Report

30th June 2021

TEMPLE

LEADERS IN ENVIRONMENT, PLANNING & SUSTAINABILITY.

Report for – Schroders UK Real Estate Fund
T4800 – North Crescent –
Plant Noise Assessment

Document version control

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Report for: **Schroders UK Real Estate Fund**

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0.0 Executive Summary

Temple Group has been appointed by Thornton Reynolds Ltd on behalf of Schroders UK Real Estate Fund to undertake a preliminary plant noise assessment for equipment proposed as a part of the redevelopment of Minerva House (WC1E 7ER), and Telephone Exchange (WC1E 7PH) on Chenies Street into one building. This office development includes installation of heat pumps, chillers, condensers, AHUs and smoke extractor fans.

This report presents criteria for plant noise emissions, the methodology, and results of an external noise survey undertaken at the site to establish the background noise levels in the area. These have been used to assess the impact of the proposed roof mounted plant on the nearest noise sensitive receptors.

Camden Council has expressed their requirement that the external rating noise level L_{Aeq} emitted from this building services plant to be lower than the background sound level $L_{A90,15mins}$ by 10dBA (15dB if tonal components are present) at the most noise sensitive receptors at surrounding premises.

Based on the manufacturer's data for the noise levels of the proposed roof level plant, it is predicted that noise emissions will be adequately controlled during both the daytime and night-time as they are at least 10dB below background sound level $L_{A90,15mins}$.

1.0 Introduction

Proposals are in place for the refurbishment and reconfiguration of North Crescent to replace Minerva House (WC1E 7ER) and Telephone Exchange (WC1E 7PH); including a one storey extension, plus plant, minor demolition works associated with internal and external alterations to provide additional office accommodation and associated works. As part of the planning process, Temple has been appointed to undertake a noise assessment for new building services plant that would be installed at roof level. These include chillers, heaters, AHUs and smoke extractor fans.

The purpose of the noise assessment is to assess the impact on nearby noise sensitive receptors and, where required, to provide outline mitigation measures for further noise attenuation. The assessment has been carried out in line with the guidance from Camden Council and relevant national standards.

The following sections of the report describe criteria for plant noise emissions, assessment methodology, external noise measurement methodology, along with results of the assessment of the proposed plant.

The acoustic terminology used in this report is explained in **Appendix A**

2.0 Policy, Standards and Guidance related to Noise Emission Limits

2.1 Local Authority Requirements

The site lies within the jurisdiction of London Borough of Camden. Temple contacted Environmental Health Officer, Nick Priddle and Pollution Planning Officer, Edward Davies, of Camden Council via email on Friday 9th October 2020 to request confirmation of the methodology and they provided us with the Camden Local Plan 2017[1] for guidance. The report states the following:

"*A relevant standard or guidance document should be referenced when determining values for LOAEL and SOAEL for non-anonymous noise. Where appropriate and within the scope of the document it is expected that British Standard 4142:2014[2] 'Methods for rating and assessing industrial and commercial sound' (BS 4142) will be used. For such cases a 'Rating Level' of 10 dB below background (15dB if tonal components are present) should be considered as the design criterion).*"

2.2 Standards and Guidance

British Standard 7445 – Description* and *Measurement of Environmental Noise

British Standard 7445 Part 1 (BS 7455-1:1991)[3] 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.

British Standard 7445 Part 2 (BS 7455-2:1991)[4] describes methods for the acquisition of data which provide descriptors that enable:

a) a description of the environmental noise in a specified area of land to be made in a uniform way;

b) the compatibility of any land use activity or projected activity to be assessed with respect to existing or predicted noise; and

c) Using the data as a basis, authorities may establish a system for selecting the appropriate land use, as far as levels of noise are concerned, for a specified area, or the sources of noise - existing or planned - which are acceptable with respect to land use, existing or planned.

[1] Camden Local Plan, 2017 supplied by Edward Davies (9/10/20)

[2] British Standards Institute (BSI), (2014+A1:2019): 'BS 4142 – Methods for rating and assessing industrial and commercial sound

[3] British Standards Institute (BSI), (1991): 'BS 7445 – Description and Measurement of Environmental Noise. Part 1: Guide to Quantities and Procedures'. BSI, London.

[4] British Standards Institute (BSI), (1991): 'BS 7445 – Description and Measurement of Environmental Noise. Part 2: Guide to the Acquisition of Data Pertinent to Land Use'. BSI, London.

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

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

The standard requires determination of the following:

- Rating level - $L_{Aeq,Tr}$ sound level produced by the specific sound source at the assessment location with any adjustment added to the specific sound level if a tone, impulse or other acoustic characteristic occurs, or is expected to be present.
- Background sound level, $L_{A90,T}$ – A-weighted sound pressure level that is exceeded by the residual sound at the assessment location for 90% of a given time interval, T.
- T_r is the reference time interval over which the specific sound level is determined. This is 1-hour for daytime (07:00-23:00 h) and 15-minutes for night-time (23:00-07:00 h).

An estimate of the impact of the specific sound generated can be obtained by subtracting the measured background sound level from the rating level, and the following is considered:

a) Typically, the greater this difference, the greater the magnitude of the impact.

b) A difference of around +10dB or more is likely to be an indication of a significant adverse impact, depending on the context.

c) A difference of around +5dB 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.

The assessment methodology considers the Specific Sound Level, as measured or calculated at a potential noise sensitive receptor, due to the sound under investigation. A correction factor is added to this level to account for the acoustic character of the sound as follows:

- Tonality – A correction of up to 6dB depending on the prominence of tones;
- Impulsivity – A correction of up to 9dB depending on the prominence of impulsivity;
- Other sound characteristics – A 3dB correction may be applied where a distinctive acoustic character is present that is neither tonal nor impulsive;
- Intermittency – A 3dB correction may be applied where the specific sound has identifiable on-off conditions.

All pertinent factors should be taken into consideration when assessing the impact, including the following:

- Where background sound levels and rating levels are low, absolute levels might be as, or more, relevant than the margin by which the rating level exceeds the background. This is especially true at night.
- The character and level of the residual sound compared to the character and level of the specific sound.
- The sensitivity of the receptor.

3.0 The Site and its Surroundings

The development proposed is to be located just off Chenies Street, London WC1E 7ET, and comprises of Minerva House and Telephone Exchange that are all situated on North Crescent. The height of the existing Telephone Exchange building will be raised with an additional 4th floor, and the plant installed on the roof.

The location of the site is indicated in **Figure C.1** in **Appendix C**

The site is close to Tottenham Court Road and the surroundings include residential and commercial use buildings. The nearest noise sensitive residential receptor to the proposed plant locations was noted to be the fifth-floor windows of the Chenies Street Chambers; located on the corner of Chenies Street and Huntley Street, approximately 30m away from the proposed plant on the roof of Telephone Exchange.

It is proposed to install the plant on the roof of Telephone Exchange once the lower section has been raised. Figure 3.1 shows the layout of the proposed plant on the roof of Telephone Exchange.

