



The University of Manchester
The Relocation of The Limes, Fallowfield Campus
Noise Impact Assessment
DC4816-NR1v3



Report Version Issue Log

Report Number	Issue Date	Note or Change	Author	Reviewed By	Approval for Issue
DC4816-NR1v3	28.10.24	Updated Site Plan	CC	--	CC
DC4816-NR1v2	23.10.24	Development Description Amendment	CC	--	SGC
DC4816-NR1	11.10.24	Report First Issue	CC	MAS	SGC

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Limitations to this Report

This report entails a physical investigation of the site with a sufficient number of sample measurements to provide quantitative information concerning the type and degree of noise affecting the site. The objectives of the investigation have been limited to establishing sources of noise material to carrying out an appropriate assessment.

The number and duration of noise measurements have been chosen to give reasonably representative information on the environment within the agreed time, and the locations of measurements have been restricted to the areas unoccupied by building(s) that are easily accessible without undue risk to our staff.

As with any sampling, the number of sampling points and the methods of sampling and testing cannot preclude the existence of “hotspots” where noise levels may be significantly higher than those actually measured due to previously unknown or unrecognised noise emitters. Furthermore, noise sources may be intermittent or fluctuate in intensity and consequently may not be present or may not be present in full intensity for some or all of the survey duration.

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1.0 INTRODUCTION

1.1 Details of Instruction

The University of Manchester has appointed Dragonfly Consulting to carry out a noise impact assessment relating to the proposal to relocate the current 'The Limes' catering and maintenance facility from its existing site within Owens Park, to a new site on the current car park at Unsworth Park.

The noise assessment has been conducted with reference to the National Planning Policy Framework and the appropriate British Standards, recognised guidance & reference documents relevant to this site.

This report describes a noise survey of the site and the subsequent analysis to determine the noise environment of the proposed development. It then compares the results with the adopted criteria and, where applicable, recommendations are made with respect to the design of the development.

A glossary of technical terminology is included in Appendix A.

1.2 Site Description

1.2.1 Site Conditions

The current development site is a car park providing vehicle parking for the Unsworth Park campus, the Richmond Park campus and the University of Manchester Ashburne Hall site, as well as for the wider existing Owens Park site. The area around the site is as follows:

- To the north: To the north of the site is Redshaw Close, approximately 20 semi-detached and terraced properties. Four properties (10-16) have rear facades facing the development site.
- To the east: The site is bordered by the Unsworth Park development with the Unsworth Park combined heat and power plant directly adjacent to the site.
- To the south: The site is bordered by the Richmond Park development.
- To the west: The site sits within the wider car park and adjacent to the Ashburne Hall car park with the hall itself beyond.

The site is a busy car park, particularly during the day and for an extended period served as site compound with vehicle material storage and generators for the Unsworth park development construction scheme.

1.2.2 Development Proposals

The Proposed Development will combine the University's Catering Central Processing Unit (CPU), Maintenance Services Unit (MSU), Environmental Services Unit (ESU) and Residences Team to form a facility consisting of facility management stores and workshops, catering facilities, staff workspaces and storage facilities.

The site is divided into two main sections: the western area is to be designated for parking, whilst the eastern area will house the main building and associated external stores.

The current Limes site operates between 0600hrs and 1700hrs. However, the new site will need to be able to facilitate longer operating hours to provide increased capacity for the expanded brief of the new building.

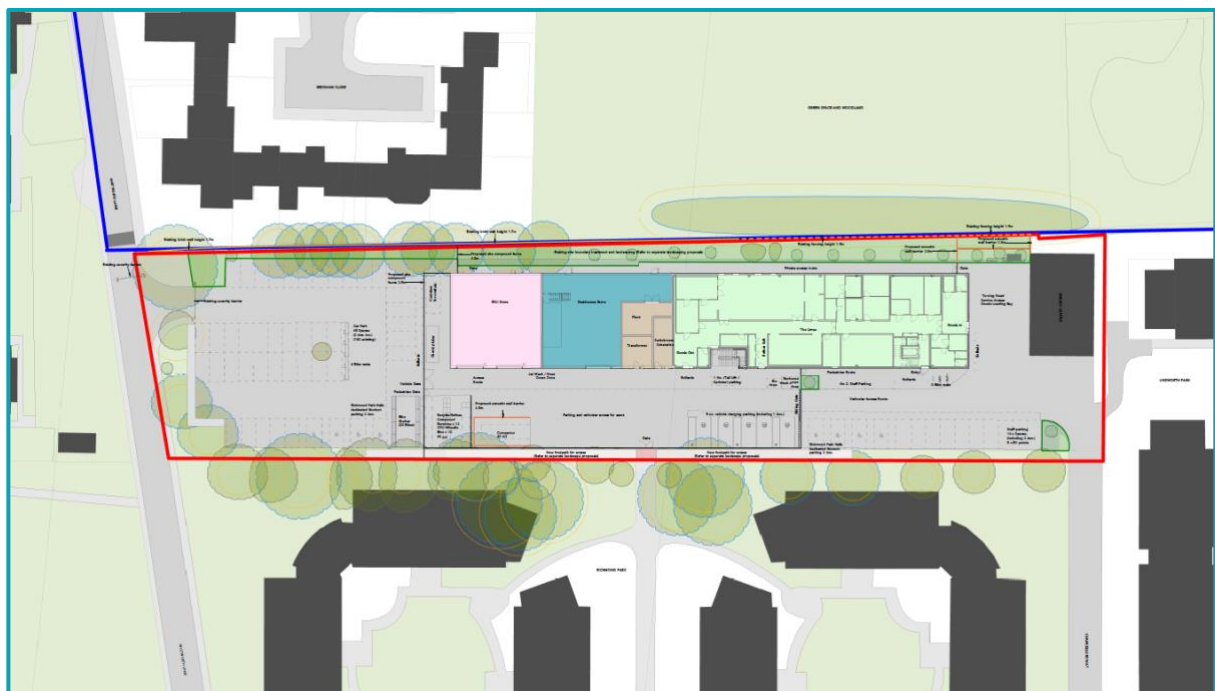
To provide flexibility moving forward, the noise impact assessment assumes that the fixed plant for extraction, cooling and heating will operate 24hrs per day and will be assessed based on a maximum load basis.

For the purposes of site servicing, it has been assumed that the site will receive deliveries by HGV between 0700hrs and 2300hrs, although it is normally expected that deliveries by HGV will be between 0700hrs and 1700hrs. There will be up to 4 deliveries by HGV per day with no more than 1 delivery in any one-hour period.

Site servicing by light goods vehicle (vans) has been assumed to occur 24hrs per day. It is expected that site servicing using LGV will occur normally between 0600hrs and 1800hrs.

The indicative site layout utilised to inform this assessment is provided in Figure 1.1, below.

Figure 1.1
Indicative Site Plan



2.0 GUIDANCE

2.1 Consultation with Local Authority

A pre-application planning consultation has not been possible by the date of issue of this assessment. MCC issues detailed guidance for developers within its guidance document 'Planning & Noise - Technical Guidance' issued in May 2022.

2.2 National Policy

2.2.1 National Planning Policy Framework

The National Planning Policy Framework (NPPF) does not provide any specific or quantified guidance with respect to noise and has withdrawn all previous guidance documents on the assessment of noise for planning purposes, which was detailed in Planning and Policy Guidance 24 (PPG24). Instead, the NPPF places the onus on a local authority to develop a suitable local development plan, within which noise is addressed, taking account of the guidance within the NPPF.

However, much of the previous guidance within PPG24 related to the assessment of noise using other guidance or standards specific to the type or nature of the noise being assessed. These guidance documents and referenced British Standards have not been withdrawn and remain relevant to the assessment of noise impact on a proposed residential development.

Dragonfly Consulting has referred to the guidance detailed in the NPPF and the Noise Policy Statement for England for guidance on assessment of acceptable impact in terms of noise. These documents contain no quantitative guidance with respect to noise.

The NPPF requires at Paragraph 191 that:

"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;*
- 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*
- c) limit the impact of light pollution from artificial light on local amenity, intrinsically dark landscapes and nature conservation."*

2.2.2 Noise Policy Statement for England

The document 'Noise Policy Statement for England' sets out the following vision for ongoing noise policy:

"Promote good health and a quality of life through the effective management of noise within the context of Government policy on sustainable development."

