2: General Method of Calculation'

4.16 ISO 9613-2:1996 specifies methods for the description of sound outdoors in community environments. ISO 9613 can be applied to a wide variety of sound sources and includes methods to determine most of the major mechanisms of sound attenuation, such as:

- Geometric divergence (A_{div}) – spherical spreading of sound energy;
 - Atmospheric absorption (A_{atm}) – attenuation of sound due to interaction with the air (dependant on frequency of sound and negligible at short distances);
 - Ground effect (A_{gr}) – sound reflecting by the ground surface interfacing with the sound propagating directly from source to receiver;
 - Reflection from surfaces (image source method, included in A_{gr} calculation) – sound is reflected from hard surfaces such as building facades due to atmospheric impedance of the surface. This effect increases the sound level when compared to a location free of buildings (i.e. free field); and
 - Screening by obstacles (A_{bar}) – Hard obstacles such as close boarded timber fences and varying topography, including hills attenuate the sound from a source due to the insertion loss properties of the obstacle. However, there is an element of the sound which will diffract around the obstacle, especially at lower frequencies. The diffraction effect is determined using the path differences between the direct and diffracted sound. It should be noted that the screening effect provided by trees and foliage is negligible in the majority of cases; the exception is large areas of dense forest or plantations.
-

5 Baseline Sound Levels

- 5.1 To establish the ambient sound levels and background sound levels at the nearest residential receptors, long-term monitoring was carried out from the 4th to the 12th May 2023.
- 5.1 The measurement location was deployed on the second-floor balcony, approximately 1 m away from the building façade, therefore the sound levels will be reduced by 3 dBA (sound level increased by building façade reflection) to represent neighbouring noise sensitive receptors. The measurement was undertaken at a height of approximately 1.5 m above the floor. The typical background sound levels during day, evening and night-time periods were obtained by analysing the baseline data measured. The measurement location is shown in **Appendix Two**.
- 5.2 The measurement was undertaken in free-field conditions at a height of approximately 1.5 m above the roof. The noise monitoring equipment was calibrated at the beginning and end of the assessment period using an acoustic calibrator, which had itself been calibrated against a reference set traceable to National and International Standards. No shift in calibration level was observed.
- 5.3 During the measurement survey, the meteorological conditions were 6-19 °C temperature, mostly sunny and cloudy and wind direction from diverse directions. The windspeed was 0-8 m/s.
- 5.4 The dominant sound is traffic noise from King Street. Construction work with drilling sound was loud and intermitted (daytime on the 4th and 5th May, only). Traffic noise from other local roads was audible when a lull of traffic noise from King Street. Birdsong and tree rustling were also audible but quiet.
- 5.5 **Table 5.1** presents a summary of the sound level survey results during the long-term monitoring. The full long-term measurement data and weather data are shown in **Appendix Four**. The sound levels when rain occurred or wind speed >5m/s were filtered out.

Table 5.1: Summary of Derived Sound Levels at the long-term monitoring location

Date	Period	Sound Pressure Level, dB re: 20µPa (Fast, façade)			
		L _{Aeq,15m}	L _{Amax,15m}	L _{A10,15m}	L _{A90,15m}
04-12/05/23	06:30 – 07:00 (Night)	54 – 64 Average 57	67 - 80 Average 73	57 – 66 Average 60	47 – 60 Mode 49
	07:00 – 23:00 (Day)	50 – 76 Average 58	60 - 101 Average 75	54 – 80 Average 61	46 – 60 Mode 51

Table 5.2: Summary of Derived Sound Levels at the long-term monitoring location with 3 dBA correction

Date	Period	Sound Pressure Level, dB re: 20µPa (Fast, Free-field)			
		L _{Aeq,15m}	L _{Amax,15m}	L _{A10,15m}	L _{A90,15m}
04-12/05/23	06:30 – 07:00 (Night)	51 – 61 Average 54	64 - 77 Average 70	54 – 63 Average 57	44 – 57 Mode 46
	07:00 – 23:00 (Day)	47 – 73 Average 55	57 - 98 Average 72	51 – 77 Average 58	41 – 57 Mode 48

- 5.6 To do a robust assessment, the representative background sound levels were determined to be **46 dB L_{A90}** for NSRs during the night-time period (0630-0700), **48 dB L_{A90}** during daytime (0700-2300).