It is proposed to install the following plant:

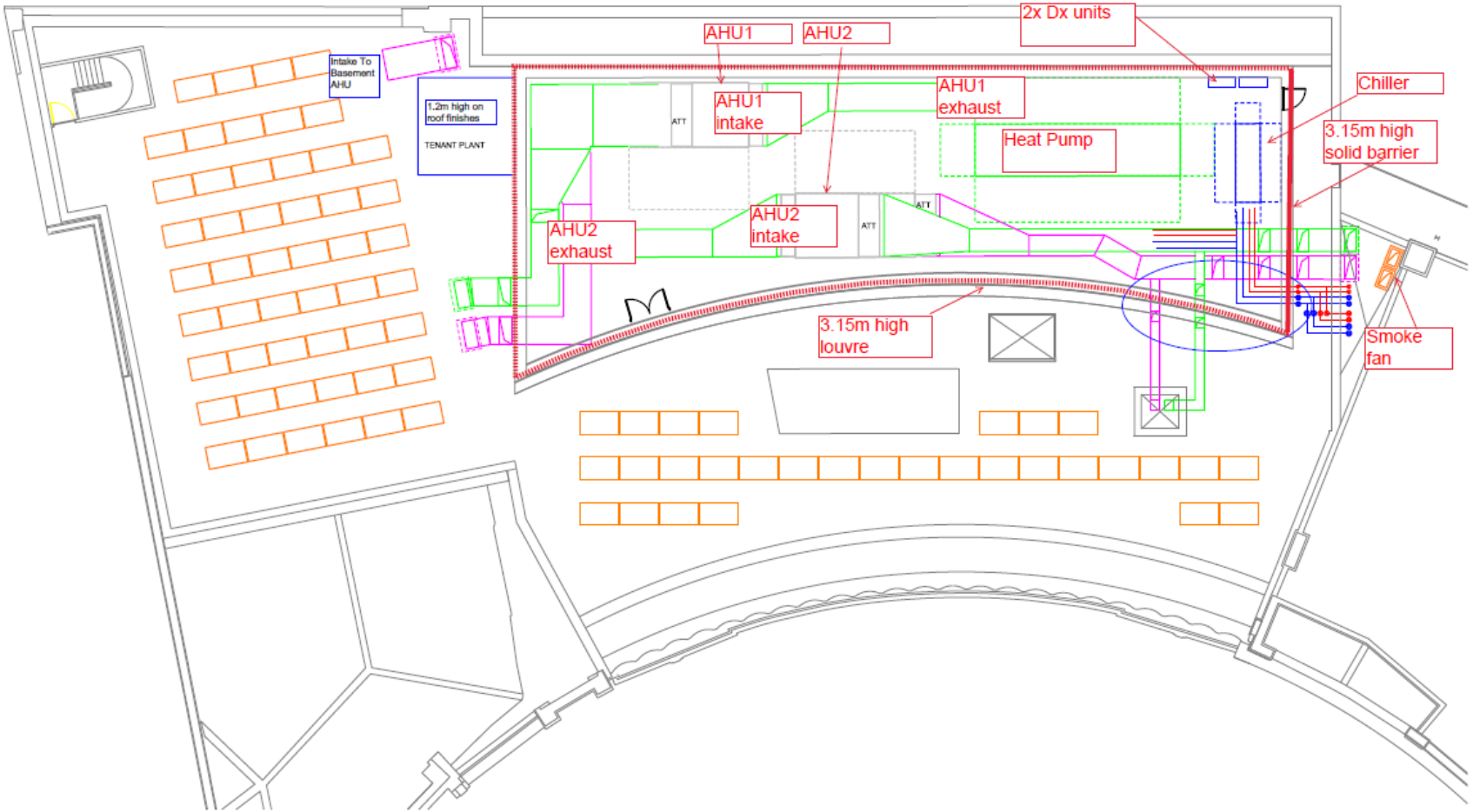
Telephone Exchange

- 2 Office Air Handling Units – Office hours operation only,
- 1 Chiller – Office hours operation only,
- 1 Heat Pump – Operating 24/7
- 2 DX Units – Operating 24/7
- 1 Basement Air Handling Unit – Operating 24/7
- 1 Smoke Extractor Fan – Operating 24/7
- Tenants plant area – Operation 24/7

Plant Specification data can be found in **Appendix B**

There is an allowance for Tenant's plant at the North-West Boundary of the Telephone Exchange. The proposed plant will be screened at the edge of the roof boundary. The east part of the screen is proposed the be a solid barrier with a minimum height of 3.15 metres, relative to a maximum plant height of 2.63 metres, the remainder of the screen will be made of 500mm acoustic louver with a minimum height of 3.15 metres.

Figure 3.1 – Proposed Plant on the Telephone Exchange



4.0 Measurement Methodology

4.1 Unattended Monitoring

An unattended environmental noise survey was carried out between Tuesday 2nd and Tuesday 9th February 2021 to obtain prevailing noise levels at the site. The background noise climate is a combination of local road traffic and the existing plant on the roof. The normal operating hours of the existing plant on Fitzroy House are Monday to Friday, 07:00 – 20:00, but it is understood that the unit may currently be operating 24 hours a day, 7 days a week to provide increased ventilation rates due to COVID-19.

The measurement positions shown in Figure C.1in **Appendix C** were located on the northern and southern boundaries of the existing roof. Location 1 was on the external stairwell on the northern side closest the nearest residential receptors. Location 2 was on the southern top edge of the Telephone Exchange closest to Chenies Street. The measurement microphone in each case was positioned at a height of approximately 1.5m above the local ground level and the measurements are considered free-field.

The $L_{Aeq,15min}$ and $L_{AF90,15min}$ sound pressure levels were measured over 15-minute periods during the survey. Road traffic noise from Tottenham Court Road and Chenies Street was observed to be the dominant noise source during the survey. The existing plant was only audible once on the roof of Fitzroy House.

4.2 Equipment

The equipment used is detailed in **Table 4.1** below. The microphone was fitted with a windshield. Calibration checks were carried out at the beginning and end of the survey. No significant calibration deviation occurred. Calibration certificates are available upon request.

Table 4.1 - Survey Equipment

Manufacturer	Item	Type	Serial Number
RION	Sound Level Meter	NL-52	00410086
RION	Sound Level Meter	NL-52	00510141
RION	Sound Level Meter	NA-28	00680885
RION	Calibrator	NC-74	34936353

4.3 Meteorological Conditions

The weather conditions varied during the survey period. The local precipitation levels and wind speeds were plotted against the L_{Aeq} and L_{A90} results. **Appendix D** shows the precipitation and wind speed for each of the measurement positions for the duration of the survey. In general wind speeds were below the recommended maximum limits of 5 m/s. Data was excluded where precipitation or high wind speeds appeared to affect measurements The weather data was collected using Wundermap[5] weather data from weather station IKENSING8, 4.5 km from Chenies Street.