This vision should be achieved through the following Noise Policy Aims:

“Through the effective management and control of environmental, neighbour and neighbourhood noise within the context of Government policy on sustainable development:

- *avoid significant adverse impacts on health and quality of life;*
- *mitigate and minimise adverse impacts on health and quality of life; and*
- *where possible, contribute to the improvement of health and quality of life.”*

To achieve this vision, the Noise Policy Statement sets 3 noise levels to be defined by the assessor:

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 Noise Policy Statement considers that noise levels above the SOAEL would be seen to have, by definition, significant adverse effects and would be considered unacceptable. Where the assessed noise levels fall between the LOAEL and the SOAEL noise levels, the Policy Statement requires that:

“...all reasonable steps should be taken to mitigate and minimise adverse effects on health and quality of life while also taking into account the guiding principles of sustainable development... This does not mean that such adverse effects cannot occur.”

Where noise levels are below the LOAEL, it is considered there will be no adverse effect. Once noise levels are below the NOEL, there will be no observable change.

2.3 Local Planning Requirements

The following local planning requirements have been identified within Policy DM1 of the Manchester Local Plan:

“Development Management

All development should have regard to the following specific issues for which more detailed guidance may be given within a supplementary planning document:-

- *Appropriate siting, layout, scale, form, massing, materials and detail.*
- *Impact on the surrounding areas in terms of the design, scale and appearance of the proposed development. Development should have regard to the character of the surrounding area.*

- *Effects on amenity, including privacy, light, noise, vibration, air quality, odours, litter, vermin, birds, road safety and traffic generation. This could also include proposals which would be sensitive to existing environmental conditions, such as noise.*

2.4 Local Planning Guidance

The MCC guidance document '*Planning & Noise - Technical Guidance*' does not contain any guidance specific to the development of catering premises, however it is considered that the guidance set out for commercial developments may be relevant, based on the fixed plant noise sources associated with cooling, heating and fume extraction and noise from food delivery and distribution.

In reference to commercial uses, the guidance states the following at Section 3.7.1.5:

"BS 4142 should be used to assess the likely impact of noise from industrial and commercial sources at noise sensitive premises (section 3.5). One of the indications of the impact of a BS 4142 assessment is 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.

The Council consider that new developments should contribute and enhance the area in which they are located and where possible i.e. prevent 'noise creep', contribute to the improvement of people's health and quality of life as per the NPSE. With this in mind, the design objective should be:

'The development should be designed so as to achieve a rating level of 5dB (L_{Aeq}) below the typical background (L_{A90}) level at the nearest noise sensitive location.'

Where this criterion cannot be achieved, the various noise control measures considered as part of the assessment should be fully explained (i.e. relocation of noise sources, use of quieter equipment, enclosures, screening, restriction of the hours of operation) and the achievable noise level should be identified. This information will allow a judgement to be made concerning the application and its likely impact on the surrounding area."

In reference to residential uses, the guidance states the following at Section 3.7.1.1:

The Council has adopted the following noise limits for residential properties:

- Bedrooms (night time - 23.00h - 07.00h) 30 dB L_{Aeq} (individual noise events should not normally exceed 45 dB $L_{Amax,F}$ by more than 10 times)
- Living Rooms (daytime - 07.00h - 23.00h) 35 dB L_{Aeq}
- Gardens and terraces (daytime) 55 dB L_{Aeq}

2.5 British Standards and Guidance Documents

2.5.1 ANC Green Book: Environmental Noise Measurement Guide

The ANC Green Book provides practical guidance around the measurement and analysis of environmental sound. Areas which are covered include the preparation, execution and reporting of site survey work, and some road signs through the maze of guidance and policy applicable to this work. It also outlines a number of industry standard practices for the determination of L_{Amax} as a design case.

2.5.2 BS 4142:2014+A1:2019 Method for rating and assessing industrial and commercial sound

BS 4142 describes methods for rating and assessing sound of an industrial and/or commercial nature. The methods use outdoor sound levels to assess the likely effects of sound on people who might be inside or outside a dwelling or premises used for residential purposes upon which sound is incident.

2.5.3 British Standard (BS) 8233:2014 – Guidance on Sound Insulation and Noise Reduction in Buildings

BS 8233 provides a methodology to calculate the noise levels entering a building through facades and façade elements. It also provides details of appropriate measures for sound insulation between dwellings and recommended internal noise levels which are provided for a variety of situations.

2.5.4 BS 7445:2003 Parts 1 and 2 – Description and Measurement of Environmental Noise

The assessment of noise impact for this development has been undertaken by measuring external noise levels in accordance with the guidance detailed in BS 7445-1:2003 *Description and Measurement of Environmental Noise – Part 1: Guide to Quantities and Procedures*.

This document defines the basic quantities to be used for the description of noise in community environments and describes basic procedures for the determination of these quantities.

The methods and procedures described in this British Standard are intended to be applicable to sounds from all sources, individually and in combination, which contribute to the total noise at a site. This British Standard does not specify limits for environmental noise.

2.5.5 ISO 9613 Attenuation of Sound during Propagation Outdoors

ISO 9613 presents a calculation methodology for the determination of the attenuation of sound outdoors. The methodology enables the prediction the levels of environmental noise at a distance from a variety of sources.

3.0 ASSESSMENT METHODOLOGY

3.1.1 Noise Sensitive Receptor (NSR) Locations

Neither MCC local guidance nor national guidance directly considers the situation where a receptor has some noise sensitivity but form part of the same premises as the proposed new noise sources. This scenario exists in many rooms for residential use schemes such as hotel uses, care homes and student accommodation.

In these scenarios, the guidance assumes that these controls sit largely outside of the planning regime. In this circumstance, it is considered that it would be appropriate to ensure that noise from commercial operations within the university estate is controlled, but that considering noise impacts for university buildings in the same context as those outside the university estate would be unduly onerous.

Therefore, to ensure that the assessment of noise impact considers all potentially noise sensitive receptors, those receptors have been considered as either 'offsite' noise sensitive receptors, which have been considered in-line with the guidance set out in BS 4142:2014+A1:2019 to consider noise impact from commercial (HGV/LGV and fixed plant) or 'on-site' which have been considered in line with the guidance set out in BS 8233:2014 for the same sources.

This approach is consistent with the approach taken towards the design of the recent Unsworth Park accommodation scheme, where buildings within the university estate were considered based on the above approach. This includes the assessment of noise emissions from the Energy Centre which formed part of that scheme.

Noise contributions will be considered at the following sensitive receptor locations as follows:

Off-site Receptors:

- NSR1 – 16 Redshaw Close (Grid Ref 385864, 394356).

On-site Receptors:

- NSR2 – Richmond Park Accommodation Block, University of Manchester (Grid Ref 385861, 394307);
- NSR3 – Richmond Park Accommodation Block, University of Manchester (Grid Ref 385923, 394313); and
- NSR4 – Unsworth Park Accommodation Block, University of Manchester (Grid Ref 385980, 394327).

Noise contributions at all NSRs have been considered at First Floor (4.0m AGL) during daytime (0700h-2300h) and night-time (2300h-0700h) hours.

The NSR locations are shown in Appendix C.

3.2 Potential Sources of Environmental Noise

The following sources of environmental noise have been considered relevant to this assessment:

Table 3.1
Assessed Sources of Environmental Noise

Scenario	Receptor Type	Relevant Assessment Methodology
Noise from HGV and LGV servicing.	Offsite	BS 4142:2014+A1:2019
	Onsite	BS 8233:2014
Noise from Fixed Plant	Offsite	BS 4142:2014+A1:2019
	Onsite	BS 8233:2014

3.3 Selection of Assessment Criteria

With reference to the guidance detailed in Section 2.0, the following criteria have been selected to determine the threshold of effect levels in the context of the National Planning Policy Framework and Noise Policy Statement for England.

Table 3.2
Assessment Criteria: BS 4142:2014+A1:2019

Effect Level	Criteria	Justification
Lowest Observed Adverse Effect Level (LOAEL)	Free-field external noise levels at adjacent sensitive receptor locations no higher than the representative background noise level	Noise levels above background are considered an indication of where adverse noise impacts may occur in the context of BS 4142. Noise levels below this level are an indication that it is less likely that the specific sound source will have an adverse impact
Significant Observed Adverse Effect Level (SOAEL)	Free-field external noise levels at receptor above +10dB of representative background noise level	None Mitigate to achieve LOAEL Criteria

It is acknowledged that local guidance seeks to establish a target criteria of 5dB below background for the purposes of a BS 4142 assessment. While this target is suitable for protecting against background noise creep in noisier environments, such as Manchester City Centre, it can be unduly onerous in situations where background noise levels are within the normal range. In such cases, strictly adhering to this target may not be reasonably achievable without imposing disproportionate constraints on the development. Therefore, for this instance where background levels are typical and the scheme includes for significant inherent noise mitigation in the design, the standard BS 4142 assessment criteria is considered more reasonable and appropriate. Accordingly, we will apply the standard criteria detailed above, aligned with NPPF objectives.