6 Noise Assessment

Introduction

- 6.1 The sound levels of site operation at the nearest sensitive receptors have been predicted by noise modelling, using CadnaA.
- 6.2 The assessment of the noise impact of the plant operation is based on the ambient sound levels ($L_{Aeq,T}$) and the background sound levels ($L_{A90,T}$) measured in April 2023. Noise propagation was predicted using algorithms described in ISO 9613-2, as incorporated within the noise modelling software.
- 6.3 Due to the typically low vibration levels that are likely to be generated, it is expected that operational activities would not result in perceptible vibration impacts on any of the sensitive receptors. Therefore, no further assessment of operational vibration was undertaken.

Sound Sources

- 6.4 The existing dominant sound sources on the roof are the two plant ventilation hatches and one extra fan. It is confirmed by the client that after the installation of the new plants, the old plants will be replaced and therefore these existing sound sources have been excluded in the assessment.
- 6.5 The new plant noise has no perceptible tone or other distinctive acoustic features, with a broad sound spectrum. The levels do not rise impulsively or have a noticeable on/off nature as they change slowly with the requirements set in the house and have a warm up/cool down time of around 1-3 minutes.
- 6.6 The proposed rooftop plants include 27no. VRV units at sound power level of 82 dB L_{WA} and 2no. Reversible ASHPs at sound pressure level of 75 dBA @ 1m. The sound emission data relating to the plant items are based on Bureau Veritas' in-house database, as shown in **Table 6.1**.

Table 6.1 Plant Emission Data

Plant	Sound Power Level, dB L _{WA}	Octave Band Sound Power Level SWL (dB)								
		31.5 Hz	63Hz	125Hz	250Hz	500Hz	1kHz	2kHz	4kHz	8kHz
VRV unit	82	54	65	75	75	77	76	74	76	70
ASHP	86	58	70	79	80	81	80	79	81	75

- 6.7 The weather louvre provides minimal noise attenuation. To do a worst-assumption of the noise assessment, no noise reduction is assumed by the weather louvre enclosure.
- 6.8 As mentioned above, the roof top plants will run during daytime to serve the office floors when the offices are in use (typically 08:00 – 18:00). The roof plants linked to the ground floor retail and basement leisure operators will be run accordance with their operational hours, which are typically from 06:30 – 23:00.

- 6.9 Therefore, the assessment will focus on the plant operation during daytime (07:00-23:00) and a short night-time period (06:30 – 07:00). Given that at this stage, the specific number of plants for the ground floor retail and basement leisure operators and offices has not been confirmed, the assessment is based on the worst-case assumption of all the plants being in operation during all the time periods.

Operational Noise

- 6.10 The predicted specific sound levels at the nearest receptors during the daytime operation are shown in **Table 6.2** below.

Table 6.2: Summary of Predicted Sound Levels of Plant Operation on the Nearest Facades during daytime

Receptor(s)	Sound Pressure Level, dB $L_{Aeq,T}$
NSR1_ Residential receptors above Diesel Shop	40
NSR2_ Hotel Gotham	43
NSR3_ Pam Mall Medical	41
NSR4_ Abbey College Manchester	44

- 6.11 **Figure 6.1 and Figure 6.2** show the predicted sound propagation grids at 7.5 m (2nd floor) and 16.5 m (4th floor), which indicates the sound levels at NSRs.
-

Figure 6.1: Indicative Prediction of Specific Sound Level (Day) – 7.5 m above ground