[5] https://www.wunderground.com/dashboard/pws/IKENSING8

5.0 Noise Survey Results

5.1 Unattended Measurement Results

In line with BS 4142:2014+A1:2019, representative background sound levels have been determined using statistical analysis of the continuous measurements. Day and night-time $L_{A90,15min}$ background sound levels measured during the unattended survey are presented in Figure 5.1 to 5.4.

Figure 5.1 – Statistical analysis of the daytime L_{A90} measurements to determine background sound level at MP1.

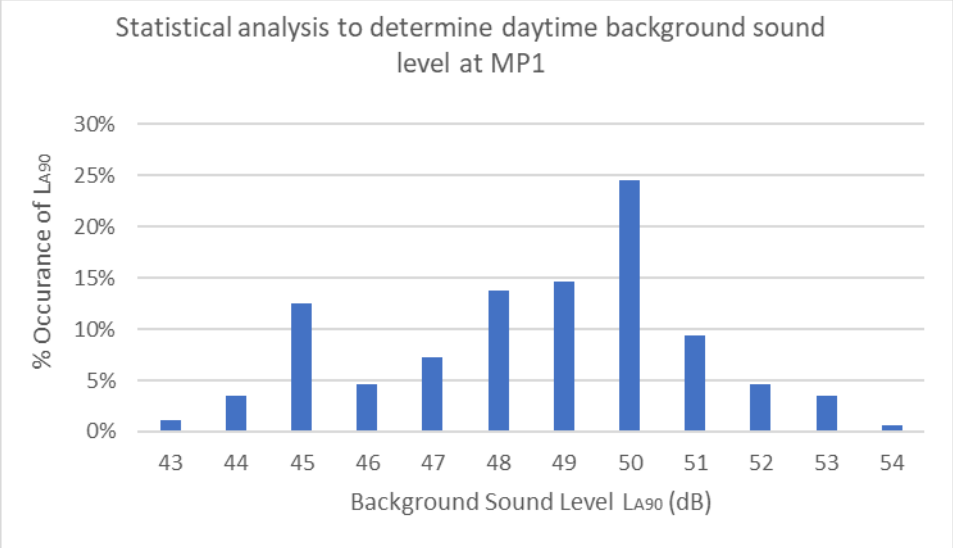


Figure 5.2 - Statistical analysis of the night-time L_{A90} measurements to determine background sound level at MP1.

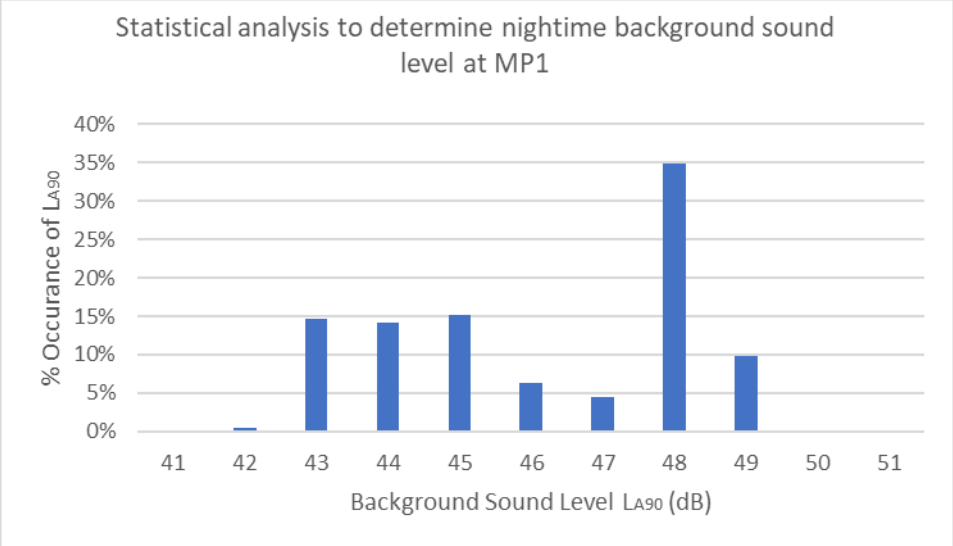


Figure 5.3 – Statistical analysis of the daytime L_{A90} measurements to determine background sound level at MP2.

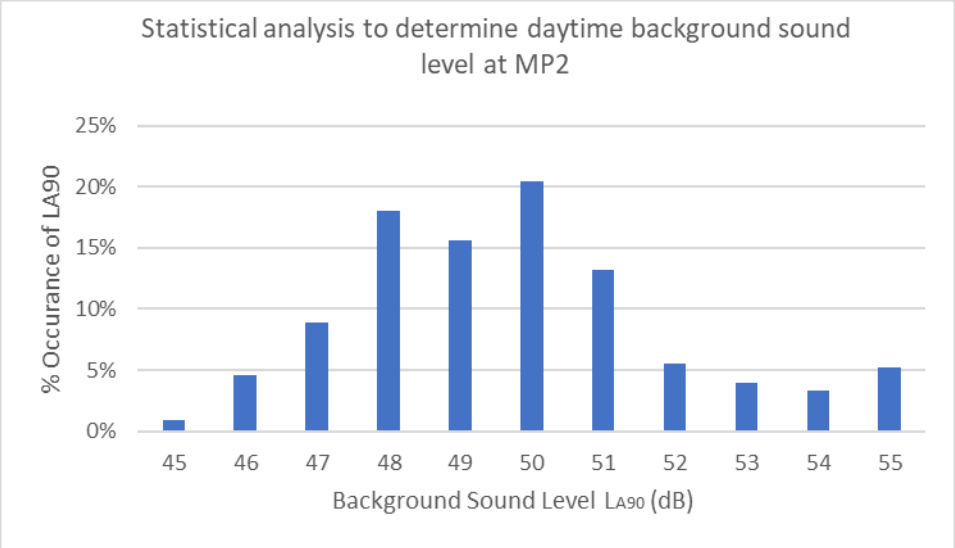
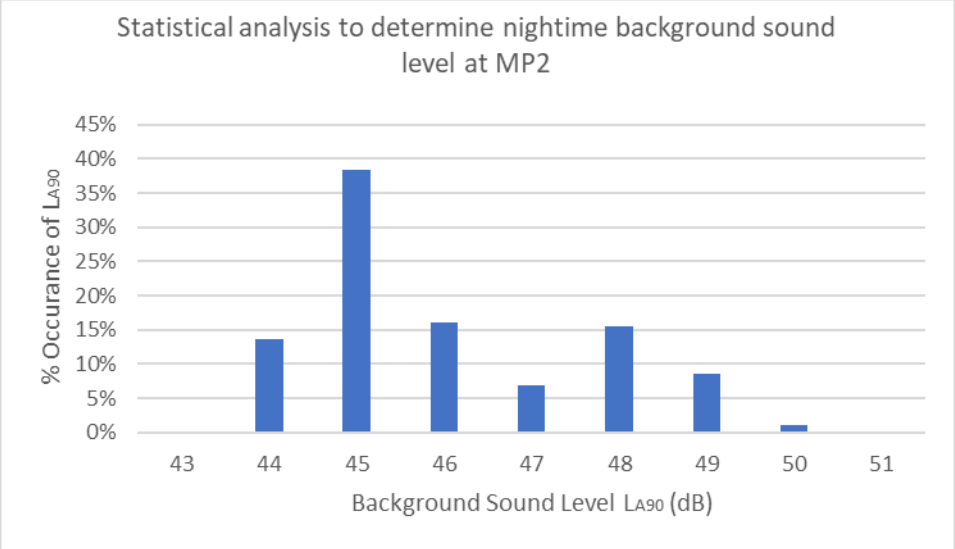


Figure 5.4 - Statistical analysis of the night-time L_{A90} measurements to determine background sound level at MP2.