Table 3.3
Assessment Criteria: BS 8233:2014

Effect Level	Criteria	Justification
Lowest Observed Adverse Effect Level (LOAEL)	Internal noise levels achieve the requirements of the BS 8233:2014 standard assuming windows are closed, and an additional source of ventilation is provided	Noise levels within the BS 8233:2014 criteria whilst ensuring no conflict with acceptable levels of indoor air quality management are considered to be suitable
Significant Observed Adverse Effect Level (SOAEL)	Internal noise levels fail to achieve the BS 8233:2014 standard by more than 5dB assuming windows are closed, and an additional source of ventilation is provided	None Mitigate to achieve LOAEL Criteria

4.0 ENVIRONMENTAL NOISE SURVEY

External daytime and night-time measurements were undertaken from the 27th to the 30th of September 2024. The noise measurements established typical environmental noise levels at the site.

4.1 Survey Methodology

The equipment used during the survey is detailed in Appendix B. The sound level meters were calibrated before and after the measurements and no significant calibration drifts were found to have occurred (>0.2dB). All of the noise monitoring equipment had been calibrated to a traceable standard within the twenty-four months preceding the survey. Calibration certificates are available on request.

Four (4no.) measurement locations were surveyed in order to establish the typical ambient and background noise levels at the proposed development site. The measurement locations are hereby referred to in this report as follows:

Long-term monitoring locations:

- 'Location 1' – sound level meter positioned on northern site boundary, adjacent to rear of NSR1, approximately 3m AGL;
- 'Location 2' – sound level meter positioned on south-eastern site boundary, adjacent to Richmond Hall, approximately 3m AGL;

The measurement locations are shown in Appendix C.

4.2 Survey Results

All monitored noise data has been screened to remove samples influenced by adverse conditions, including periods of rainfall and high wind speeds (>5m/s), which has been obtained from a nearby weather monitoring station on the Met Office Weather Observations Website (WOW) database. Table 4.1 provides a summary of periods excluded from the results due to adverse weather conditions; all other periods not excluded were considered suitable for noise monitoring.

Table 4.1
Excluded Periods

Excluded Monitoring Periods	Excluded Monitoring Periods
28/09/2024	1330h-1715h
29/09/2024	1015h-1130h
	1700h-1945h
	2045h-0000h
30/09/2024	0145h-0300h
	0400h-1045h

Summaries of the measured noise levels are given in Tables 4.2-4.5 overleaf. Full survey results are available on request.

Table 4.2
Summary of Measured Noise Levels – ‘Location 1’ – Free Field, dB

Date	Period	Time (h)	L _{Aeq, T}	L _{A10}	L _{A90}	L _{AFMax}
27/09/24	Daytime	1515h-2300h	53.7	47.9	42.2	85.5
27/09/24-28/09/24	Night-time	2300h-0700h	64.4	47.9	41.0	85.7
28/09/24	Daytime	0700h-0930h	46.3	47.9	41.2	73.4
28/09/24-29/09/24	Night-time	2300h-0700h	45.0	44.1	38.7	80.5
29/09/24	Daytime	0700h-0930h	49.2	50.5	43.4	76.9
29/09/24-30/09/24	Night-time	2300h-0700h	52.5	54.9	45.2	73.9

Table 4.3
Summary of Measured Noise Levels – ‘Location 2’ – Free Field, dB

Date	Period	Time (h)	L _{Aeq, T}	L _{A10}	L _{A90}	L _{AFMax}
27/09/24	Daytime	1515h-2300h	48.6	49.2	44.0	72.6
27/09/24-28/09/24	Night-time	2300h-0700h	46.8	47.6	43.3	79.8
28/09/24	Daytime	0700h-0930h	48.8	49.4	43.4	88.7
28/09/24-29/09/24	Night-time	2300h-0700h	47.1	47.4	41.1	73.3
29/09/24	Daytime	0700h-0930h	48.5	49.8	43.7	77.2
29/09/24-30/09/24	Night-time	2300h-0700h	47.8	49.6	43.5	61.4

4.3 Subjective Assessment of Noise Environment

The noise environment during the attended portion of the survey at each location was noted as being primarily road traffic noise from the surrounding road network. At Location 1 ambient noise levels were often influenced by noise from the heavy tree cover along the northern boundary of the site, even at low wind speeds. Noise generated by tree cover does not appear to affect measured background noise levels.

For the assessment, it is considered that the levels measured are representative of the typical acoustic environment at the survey locations.

4.4 BS 4142 Background (L_{A90}) Statistical Analysis

To enable to assessment of commercial / industrial noise sources, statistical analysis of measured background noise levels has been undertaken at the following locations, in relation to adjacent NSRs:

- ‘Location 1’ – levels representative of NSR1; and
- ‘Location 2’ – levels representative of NSR2 and NSR3.

The results of the statistical analysis are presented in Figures 4.1 - 4.4. Records highlighted in teal denote the typical background noise levels in accordance with BS 4142.