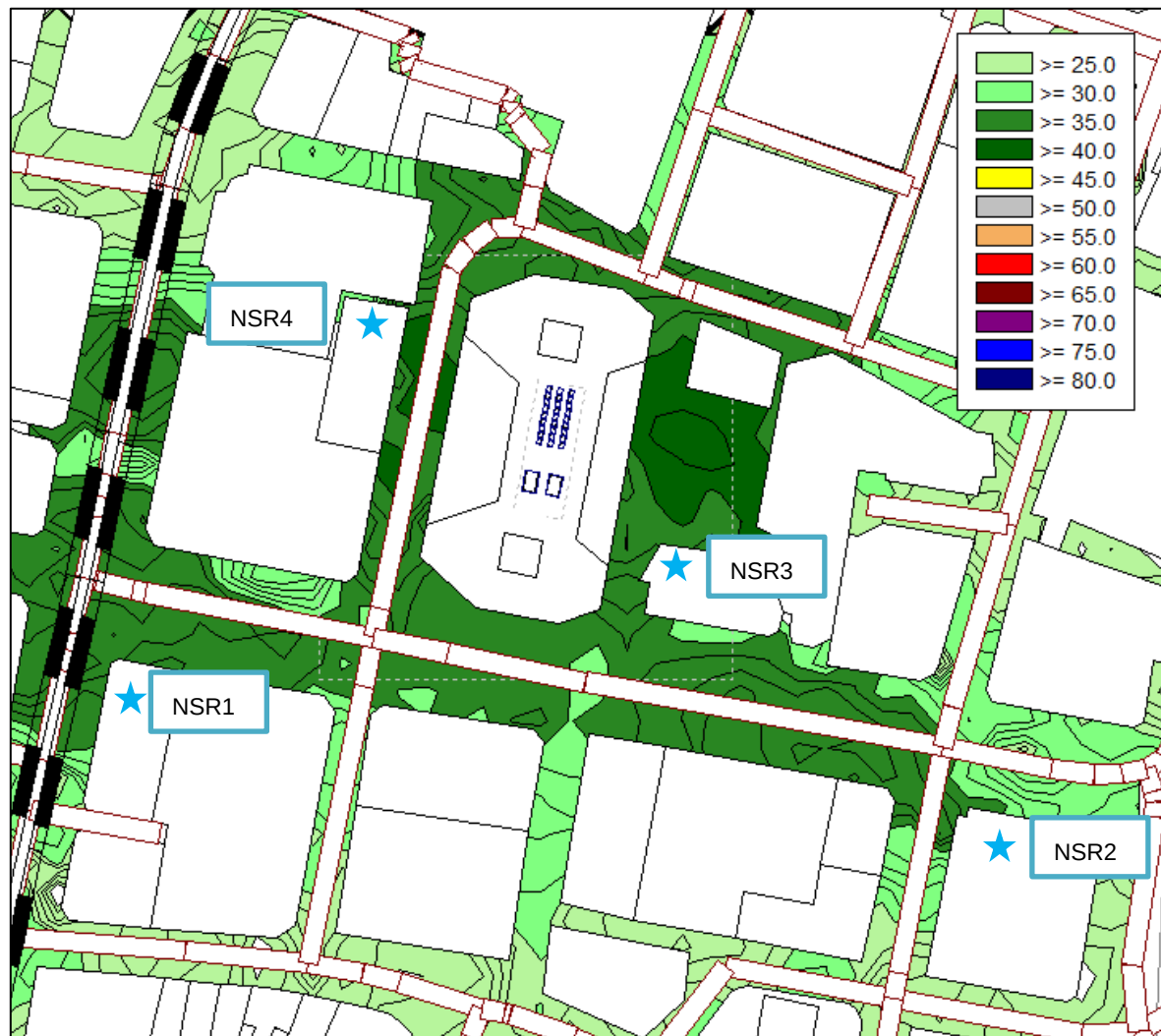