The representative background sound levels at MP1 measured during the survey were $L_{A90,15min}$ **45 dB** during the daytime and $L_{A90,15min}$ **43 dB** at night.

6.0 Assessment

Due to the distance separation, screening from the building edge, and various types of plant, a CadnaA noise model was prepared to predict the resultant noise levels at the identified sensitive receptors. Screenshots from the model are shown in **Appendix E**.

6.1 Assumptions

Table 6.1 shows example noise limits used in the noise model for plant that has not been selected yet at his stage.

Table 6.1.1 - Sound Power Level of Future Plant

Plant Name	Sound Power Level (dBA)
Smoke Fan Telephone Exchange	50
Tenants Plant Telephone Exchange	70
Basement AHU	70

The sound power levels specified in table 6.1 are intended to be used as guidance. Upon final selection of plant it is recommended to carry out additional calculation.

Table 6.1.2 - Sound Power Level of Proposed Plant

Plant Name	Octave Band								Sound Power Level (dBA)
	63	125	250	500	1k	2k	4k	8k	
AHU Telephone Exchange intake/exhaust	45.8 / 51.8	58.9 / 61.9	61.4 / 65.4	61.8 / 71.8	63.0 / 79.0	57.2 / 75.2	54.0 / 70.0	42.9 / 61.9	78.0 / 84.7
Chiller	72.0	76.0	70.0	70.0	65.0	62.0	58.0	49.0	82.2
Heath Pump	60.8	70.9	78.4	82.4	84.0	79.2	72.0	65.9	88.0
Condenser unit SP140	62.0	58.0	56.0	53.0	51.5	47.0	41.5	33.5	64.0
Condenser unit SP112	57.0	55.5	54.5	51.5	49.0	45.0	38.0	32.0	61.9
Condenser unit P200	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	75.0

It is understood that the proposed AHU1 exhaust will be fitted with an attenuator, however the performance is not confirmed. In order to achieve Camden criteria the attenuator's acoustic performance shown in Table 6.1.3 has been assumed.

Table 6.1.3 - Sound Power Level of Proposed Plant

Plant Name	Octave Band								R_w
	63	125	250	500	1k	2k	4k	8k	
AHU1 exhaust attenuator	2.7	4.0	12.4	24.2	34.5	30.1	19.3	18.3	24

6.2 Roof Plant Noise Assessment

The impact caused by the proposed plant was assessed using a CadnaA noise model. The results from the meter closest to the residential receptor are summarised in Table 6.2

Table 6.2 - BS4142 assessment of residential block of flats to the north, from measurement location 1

Results		**dB (day)**	**dB(night)**	
Background Sound Level	$L_{A90,15mins}$	45	43	Based on the typical background noise level, measured over 7 consecutive days
Assessment made for seven consecutive days; reference time interval is 15mins. The plant is proposed to be used at full capacity during office hours and reduced capacity for out of office hours as described in Section 3.0.				
Distance Attenuation	N/A	N/A	N/A	Considered in noise modelling software
On Time Correction	N/A	N/A	N/A	Considered in noise modelling software
Specific Sound Level	$L_{Aeq,Tr}$	35.0	32.8	Specific sound level at worst affected receptor calculated in CadnaA.
Acoustic feature correction	Tonality	0	0	Spectral data is not available at the current stage
	Intermittency	0	0	Normal use of the plant means that it is on constantly with a number of plant items switching off after office hours. As such, it is assumed that correction is not required.
	Impulsivity	0	0	Temple was not provided with information that the proposed plant will have impulsive sound features, but experience of similar equipment indicates that this is unlikely to be the case.
	Other Sound Characteristics	0	0	No other sound characteristics are known at this stage of the assessment.
Rating Level		35.0	32.8	Rating level including acoustic feature corrections
Excess of rating level over background sound level		-10	-10.2	The rating level is 10 dB below the daytime background level and therefore meets the criteria imposed by Camden Council. The assessment indicates that the specific sound source is likely to have a low impact (Green). The rating level is 10.2 dB below the night-time background level and therefore meets the criteria imposed by Camden Council. The assessment indicates that the specific sound source is likely to have a low impact (Green).
It should be noted that the above assessment assumes no correction for tonality, impulsivity, other distinctive acoustic character, or intermittency. Consequently, all sources should be controlled so that these issues are not present at noise sensitive locations or else corrections will need to be applied.				

To comply with Camden Council criteria of 10 dB below the background sound level $L_{A90,15mins}$; the assessment indicates a rating level of 10 dB for day time and 10.2 dB for night time below the background sound level $L_{A90,15mins}$.

Note without the assumed attenuator on the proposed AHU on Telephone exchange (which only operate during the daytime) the assessment indicates a rating level of 9 dB for day time and 10.2 dB for night time below the background sound level $L_{A90,15mins}$.

As the design progresses, all sources should be selected and/or controlled such that tonality, impulsivity, or other distinctive acoustic characteristics are not present at noise sensitive locations.

7.0 Conclusion

Temple Group has been appointed by Thornton Reynolds Ltd to undertake a preliminary plant noise assessment for equipment proposed as a part of the refurbishment and reconfiguration of North Crescent to replace the Minerva House (WC1E 7ER) and Telephone Exchange (WC1E 7PH) on Chenies Street into one building.

Consequently, Temple has undertaken an unattended noise survey and plant noise calculations which have been used to assess the effects of the proposed mechanical plant on the nearest noise sensitive receptors to the proposed development. This has been assessed in line with the Camden Council guidance and relevant national standards.

The assessment indicates that, with suitable attenuators in place on the proposed chiller and AHU1 on Telephone exchange, the rating level of the plant is likely to comply with the Camden Council criteria of 10dB below the lowest existing background sound level $LA_{90,15mins}$. Where specific plant selection is not available a noise level recommendation has been made.

Appendix A. Acoustic Terminology

Noise/Sound

Noise and sound need to be carefully distinguished. Sound is a term used to describe wave-like variations in air pressure that occur at frequencies that can stimulate receptors in the inner ear and, if sufficiently powerful, be appreciated at a conscious level. Noise implies the presence of sound but also implies a response to sound: noise is often defined as unwanted sound.