Figure 4.1
L_{A90} Statistical Analysis – ‘Location 1’ – Daytime

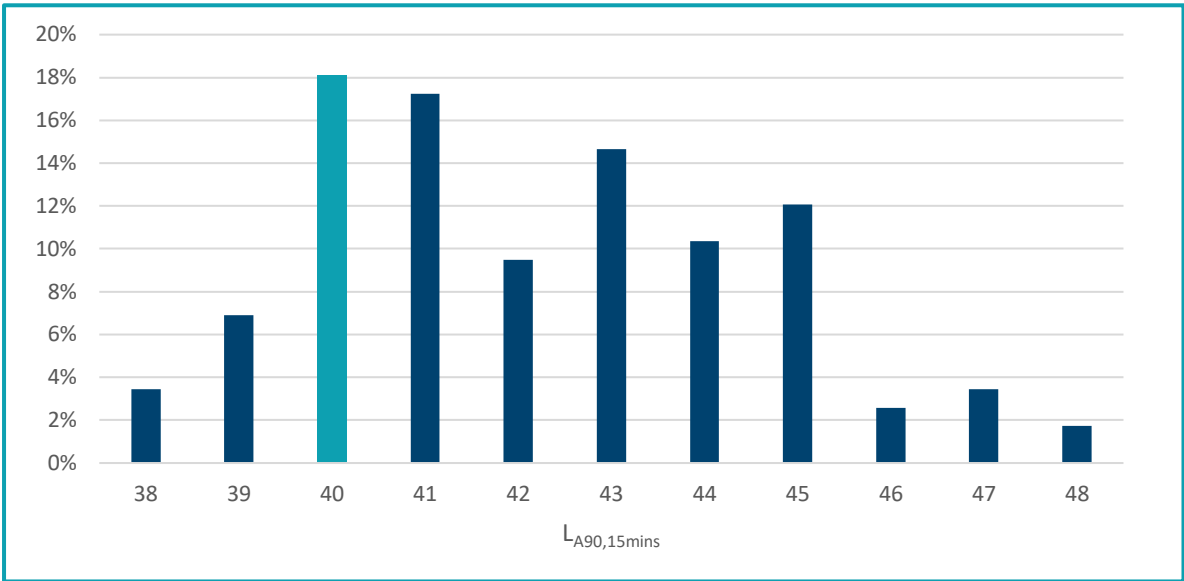


Figure 4.2
L_{A90} Statistical Analysis – ‘Location 1’ – Night-time

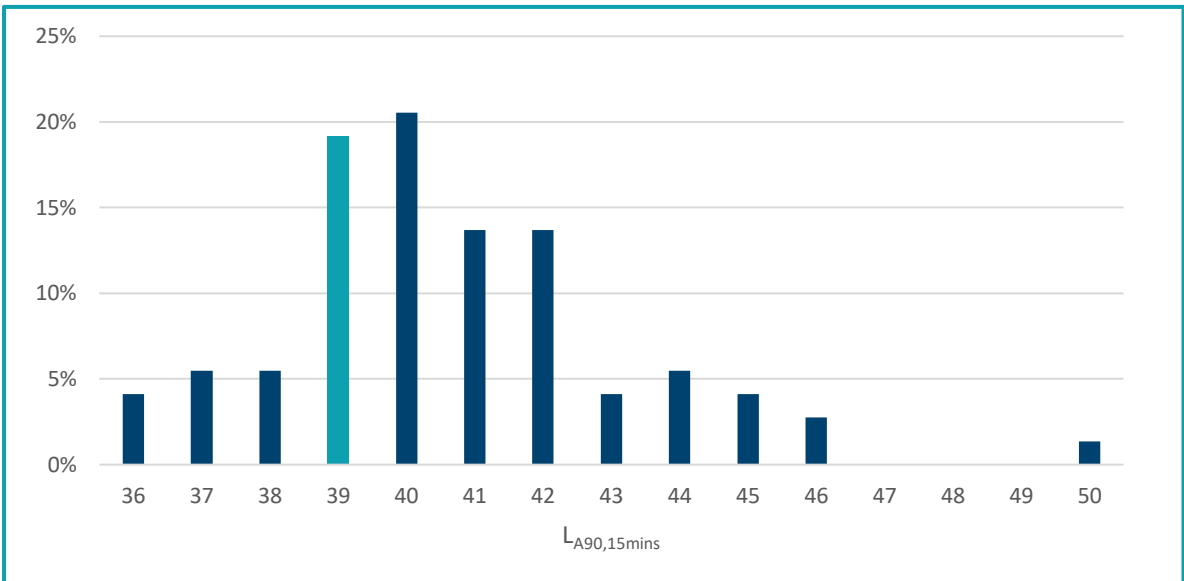


Figure 4.3
L_{A90} Statistical Analysis – ‘Location 2’ – Daytime

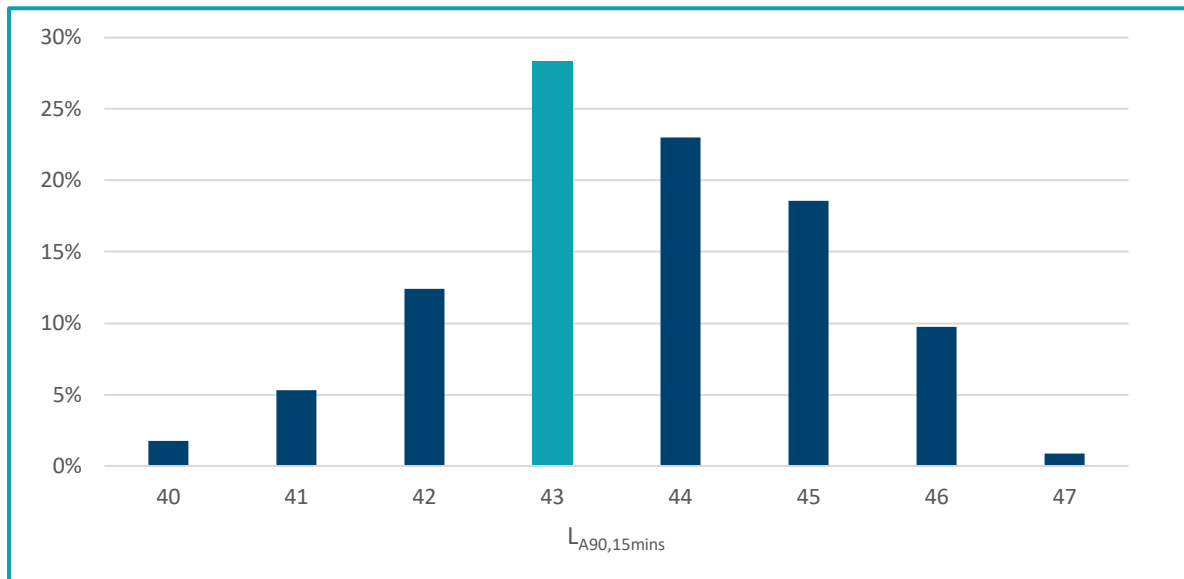
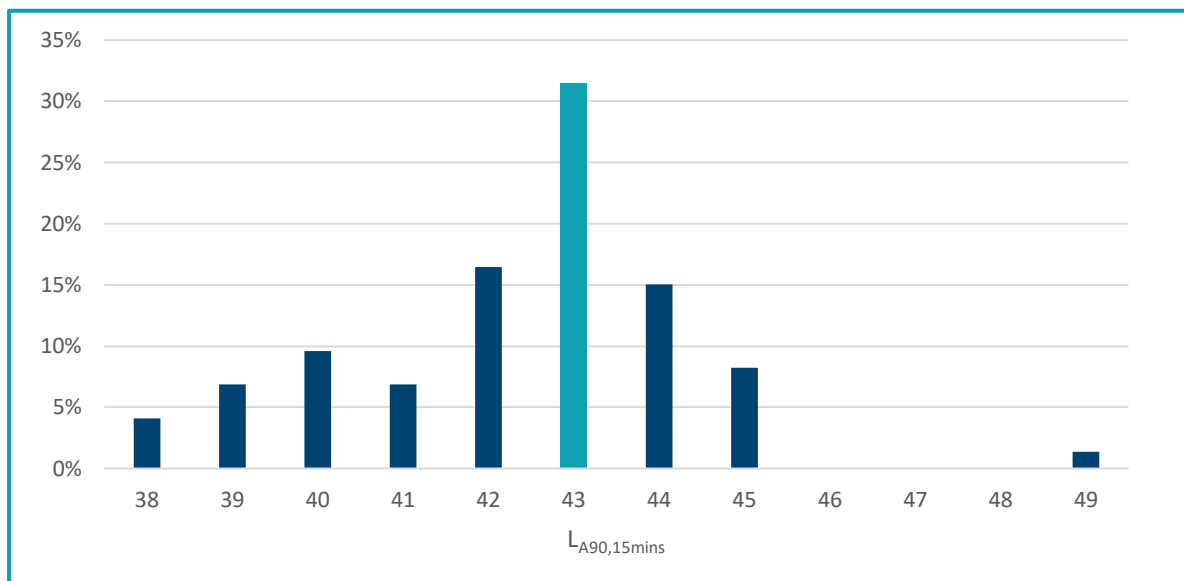


Figure 4.4
L_{A90} Statistical Analysis – ‘Location 2’ – Night-time



5.0 NOISE MODEL INPUT DATA

5.1.1 Data Sources

Modelling calculations have been undertaken based on the spatial settings and data sources identified in the Table below.

Table 5.1
Noise Model Input Data

Parameter	Scenario	Data Source	Assumptions
Site Plans	Existing	OS Mastermap Data	Existing building heights modelled as 8.5m above ground level (AGL) (typical 2-storey building height)
	Proposed	Butress Architects Drawings - <i>LIMES-BUT-B1-01-DR-A-04000-P01 to LIMES-BUT-B1-01-DR-A-04004-P01 and LIMES-BUT-B1-01-DR-A-04101-P01</i>	None
Ground Heights	All	Environment Agency Open Data LiDAR Digital Terrain Model (2.0m resolution)	None
Ground Absorption	Existing	n/a	Hard ground on and off site (G=0), roads hard/ reflective (G=0)
	Proposed		Hard ground on and off site (G=0), roads hard/ reflective (G=0)
Reflections	All	n/a	3 rd order reflections have been accounted for within the noise model
Barriers	Proposed	Butress Architects Drawings - <i>LIMES-BUT-B1-01-DR-A-04000-P01 to LIMES-BUT-B1-01-DR-A-04004-P01 and LIMES-BUT-B1-01-DR-A-04101-P01</i>	3.5m Barrier to rear of loading yard and 5.7m barrier around the first floor plant deck.