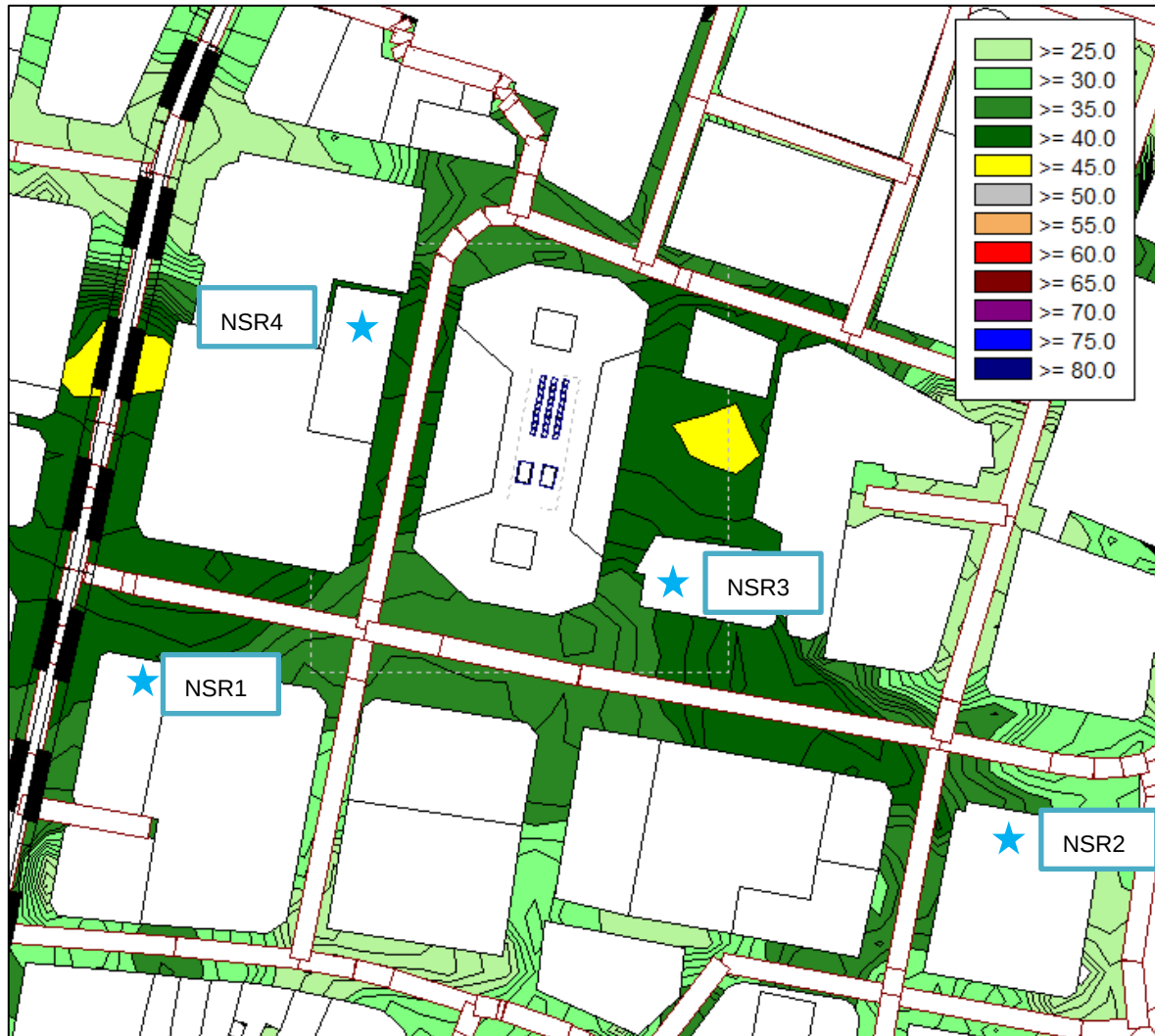