Decibel, dB

The unit used to describe the magnitude of sound is the decibel (dB) and the quantity measured is the sound pressure level. The decibel scale is logarithmic, and it ascribes equal values to proportional changes in sound pressure, which is a characteristic of the ear. Use of a logarithmic scale has the added advantage that it compresses the very wide range of sound pressures to which the ear may typically be exposed to a more manageable range of numbers. The threshold of hearing occurs at approximately 0 dB (which corresponds to a reference sound pressure of 20 µPa) and the threshold of pain is around 120 dB.

Frequency, Hz

Frequency is the number of occurrences of a repeating event per unit second or Hertz (Hz). The human ear is sensitive to sound in the range 20 Hz to 20,000 Hz (20 kHz). For acoustic engineering purposes, the frequency range is usually divided up into octave bands, in which the upper limiting frequency for any band is twice the lower limiting frequency. The bands are described by their centre frequency value. In environmental acoustics the ranges typically used are from 63 Hz to 8 kHz.

A-weighting

The sensitivity of the ear is frequency dependent. Sound level meters are fitted with a weighting network which approximates to this response and allows sound levels to be expressed as an overall single figure value, in dB(A).

Ambient sound

Totally encompassing sound in a given situation at a given time, usually composed of sound from many sources near and far.

Ambient sound level ($LA_{eq,T}$)

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.

Background sound level ($LA_{90,T}$)

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.

Rating level

Specific sound level plus any adjustment for the characteristic features of the sound.

Reference time interval

Specified interval over which the specific sound level is determined. This is 1 h during the day from 07:00 h to 23:00 h and a shorter period of 15 min at night from 23:00 h to 07:00 h.

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.

Residual sound level ($LA_{eq,T}$)

Equivalent continuous A-weighted sound pressure level of the residual sound at the assessment location over a given time interval, T.

Specific sound level

Equivalent continuous A-weighted sound pressure level produced by the specific sound source at the assessment location over a given reference time interval.

Specific sound source

Sound source being assessed.

Appendix B. Preliminary Plant Data

Figure B.1 The Telephone Exchange Office Air Handling Unit

AHU ACOUSTIC DATA SUPPLY SECTIONS									
Frequency	63 Hz	125 Hz	250 Hz	500 Hz	1k Hz	2k Hz	4k Hz	8k Hz	Overall dB(A)
SWL @ AHU Inlet (dB)	73	74	77	70	67	62	58	52	73
SWL @ AHU Outlet (dB)	77	78	76	73	74	67	59	50	77
Case Radiated SPL @ 1m (dB)	61	61	48	43	42	46	36	29	51

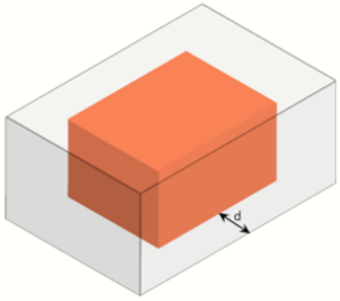
AHU ACOUSTIC DATA EXHAUST SECTIONS									
Frequency	63 Hz	125 Hz	250 Hz	500 Hz	1k Hz	2k Hz	4k Hz	8k Hz	Overall dB(A)
SWL @ AHU Inlet (dB)	72	75	70	65	63	56	53	44	68
SWL @ AHU Outlet (dB)	78	78	74	75	79	74	69	63	82
Case Radiated SPL @ 1m (dB)	57	57	39	37	38	38	29	18	45

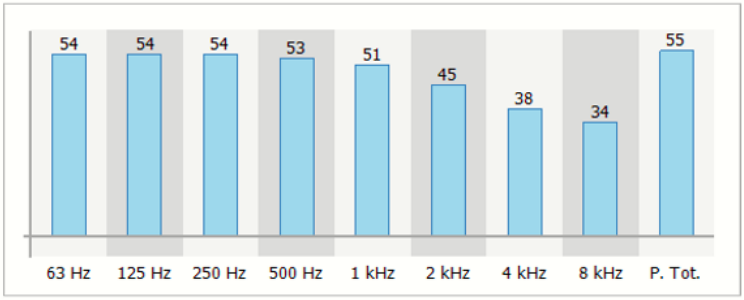
Figure B.2 The Telephone Exchange Heat Pump

NOISE DATA

SOUND DATA COLD

Frequencies	Hz	63	125	250	500	1000	2000	4000	8000
Sound power (spectrum)	dB	87	87	87	86	84	78	71	67
Sound power level in cooling	dB(A)					88			
Sound pressure level (spectrum)	dB	54	54	54	53	51	45	38	34
Sound Pressure	dB(A)					55			





SOUND DATA OUTDOOR HOT

Sound power level in heating	dB(A)	89

Note

Distance	m	10
Note		Average sound pressure level at 10 m distance, unit in a free field on a reflective surface; non-binding value calculated from the sound power level. Sound power on the basis of measurements taken in compliance with ISO 9614.

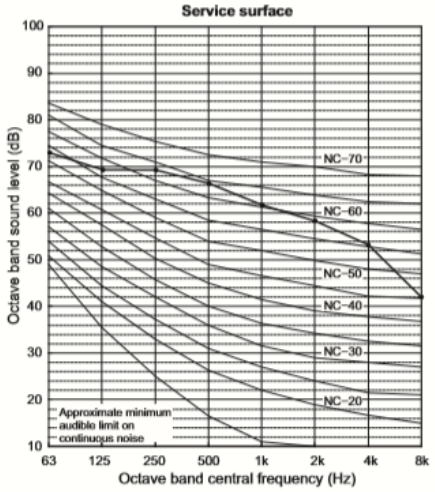
Figure B.3 The Telephone Exchange Mitsubishi P1800 Chiller

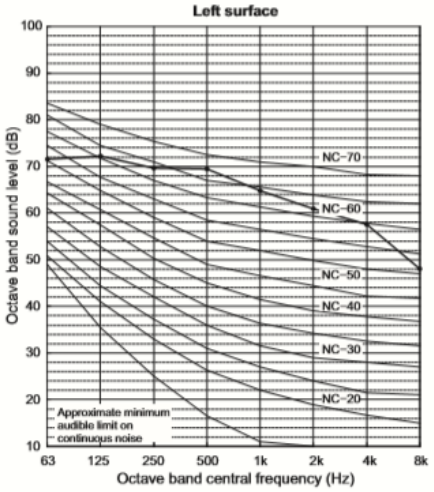
Sound pressure level

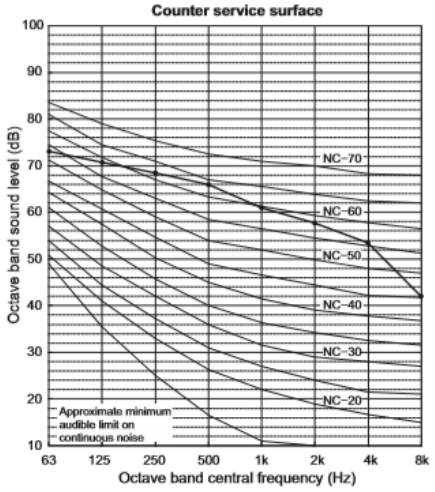
The following values are the planned value.