5.2 Source Noise Assumptions

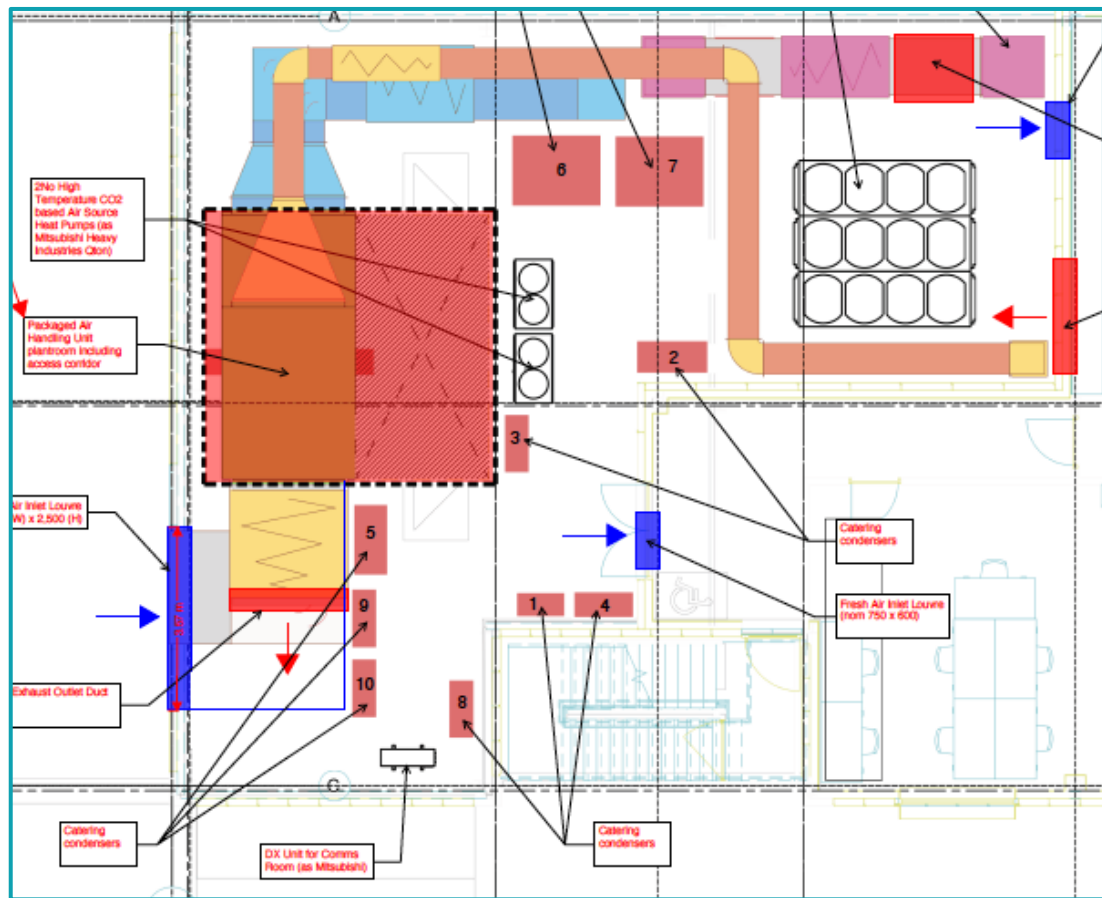
5.2.1 Fixed Plant

All fixed plant is contained within a rooftop plant compound. The location of the plant compound is detailed within drawing ref: *LIMES-BUT-B1-01-DR-A-04001-P01*. The plant compound is enclosed within a solid barrier, details of which can be found within drawing ref: *LIMES-BUT-MS-ZZ-DR-A-06001-P01*.

At the current design stage, the M&E strategy for the development is not fixed. However, for the purposes of presenting a robust assessment and to give an indication of the development's potential operational noise output, an initial plant assessment has been completed based on RIBA Stage 3 extraction, cooling and heating scheme designs. Once details of the final M&E strategy become available, further assessment can be undertaken to ensure plant noise contributions are adequately controlled to the extent assumed by this assessment.

Indicative plant locations are shown in Figure 5.1, below:

Figure 5.1
Indicative Fixed Plant Locations



Details of plant items to be installed on a permanent basis have been provided by Hydrock. The following items (or equivalent) are expected to be included within the development:

- One (1no.) J&E Hall JEHR-0100-B1-M1 Condenser;
- One (1no.) J&E Hall JEHS-0950-L-3 Condenser;
- Three (3no.) J&E Hall JEHS-0300-B2-M3 Condenser;
- Two (2no.) J&E Hall JEHR-0170-B2-M3 Condenser;
- One (1no.) J&E Hall JEHS-0500-B3-L-3 Condenser;
- Two (2no.) RC Scutt (Bespoke Unit) Condenser;
- One (1no.) Mitsubishi EAHV-M1500YCL ASHP;
- One (1no.) Mitsubishi Q-Ton ASHP;
- One (1no.) Mitsubishi PURY-P300YSNW-A2 DX Unit;
- One (1no.) Main AHU c/w Attenuation;
- One (1no.) Internal Plant Room AHU c/w Attenuation; and
- One (1no.) Kitchen Extract c/w Attenuation.

A summary of the noise emissions of all assessed fixed plant noise sources associated with the development, as provided by Hydrock, is presented in Table 5.2, below.

Table 5.2
Fixed Plant: Assessed Noise Source Sound Power Levels, dB

Noise Source	Octave Band Sound Power Level (L_w), Hz (dB(Z))								Sum dB(A)
	63	125	250	500	1000	2000	4000	8000	
J&E Hall JEHR-0100-B1-M1	-	-	-	-	-	-	-	-	59.0
J&E Hall JEHS-0950-L-3	-	-	-	-	-	-	-	-	68.0
J&E Hall JEHS-0300-B2-M3	-	-	-	-	-	-	-	-	67.0
J&E Hall JEHR-0170-B2-M3	-	-	-	-	-	-	-	-	64.0
J&E Hall JEHS-0500-B3-L-3	-	-	-	-	-	-	-	-	69.0
RC Scutt (Bespoke Unit)	-	-	-	-	-	-	-	-	79.0
Mitsubishi EAHV-M1500YCL	86	82	80	77	76	71	67	54	80.0
Mitsubishi Q-Ton ASHP	-	-	-	-	-	-	-	-	77.0
Mitsubishi PURY-P300YSNW-A2	93.5	89	87.5	84.5	79.5	75.5	71	67	86.0
Main AHU Intake c/w Attenuation	82	88	88	91	84	80	73	73	91.0
Main AHU Exhaust c/w Attenuation	84	91	91	94	88	85	77	80	94.0
Internal Plant Room AHU Intake c/w Attenuation;	82	88	88	91	84	80	73	73	91.0
Internal Plant Room AHU Exhaust c/w Attenuation;	82	88	88	91	84	80	73	73	91.0
Kitchen Extract Exhaust c/w Attenuation	101	101	97	92	85	82	76	69	80.2
Kitchen Extract Breakout c/w Attenuation	79	80	87	72	65	66	61	52	58.0

N.b. In accordance with ISO 9613-1, where spectral content of assessed noise sources is not available, the attenuation terms for 500Hz are applied to determine noise contributions at adjacent sensitive receptor locations.

5.2.2 Site Servicing Arrangements

Given the inherent variability in noise output from site servicing operations, modelling has been undertaken based on knowledge of typical delivery operations from the existing site, accounting for any expected changes for the new development.

It has been assumed that all delivery operations will be undertaken externally with unloading undertaken via the use of forklift hand truck and rolling cages as per the existing site. As the nature of

the site servicing operations will not change, measured noise data from the existing site operations has been utilised in predicting noise from the proposed development.

Noise levels from existing site servicing process have previously been measured by Stantec on 24th June 2024. The results of those measurements were as follows:

Table 5.3
Site Servicing: Source Sound Power Levels, dB

Noise Source	Description	Distance	Sum dB(A)
Goods in Loading	2 x small vans being unloaded with roller trollies	5m	59.0
Accelerating HGV Engine	Noise from articulated HGV accelerating on site at approx 5mph	5m	68.0
Reversing HGV	Noise from reversing articulated HGV with tonal alert system	3m	67.0
Goods in Loading	1 x articulated HGV unload with tail lift, pump truck and metal roller cage and 1x smaller van being unloaded with stackable metal roller cage	5m	64.0
Goods out Loading	Small van with stackable boxes	4m	69.0
Goods out Loading	Catering van with tail lift load with metal roller cages	6m	79.0
Van Chiller	Small van with chiller operating	5m	77.0

The information collected by Stantec did not contain spectral data which is important to ensure the most accurate predicted noise levels. To increase accuracy spectral data collected by Dragonfly Consulting previously was utilised and corrected to meet the required overall sound power levels based on the Stantec data.

A summary of all assessed noise sources associated with site servicing is presented in Table 5.3 below. The Table also provides details of the associated data sources utilised to inform the assessment.