Figure 6.2: Indicative Prediction of Specific Sound Level (Day) – 16.5 m above ground



Noise Assessment

Residential Receptors

- 6.12 As shown in **Table 6.2**, the highest noise level is 43 dB at the nearest residential receptor façade. Since the ambient sound levels are significantly higher (more than 10 dB) than the predicted ASHP noise level, and no perceptible tone or other distinctive acoustic features were observed during the site survey, the rating level is determined to be 43 dB, which is above the upper limit of 40 dB $L_{Aeq,T}$.
- 6.13 Therefore, a BS4142 assessment is further undertaken as below.

Non-Residential Receptors

- 6.14 Regarding noise assessment for the non-residential receptors, Abbey College Manchester (NSR4) and Pam Mall Medical (NSR3), the noise limits in the guidance BB93 and Health Technical Memorandum 08-01: Acoustics are adopted.

- 6.15** As it is shown in **Table 6.2**, the highest plant noise level on façade of Abbey College Manchester is predicted as 44 dB $L_{Aeq,T}$ at daytime. The internal sound level of the classrooms will be 31 dB $L_{Aeq,T}$, with 13 dB sound reduction by partially open windows, which is lower than the lower limit of 35 dB in BB93.
- 6.16** Therefore, based on the assessment, the proposed development has no adverse impact at Abbey College Manchester.
- 6.17** The highest plant noise level on façade of Pam Mall Medical is predicted as 40 dB $L_{Aeq,T}$ at daytime. The internal sound level of the classrooms will be 27 dB $L_{Aeq,T}$, with 13 dB sound reduction by partially open windows, which is much lower than the limit of 45 dB $L_{Aeq, 1hr}$ for clinic areas in Table 1 of HTM08_01.
- 6.18** Therefore, based on the assessment, the proposed development has no adverse impact at Pam Mall Medical.

BS4142 Assessment

- 6.19** The indicative assessment is provided in **Table 6.3** and **Table 6.4** below.
- 6.20** The results in **Table 6.3** and **Table 6.4** indicate that, during the daytime and night-time periods, the predicted sound levels generated by the operation of the plants would result in no impact at the nearest residential receptors. As such, no further noise mitigation measures are required for the operation.

Table 6.3: Indicative BS 4142:2014 Assessment of plant Noise- Day (0700-2300)

Description	Result	Relevant Clauses of BS 4142:2014	Commentary
Specific Sound Level (free-field)	$L_{Aeq,T} = 40$ dB (NSR1) $L_{Aeq,T} = 43$ dB (NSR2)	7.3.6	Predicted level (free-field) at ground floor level at the nearest receptor. Determined by calculation using CadnaA.
Background sound level	48 dB	8.1 and 8.2	The background noise levels (free-field) were measured at the monitoring location representative for the noise-sensitive receptors.
Acoustic features correction	0	9.2	No perceptible tone or other distinctive acoustic features are predicted to be audible at the receptors due to the low noise level.
Rating Level	40 dB (NSR1) 43 dB (NSR2)		
Excess of Rating Level over Background Sound Level	-8 dB (NSR1) -5 dB (NSR2)		
Assessment of impact: indication of no impact due to the plant noise at the receptors		11	
Context		11 8.2	The predicted noise emissions from the proposed development are well below existing ambient and background levels, and therefore unlikely to be perceptible above the prevailing acoustic climate.

Description	Result	Relevant Clauses of BS 4142:2014	Commentary
Uncertainty of the assessment		10	The specific noise level has been predicted by CadnaA, which utilises ISO9613 calculations, which have a claimed uncertainty of +/- 3 dB.

Table 6.4: Indicative BS 4142:2014 Assessment of plant Noise- Night (0630 -0700)

Description	Result	Relevant Clauses of BS 4142:2014	Commentary
Specific Sound Level (free-field)	$L_{Aeq,T} = 40$ dB (NSR1) $L_{Aeq,T} = 43$ dB (NSR2)	7.3.6	Predicted level (free-field) at ground floor level at the nearest receptor. Determined by calculation using CadnaA.
Background sound level	46 dB	8.1 and 8.2	The background noise levels (free-field) were measured at the monitoring location representative for the noise-sensitive receptors.
Acoustic features correction	0	9.2	No perceptible tone or other distinctive acoustic features are predicted to be audible at the receptors due to the low noise level.
Rating Level	40 dB (NSR1) 43 dB (NSR2)		
Excess of Rating Level over Background Sound Level	-6 dB (NSR1) -3 dB (NSR2)		
Assessment of impact: indication of no impact due to the plant noise at the receptors		11	
Context		11 8.2	The predicted noise emissions from the proposed development are well below existing ambient and background levels, and therefore unlikely to be perceptible above the prevailing acoustic climate. A sound reduction of 15 dB is expected through a partially open window for ventilation, therefore internal plant noise levels would be below BS8233 guidelines for bedrooms (30 dB $L_{Aeq,8h}$).
Uncertainty of the assessment		10	The specific noise level has been predicted by CadnaA, which utilises ISO9613 calculations, which have a claimed uncertainty of +/- 3 dB.