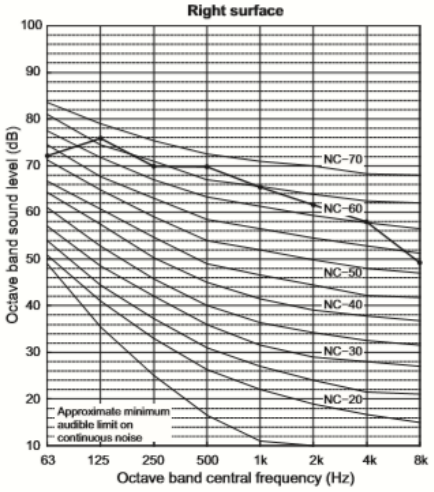
Sound pressure level dB <A> (anechoic room level)		
Measurement location	EAHV-P1500YB EACV-P1500YB	EAHV-P1800YB EACV-P1800YB
Service surface: A	66	68
Counter service surface: B	66	67
Right surface: C	68	71
Left surface: D	70	70

* The above values are obtained by converting the values measured in location with less echo sound to the anechoic room level.
The values could be larger than those values if the operating conditions are different or the measuring location is affected by echo sound.
(It could be roughly 4 dB to 6 dB higher though it depends on the installation conditions.)
Regarding the installation, consider the effect of echo sound, implement soundproof treatment as necessary.









Appendix C. Current Site Layout and Measurement Positions

Figure C.1 – Current site layout and survey locations. Approximate position of the nearest noise sensitive receptor, Chenies Street Chambers, is marked in yellow

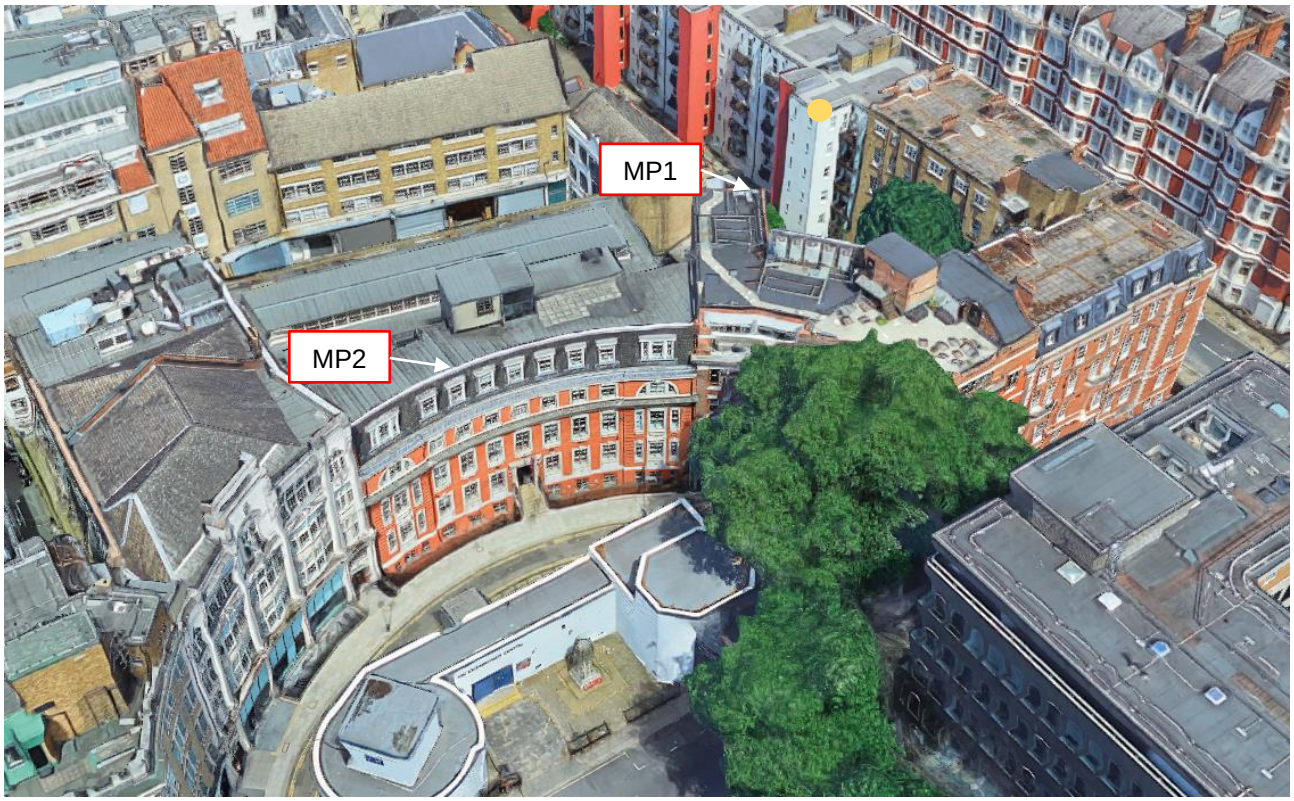


Figure C.2 - Measurement Position 1 (MP1), Northern Boundary of Fitzroy House facing the close resendtial receptor, Chenies Street Chambers on Huntley Street

Figure C.3 - Measurement Position 1 (MP2), Southern Boundary of The Telephone Exchange facing Chenies Street