Table 5.3
Site Servicing Data Summary

Noise Source	Assessed Metric	Parameter	Data Source(s)
HGV Manoeuvre	L _{Aeq}	Broadband Noise Output	Stantec Sound Measured Pressure Level (Converted to L _w)
		Spectral Data	Dragonfly Delivery Noise Survey (Planning Application: Harrogate – 17/0045/FULM)
HGV Reversing	L _{Aeq}	Broadband Noise Output	Stantec Sound Measured Pressure Level (Converted to L _w)
		Spectral Data	Dragonfly Delivery Noise Survey (Planning Application: Harrogate – 17/0045/FULM)
Van Refrigeration Unit	L _{Aeq}	Broadband Noise Output	Stantec Sound Measured Pressure Level (Converted to L _w)

Noise Source	Assessed Metric	Parameter	Data Source(s)
		Spectral Data	Manufacturer Data for Reciprocating Compressor (Themoking X430P)
Goods in Loading (Van)	L_{Aeq}	Broadband Noise Output	Stantec Sound Measured Pressure Level (Converted to L_w)
		Spectral Data	HGV (Un)loading Using Roll Cage and Tail Lift (Small Retail Unit Only) - Dragonfly Report DC3417-R1v2 (Land South of High Street, Wootton PA/2021/610)
Goods in Loading (HGV)	L_{Aeq}	Broadband Noise Output	Stantec Sound Measured Pressure Level (Converted to L_w)
		Spectral Data	HGV (Un)loading Using Roll Cage and Tail Lift (Small Retail Unit Only) - Dragonfly Report DC3417-R1v2 (Land South of High Street, Wootton PA/2021/610)
Goods Out Loading (Small Van)	L_{Aeq}	Broadband Noise Output	Stantec Sound Measured Pressure Level (Converted to L_w)
		Spectral Data	HGV (Un)loading Using Roll Cage and Tail Lift (Small Retail Unit Only) - Dragonfly Report DC3417-R1v2 (Land South of High Street, Wootton PA/2021/610)
Goods Out Loading (Catering Van)	L_{Aeq}	Broadband Noise Output	Stantec Sound Measured Pressure Level (Converted to L_w)
		Spectral Data	HGV (Un)loading Using Roll Cage and Tail Lift (Small Retail Unit Only) - Dragonfly Report DC3417-R1v2 (Land South of High Street, Wootton PA/2021/610)

Source noise level spectral data utilised in the assessment of ambient (L_{Aeq}) noise contributions are presented in the Table below. All data is presented as sound power levels with no ‘on-time’, speed or other corrections.

Table 5.4
Servicing Arrangements: Assessed Noise Source Sound Power Levels
(Ambient Noise Level L_{Aeq} Assessment)

Noise Source	Octave Band Sound Power Level (L_w), Hz (dB(Z))								Sum dB(A)
	63	125	250	500	1000	2000	4000	8000	
Goods in Loading	75.1	75.0	74.5	78.1	75.9	71.7	65.9	57.0	80.0
Accelerating HGV Engine	97.1	92.2	94.4	92.1	91.3	85.3	77.9	68.3	95.0
Goods in Loading	88.1	88.0	87.5	91.1	88.9	84.7	78.9	70.0	93.0
Goods out Loading	76.1	76.0	75.5	79.1	76.9	72.7	66.9	58.0	81.0
Goods out Loading	75.7	75.6	75.1	78.7	76.5	72.3	66.5	57.6	80.6
Van Chiller	77.0	78.0	79.0	80.0	78.0	76.0	72.0	65.0	83.0

Operational Assumptions – Site Servicing Arrangements

Operational Assumptions – Delivery Events

The following are the proposed number of HGVs entering and exiting the site:

- 1no. entering and 1 no. exiting during the daytime worst-case 1-hour period.

For the purposes of this assessment, it is assumed that HGV deliveries will take place during the daytime period (0700h-2300h) only. LGV loading and unloading will occur typically between 0600 and 2300hrs, but for the purposes of this assessment has been assumed to occur during both the daytime and night time period.

In accordance with BS 4142:2014+A1:2019, Table 5.5, below, presents a summary of the operational assumptions accounted for within the noise model to determine $L_{Aeq,1hr}$ noise contributions at adjacent sensitive receptor locations during the daytime reference periods respectively. Assumptions are based around a typical delivery / collection taking 15 minutes to complete unless stated otherwise.

Table 5.5
Operational Assumptions (Per Assessed Delivery Event)

Noise Source	Source Type	Height AGL	Operational Assumptions
HGV Manoeuvre	Moving Point Source	1.0m	HGVs travelling at 10km/h along access route. 1 complete manoeuvre per event (i.e., 1 in or 1 out)
Loading and Unloading Using Roll Cage and Tail Lift or Forklift Hand Truck		1.0m	(Un)loading operations take approximately 15mins to complete

5.2.3 Car Parking

Operational Assumptions – Car Parking

Noise emissions from use of the existing car park by cars and light goods vehicles for the current car park have been modelled in accordance with 'BayLfU Parking Area Noise'. Tables 5.9–5.12 provide a summary parameter included within the BayLfU parking area sources.

Operational assumptions for the existing car park assume a maximum utilisation rate as set out in Table 5.6 below.

Table 5.6
BayLfU Modelling Input Data: Car Parking Events – All other onsite car parks

Parameter	Input
Emissions Calculation	LfU-Study-2007
No. Parking Spaces	Varies per parking area (1190no.Total)
Events (1hr – Day)	1 per space
Events (1hr – Day)	0.5 per space

5.3 Uncertainty

5.3.1 Survey

Given the duration of the survey and the use of the highest measured daytime and night-night noise levels to ascertain noise propagation across the site, it is considered that the limits of Class 1 sound level meters are the only limiting factor when considering survey uncertainty.

Standard equipment uncertainties have been considered by applying allowable tolerances minus the maximum allowable test laboratory uncertainties given in IEC 61672-1, as defined by Narang and Bell (Narang, P. and Bell, T., 2008. *New IEC standards and periodic testing of sound level meters. Proceedings of the Internoise, Shanghai, China, pp.26-29*).

The following Table provides an overview of standard equipment uncertainties relevant to the SLM class utilised within the survey.

Table 5.7
Standard uncertainties using allowable tolerances minus test laboratory tolerances given in IEC 61672-1 (source: Narang and Bell, Table 14)

SLM Class	Frequency Weighting	Directional Response	Level Linearity	Toneburst Response	Calibrator (IEC 61672)	Supply Voltage	Combined Standard Uncertainty +/- dB
Class 1	0.5	0.5	0.4	0.25	0.125	0.05	0.9

5.3.2 Modelling

CadnaA noise modelling software has been utilised to ascertain how noise propagates throughout the proposed development. The software directly incorporates the ISO 9613 calculation procedure which has an uncertainty rating of +/- 3dB.

5.3.3 Combined Uncertainty

Based on the information provided above, the combined Root Sum Squared (RSS) uncertainty for the assessment has been calculated as +/- 3.1dB.

6.0 ASSESSMENT

6.1 Off-site Receptors

6.1.1 Fixed Plant Assessment

An assessment has been carried out in accordance with the requirements of BS 4142:2014+A1:2019 to quantify the level and significance of any noise impacts on residents of the properties due to the noise generated by the proposed fixed plant units.

The specific noise level has been obtained by calculating the noise level at the nearest noise sensitive receptor due to the operation of the proposed plant, using achievable source noise levels supplied to Dragonfly Consulting.

The range of plant to be installed at the site is not expected to have any specific tonal characteristics that would attract a correction under BS 4142. Similarly, the plant is not expected to have intermittency or impulsive characteristics that would invite a correction, however a final of any applicable penalties will only be possible on final specification of all plant to be installed.

The results of the assessment are shown in Table 6.1, below. For brevity, the highest receiving point of each NSR has been utilised for the assessment. In accordance with BS 4142:2014+A1:2019 Paragraph 8.6, the background levels are expressed as integers (with 0.5 dB being rounded up):

Table 6.1
Assessment of Plant Noise Impact at NSRs, dB

NSR	Existing Measured Background (L_{A90})		Predicted Noise Rating Level ($L_{A,T,r}$)		BS 4142:2014+A1:2019: Difference between Rating Level and Background	
	Daytime 0700h – 2300h	Night-time 2300h – 0700h	Daytime	Night-time	Daytime	Night-time
1	40	39	37.4	37.4	-2.6	-1.6

The assessment demonstrates that the rating noise levels impacting on NSR1 will be at least 2.6dB below and 1.6dB below the representative background noise levels during the daytime and night-time periods, respectively.

The proposed plant scheme already includes for significant mitigation in the form of plant selections which seek to minimise noise generation whilst achieving required cooling, heating or air flow rates. All air handling includes attenuators on intake and exhaust and the plant compound is enclosed within a significant acoustic barrier.

A large contributor to the generation of plant noise is the requirement for heating and cooling to be undertaken by means of air source to meet sustainability targets. It is therefore considered that achieving plant noise emissions lower than the above is not reasonably achievable.

Therefore, for NSR1, given the context of the assessment the suitability of the proposals should be considered against the identified criteria set out in Table 3.2 which reflect nationally recognised planning standards. When considered against this criteria, it is considered that the noise levels are below the **LOAEL** for all periods.