7 Conclusions

- 7.1 Bureau Veritas was instructed by Orbit Investments (Properties) Limited to undertake an environmental noise assessment to support the planning application for 'elevation alteration to provide ventilation louvres to replace existing windows together with the installation of roof plant equipment and associated enclosure' at 55 King Street, Manchester.
 - 7.2 The assessment concludes that the noise impacts of the plant operation would be below the Lowest Observed Adverse Effect Level. No further noise mitigation measures are required.
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Appendix One – Glossary of Acoustic Terminology

Sound power level	A logarithmic measure of the power of a sound relative to a reference value.
"A" Weighting (dB(A))	The human ear does not respond uniformly to different frequencies. "A" weighting is commonly used to simulate the frequency response of the ear. It is used in the assessment of the risk of damage to hearing due to noise.
Decibel (dB)	The range of audible sound pressures is approximately 2×10^{-5} Pa to 200 Pa. Using decibel notation presents this range in a more manageable form, 0 dB to 140 dB.
Ambient sound level, $L_{Aeq,T}$	equivalent continuous A-weighted sound pressure level of the totally encompassing sound in a given situation at a given time, usually from many sources near and far, at the assessment location over a given time interval, T. NOTE The ambient sound level is a measure of the residual sound and the specific sound when present.
Background sound level, $L_{90,T}$	A-weighted sound pressure level that is exceeded by the residual sound at the assessment location for 90% of a given time interval, T, measured using time weighting F and quoted to the nearest whole number of decibels.
Maximum sound level, $L_{Amax,T}$	The maximum RMS A-weighted sound pressure level occurring within a specified time period.
Noise	Unwanted sound.
Ambient sound	Totally encompassing sound in a given situation at any given time composed of noise from many sources, near and far.
Residual sound	Ambient sound remaining at the assessment location when the specific sound source is suppressed to such a degree that it does not contribute to the ambient sound.
Rating level	Specific sound level plus any adjustment for the characteristic features of the sound.

The map shows the following locations and landmarks:

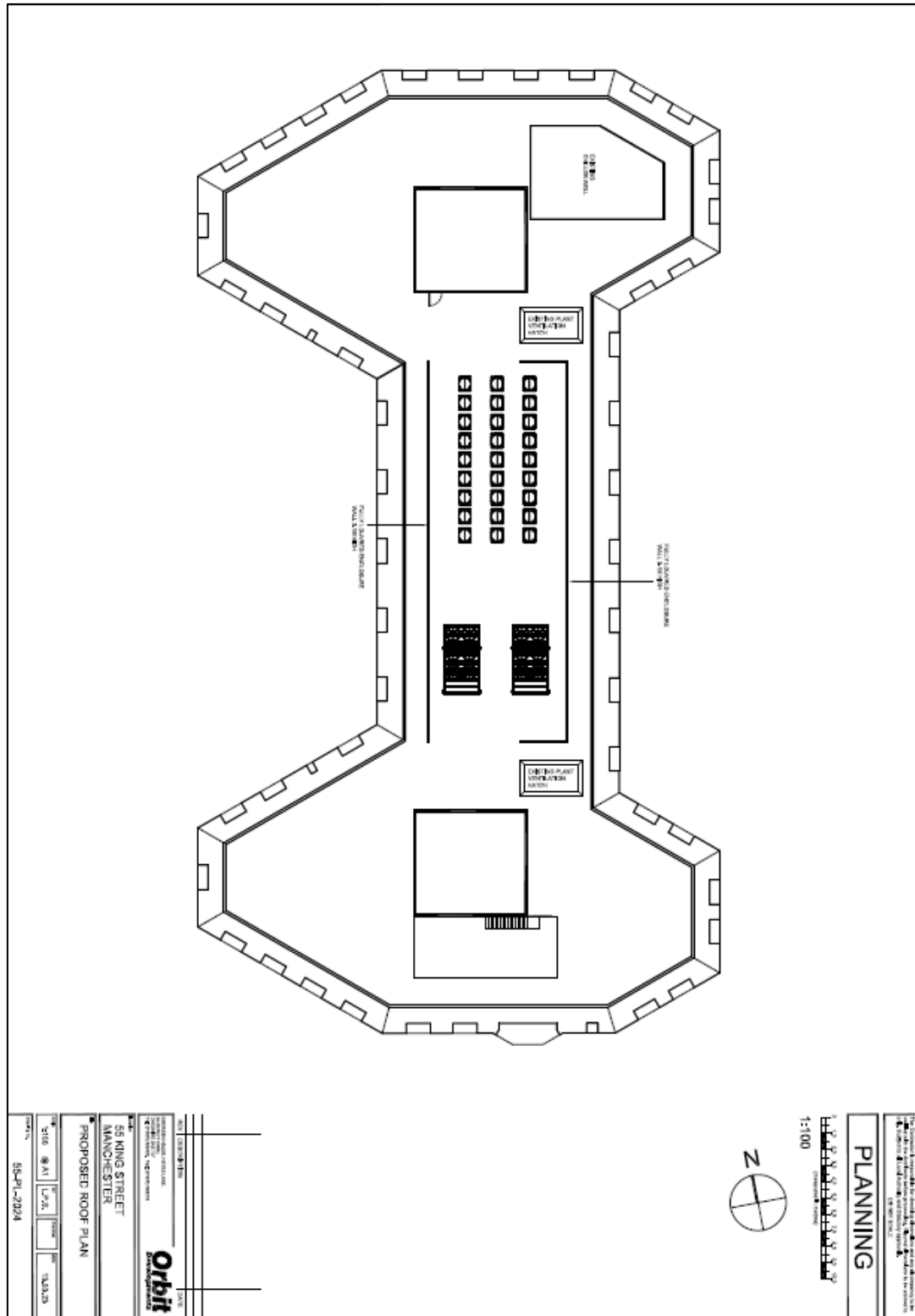
- NSR4_Abbey College Manchester**: Located near the top left, near St Ann St and Half Moon St.
- NSR1_Residential receptors above Diesel Shop**: Located near the bottom left, near S King St and Cross St.
- NSR2_Hotel Gotham**: Located near the bottom center, near King St and Chancery Ln.
- NSR3_Pam Mall Medical**: Located near the bottom right, near King St and Cross St.
- Monitoring location**: Located near the center, near Chapel Walk and King St.

Other visible landmarks and businesses include:

- Royal Exchange Theatre
- Moss Bros Manchester
- Annies
- Old Bank St
- Pret A Manger
- Sam's Chop House
- Chapel Walk
- Thar Kitchen No. 6
- The Red Angel Hair Company
- Kala Bistro
- HERVIA Store
- Totally Wicked - E-cigarette and E-liquid Vaporiser Shop
- Hudson Social
- Bold Street Coffee
- Town Hall Tavern
- Manchester Chemist Pharmacy
- Manchester Norfolk House Blood Donor Centre
- Stock Exchange Hotel
- Hotel Motel One Manchester-Royal Exchange
- Hotel Gotham
- Manchester Gardens Police Station
- Beermoth Craft Beer Bar
- Slater's Men's Clothing
- Tesco Express
- New Market Ln
- Norfolk St
- Kent St
- Pall Mall Court Shopping Centre
- Chancery Ln
- Google

Appendix Three – Plan Layout

Figure A3.1 AC unit Layout and elevation



Appendix Four – Long-term Monitoring Data and Weather Data