Appendix D. Measurement Data and Weather Data

Figure D.1 MP1 L_{Aeq} and L_{90} - Full Data Set

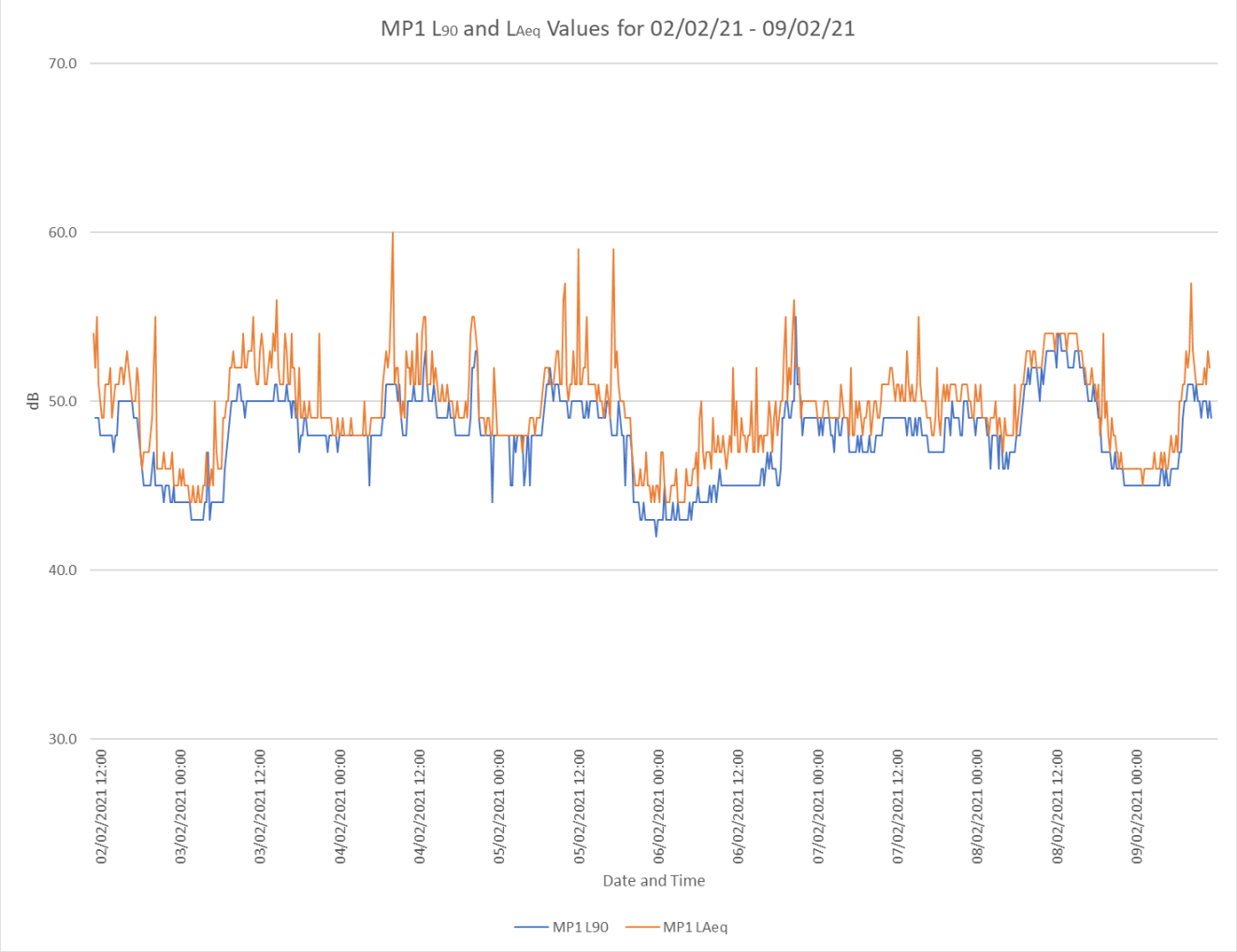


Figure D.2 MP2 L_{Aeq} and L_{90} - Full Data Set

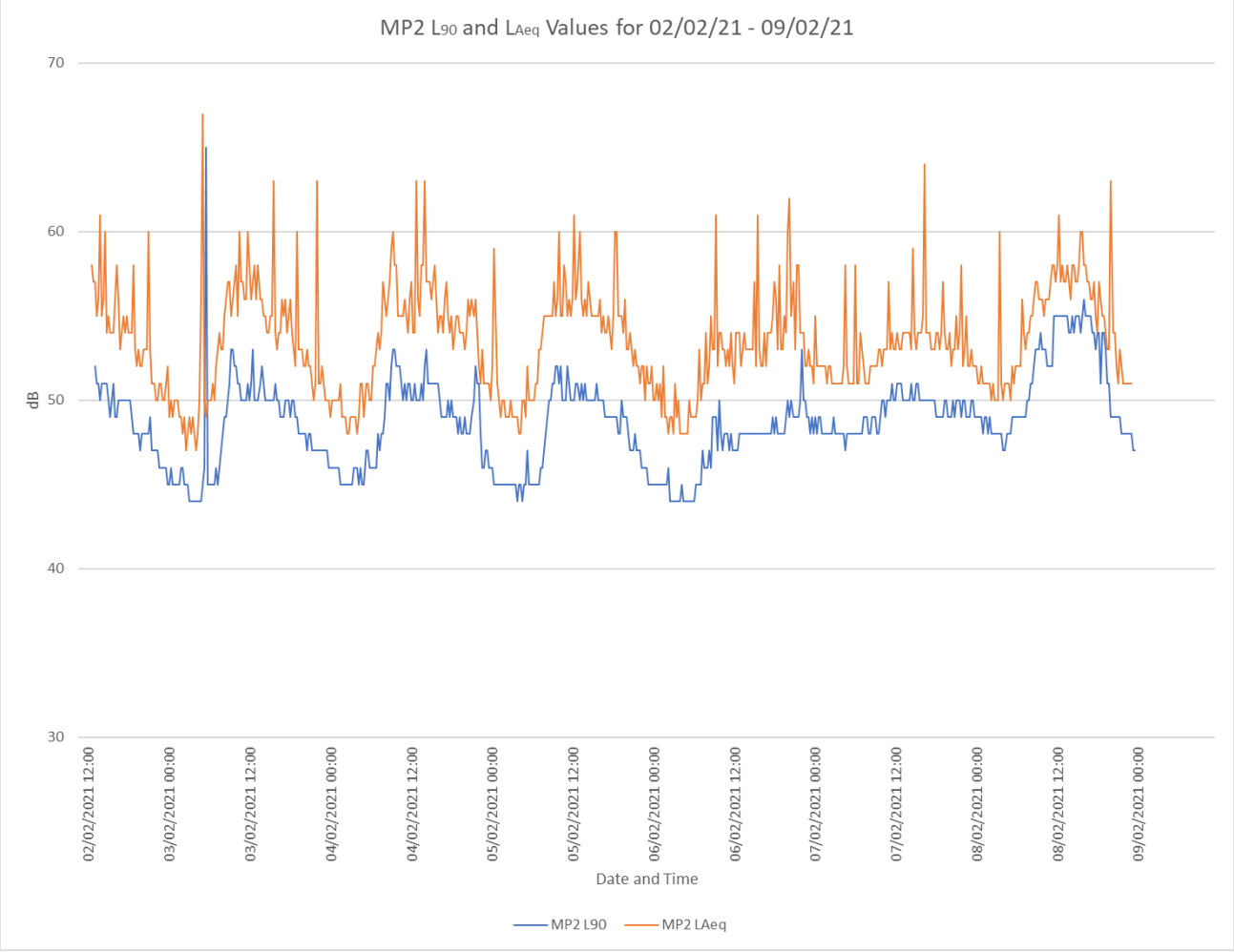