The LOAEL is defined as:

LOAEL – Lowest Observed Adverse Effect Level – *Free-field external noise levels at adjacent sensitive receptor locations no higher than the representative background noise level.*

Impacts below the Lowest Observed Adverse Effect Level (LOAEL) are considered to be acceptable when assessed against the requirements of the NPPF and meet the requirements of the planning condition. On this basis, the assessment demonstrates that the proposed fixed plant will not cause an unacceptable significant adverse impact.

6.1.2 Site Servicing Operations (HGV Deliveries / Collections)

The assessment of ambient noise contributions (L_{Aeq}) from HGV and LGV deliveries has been undertaken following the guidance within BS 4142:2014+A1:2019.

In accordance with BS 4142:2014+A1:2019, a +3dB acoustic character correction, to account for noise from delivery operations being readily distinctive, has been applied to the predicted source noise contributions (L_{Aeq}) to determine the rating level (L_{ArTr}).

The results of the assessment are shown in Table 6.2, in accordance with BS 4142 Para 8.6, background levels are expressed as integers (with 0.5 dB being rounded up):

Table 6.2
BS 4142 Assessment of Servicing Noise Impact Daytime/ Night-time, L_{ArTr} dB

NSR	Floor	Existing Measured Background (L_{A90})		Predicted Rating Level (L_{ArTr})		Difference, dB	
		Daytime	Night-time	Daytime	Night-time	Daytime	Night-time
1	FF	40	39	39.3	28.0	-0.7	-11.0

The assessment demonstrates that the rating noise levels impacting on NSR1 will be 0.7dB below and 11.0dB below the representative background noise levels during the daytime and night-time periods, respectively.

It is noted that the daytime values sit below the identified criteria based on national planning guidance, but above the criteria that the MCC guidance seeks to achieve. The proposed scheme already includes for significant noise mitigation to reduce noise from HGV activities at off-site receptors. Specifically, a 3.5m specific noise barrier is located to the rear of the HGV loading area adjacent to the site boundary. HGV operations have been limited to daytime operations only and there will be no more than one HGV arrival and unloading process is any one-hour period.

It is therefore considered that achieving HGV noise emissions lower than the above is not reasonably achievable

Therefore, for NSR1, given the context of the assessment the suitability of the proposals should be considered against the identified criteria set out in Table 3.2 which reflect nationally recognised planning standards. When considered against this criteria, it is considered that the noise levels are below the **LOAEL** for all periods.

As noted previously, the LOAEL is defined as:

LOAEL – Lowest Observed Adverse Effect Level – *Free-field external noise levels at adjacent sensitive receptor locations no higher than the representative background noise level.*

Impacts below the Lowest Observed Adverse Effect Level (LOAEL) are considered to be acceptable when assessed against the requirements of the NPPF and meet the requirements of the planning condition. On this basis, the assessment demonstrates that the proposed site servicing operations will not cause an unacceptable significant adverse impact.

6.2 On-site Receptors

6.2.1 Cumulative Site Servicing and Fixed Plant Assessment

An assessment of ambient noise level (L_{Amax}) contributions is presented in Table 6.3. Internal noise levels have been calculated based on a façade reduction measured for each building by Stantec in a previous noise assessment. The façade sound insulation performances were measured as follows:

Table 6.3
BS 8233:2014 Assessment of Plant and Servicing Noise Impact Daytime, L_{Aeq} dB

NSR	Building Name	Measured Façade Sound Level Difference
2	Richmond Park	33
3	Richmond Park	33
4	Unsworth Park	28

The predicted external and internal noise levels are as follows:

Table 6.4
BS 8233:2014 Assessment of Plant and Servicing Noise Impact Daytime, L_{Aeq} dB

NSR	Floor	External Noise Levels, L_{Aeq}	Internal Noise Levels, L_{Aeq}	Internal Criteria, L_{Aeq} (Daytime)	Within Criteria (Y/N)
2	FF	52.2	20.9	35.0	Y
3	FF	49.2	19.2	35.0	Y
4	FF	48.9	16.2	35.0	Y

Table 6.5
BS 8233:2014 Assessment of Plant and Servicing Noise Impact Night-time, L_{Aeq} dB

NSR	Floor	External Noise Levels, L_{Aeq}	Internal Noise Levels, L_{Aeq}	Internal Criteria, L_{Aeq} (Night-time)	Within Criteria (Y/N)
2	FF	47.0	14.0	30.0	Y
3	FF	41.6	8.6	30.0	Y
4	FF	40.8	12.8	30.0	Y

The results of the assessment presented in the Tables above shows that predicted ambient noise level (L_{Aeq}) contributions associated with both site servicing operations and plant noise are cumulative

predicted to be significantly below BS 8233:2014 internal noise criteria within adjacent on-site NSRs and therefore will be below the LOAEL.

The LOAEL is defined as:

LOAEL – Lowest Observed Adverse Effect Level – *Internal noise levels achieve the requirements of the BS 8233:2014 standard assuming windows are closed, and an additional source of ventilation is provided.*

Impacts below the Lowest Observed Adverse Effect Level (LOAEL) are considered to be acceptable when assessed against the requirements of the NPPF and meet the requirements of the planning condition. On this basis, the assessment demonstrates that the proposed site servicing operations will not cause an unacceptable significant adverse impact.

6.2.2 Comparison with Car Park Noise Emissions

Ambient noise contributions from car parking events have been assessed to compare the noise which may be generated by the existing permitted use with future use of the space by cars and light good vehicles.

Based on the previously provided assumptions with respect to the number of assumed changeover rates, the following noise levels have been predicted from the use of the car park:

Table 6.6
Prediction of Full Utilisation Car Parking Noise, L_{Aeq} dB

NSR	Floor	Daytime External Noise Levels, L_{Aeq}	Night-time External Noise Levels, L_{Aeq}
2	FF	52.5	49.5
3	FF	52.6	49.6
4	FF	46.8	43.8

For comparison purposes the noise levels generated by permitted car parking operations have been compared against the predicted ambient noise levels generated by site servicing operations and plant noise emissions from the proposed development. The results of that comparison are as follows:

Table 6.7
BS 8233:2014 Assessment Levels at NSR, (Daytime/Night-time) $L_{Aeq,T}$

NSR	Floor	Predicted External Noise Levels – Car Park ($L_{Aeq,T}$)		Predicted External Noise Levels – Site Servicing ($L_{Aeq,T}$)		Difference, dB	
		Daytime	Night-time	Daytime	Night-time	Daytime	Night-time
2	FF	52.5	49.5	52.2	47.0	-0.3	-2.5
3	FF	52.6	49.6	49.2	41.6	-3.4	-8.0
4	FF	46.8	43.8	48.9	40.8	-6.0	-3.0

The above table demonstrates that the noise generated by the proposed development at the on-site noise sensitive receptors will be lower than the potential noise generation from the existing permitted use of the car park site. This further reinforces the conclusion that the proposed development will not result in a significant adverse noise impact with noise emissions from the proposed development being lower than the permitted use.

6.3 Assertion of Competence

This assessment has been completed by Chris Chittock. I am Director of Acoustics with responsibility for completing and oversight of acoustic reports on behalf of Dragonfly Consulting. I hold a Bachelor of Science in Audio Technology, with Honours, from the University of Salford. I have over 20 years of professional experience within the acoustics industry, and I am a Corporate Member of the Institute of Acoustics.

I have completed a large number of assessments following the requirements of British Standard 4142:2014+A1:2019 and I assert I am competent to complete this assessment.

7.0 CONCLUSIONS

The University of Manchester has appointed Dragonfly Consulting to carry out a noise impact assessment relating to the proposal to relocate the current 'The Limes' catering and maintenance facility from its existing site within Owens Park, to a new site on the current car park at Unsworth Park.

The noise assessment has been conducted with reference to the National Planning Policy Framework and the appropriate British Standards, recognised guidance & reference documents relevant to this site.

This report considered the sites suitability for development consisting of a catering and maintenance hub to replace the existing Lines Building, located a short distance to the south-west of the proposed site.

7.1 Assessment of Offsite Noise Sensitive Receptors

The assessment demonstrates that the rating noise levels impacting on NSR1 due to fixed plant will be at least 2.6dB below and 1.6dB below the representative background noise levels during the daytime and night-time periods, respectively.

Furthermore, the assessment demonstrates that the rating noise levels impacting on NSR1 due to site servicing operations will be 0.7dB below and 11.0dB below the representative background noise levels during the daytime and night-time periods, respectively.

It is noted that these values sit below the identified criteria based on national planning guidance, but above the criteria that the MCC guidance seeks to achieve. The proposed scheme already includes for significant mitigation in the form of plant selections which seek to minimise noise generation whilst achieving required cooling, heating or air flow rates. All air handling includes attenuators on intake and exhaust and the plant compound is enclosed within a significant acoustic barrier.

A large contributor to the generation of plant noise is the requirement for heating and cooling to be undertaken by means of air source to meet sustainability targets. It is therefore considered that achieving plant noise emissions lower than the above is not reasonably achievable.

The proposed scheme already includes for significant noise mitigation to reduce noise from HGV activities at off-site receptors. Specifically, a 3.5m specific noise barrier is located to the rear of the HGV loading area adjacent to the site boundary. HGV operations have been limited to daytime operations only and there will be no more than one HGV arrival and unloading process in any one-hour period.

It is therefore considered that achieving HGV noise emissions lower than the above is not reasonably achievable.

Therefore, for NSR1, given the context of the assessment the suitability of the proposals should be considered against the identified criteria set out in Table 3.2 which reflect nationally recognised planning standards. When considered against this criteria, it is considered that the noise levels are below the **LOAEL** for all periods.

The LOAEL is defined as:

LOAEL – Lowest Observed Adverse Effect Level – *Free-field external noise levels at adjacent sensitive receptor locations no higher than the representative background noise level.*

Impacts below the Lowest Observed Adverse Effect Level (LOAEL) are considered to be acceptable when assessed against the requirements of the NPPF and meet the requirements of the planning condition. On this basis, the assessment demonstrates that the proposed fixed plant will not cause an unacceptable significant adverse impact.

7.2 Assessment of Offsite Noise Sensitive Receptors

The results of the assessment show that predicted ambient noise level (L_{Aeq}) contributions associated with both site servicing operations and plant noise are cumulative predicted to be significantly below BS 8233:2014 internal noise criteria within adjacent on-site NSRs and therefore will be below the LOAEL.

The LOAEL is defined as:

LOAEL – Lowest Observed Adverse Effect Level – *Internal noise levels achieve the requirements of the BS 8233:2014 standard assuming windows are closed, and an additional source of ventilation is provided.*

Impacts below the Lowest Observed Adverse Effect Level (LOAEL) are considered to be acceptable when assessed against the requirements of the NPPF and meet the requirements of the planning condition. On this basis, the assessment demonstrates that the proposed site servicing operations will not cause an unacceptable significant adverse impact.

7.3 Recommendation to Decision Makers

Based on the assessment detailed within this report, it is not considered that noise should be a barrier to the development providing the noise mitigation included within the design is put in place.

It is recommended that the site be granted planning consent with the addition of suitable conditions to address the following items:

- Fixed Plant – at the current design stage finalised M&E details are available. It is therefore recommended that a pre-occupation condition be included to facilitate the assessment of site fixed plant requirements as and when these become available.
- Site Servicing Operations – to ensure the maximum number of HGV movements in any one-hour period during the period 0700h-2300h and to ensure the design retains the acoustic barrier to the north side of the loading area.

Appendix A – Glossary of Terminology

In order to assist the understanding of acoustic terminology and the relative change in noise, the following background information is provided.

The human ear can detect a very wide range of pressure fluctuations, which are perceived as sound. In order to express these fluctuations in a manageable way, a logarithmic scale called the decibel, or dB scale is used. The decibel scale typically ranges from 0dB (the threshold of hearing) to over 120dB. An indication of the range of sound levels commonly found in the environment is given in the following table.

Table A-1
Sound Levels Commonly Found in the Environment

Sound Level	Location
0dB(A)	Threshold of hearing
20 to 30dB(A)	Quiet bedroom at night
30 to 40dB(A)	Living room during the day
40 to 50dB(A)	Typical office
50 to 60dB(A)	Inside a car
60 to 70dB(A)	Typical high street
70 to 90dB(A)	Inside factory
100 to 110dB(A)	Burglar alarm at 1m away
110 to 130dB(A)	Jet aircraft on take off
140dB(A)	Threshold of Pain

Acoustic Terminology

dB (decibel) The scale on which sound pressure level is expressed. It is defined as 20 times the logarithm of the ratio between the root-mean-square pressure of the sound field and a reference pressure (2×10^{-5} Pa).

dB(A) A-weighted decibel. This is a measure of the overall level of sound across the audible spectrum with a frequency weighting (i.e. 'A' weighting) to compensate for the varying sensitivity of the human ear to sound at different frequencies.

L_{Aeq} This is defined as the notional steady sound level which, over a stated period of time, would contain the same amount of acoustical energy as the A-weighted fluctuating sound measured over that period.

L₁₀ & L₉₀ If a non-steady noise is to be described, it is necessary to know both its level and the degree of fluctuation. The L_n indices are used for this purpose, and the term refers to the level exceeded for n% of the time. L₁₀ is the level exceeded for 10% of the time and is often used as a descriptor for road traffic noise. Similarly, L₉₀ is the level exceeded for 90% of the time and is often used to describe the background level. It is common practice to use the L₁₀ index to describe traffic noise.

L_{AMax} is the maximum A-weighted sound pressure level recorded over the period stated. L_{AMax} is sometimes used in assessing environmental noise where occasional loud noises occur, which may have little effect on the overall L_{eq} noise level but will still affect the noise environment.

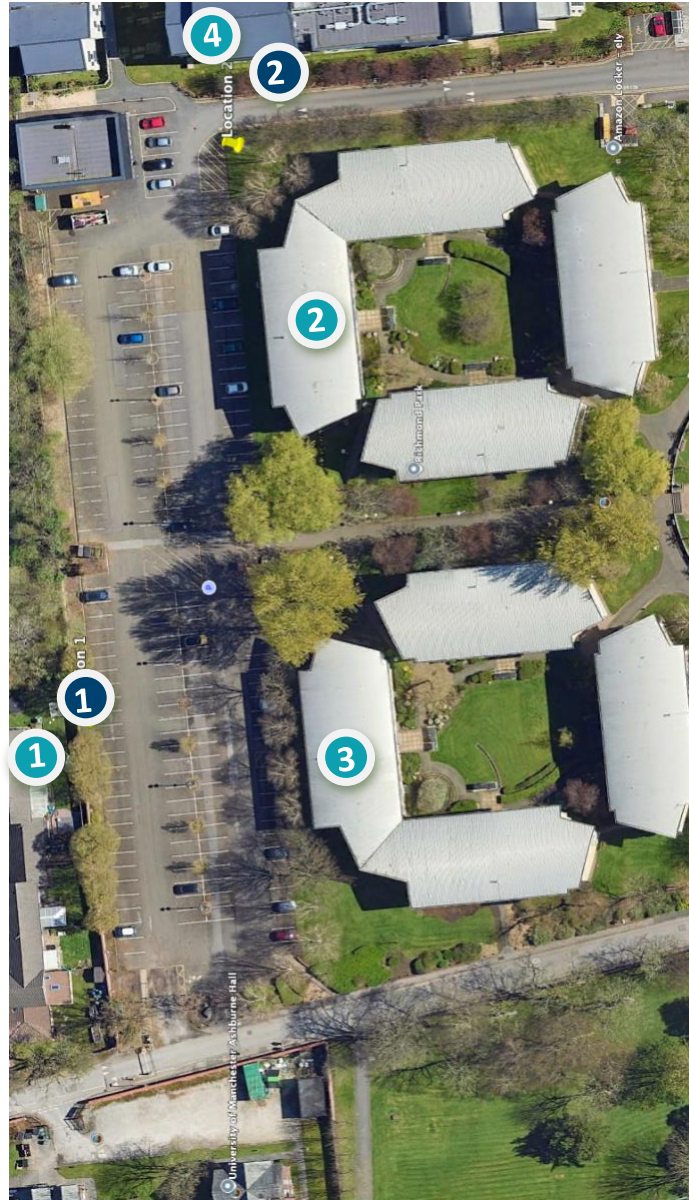
Appendix B – Monitoring Equipment

Table B-1
Noise Monitoring Equipment

Equipment	Serial Number
01dB Cube Sound Level Meter	10892
G.R.A.S 40CD Microphone	233511
01dB PRE22N Preamplifier	11071
Svantek SV307 Noise Monitoring Station	87841
Svantek ST30 Microphone	143326
Cirrus CR:515 Acoustic Calibrator	103792

Appendix C – Measurement Locations

Figure C-1
Measurement Location Plan



-  Measurement Locations
-  Noise Sensitive Receptor (NSR) Location