Figure D.3 Wind Speed and Precipitation Data

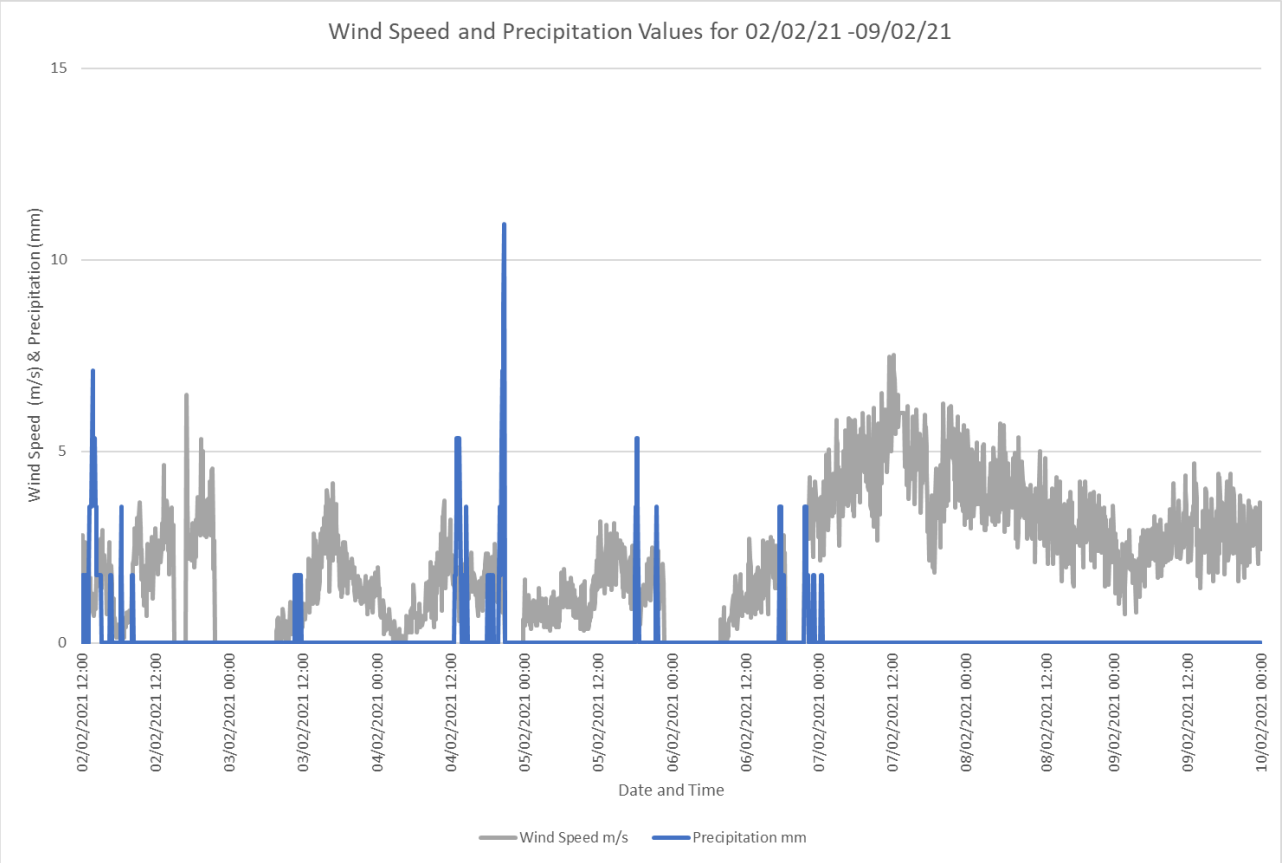


Figure D.4 MP1 L_{Aeq} and L_{90} – Data removed due to adverse weather.

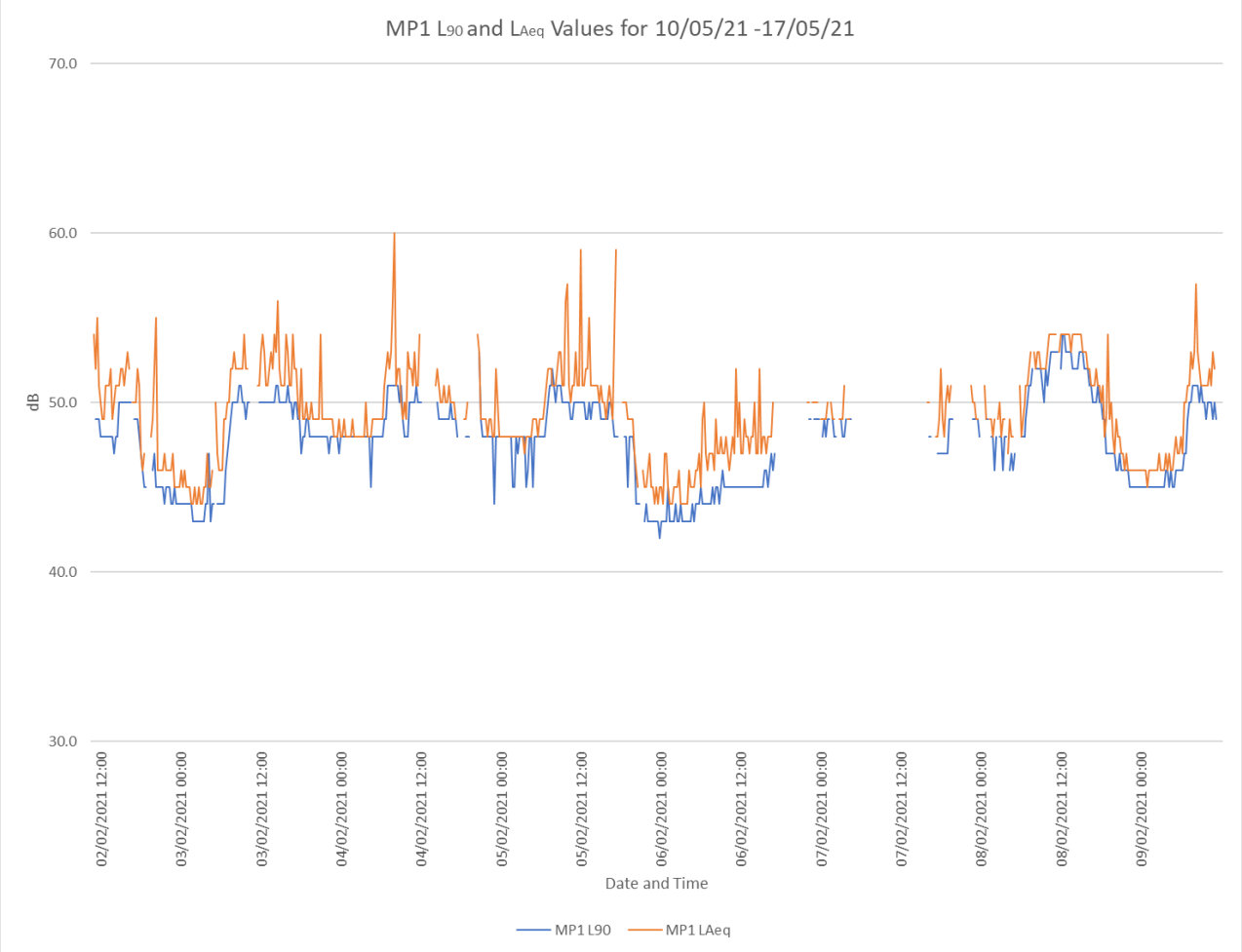
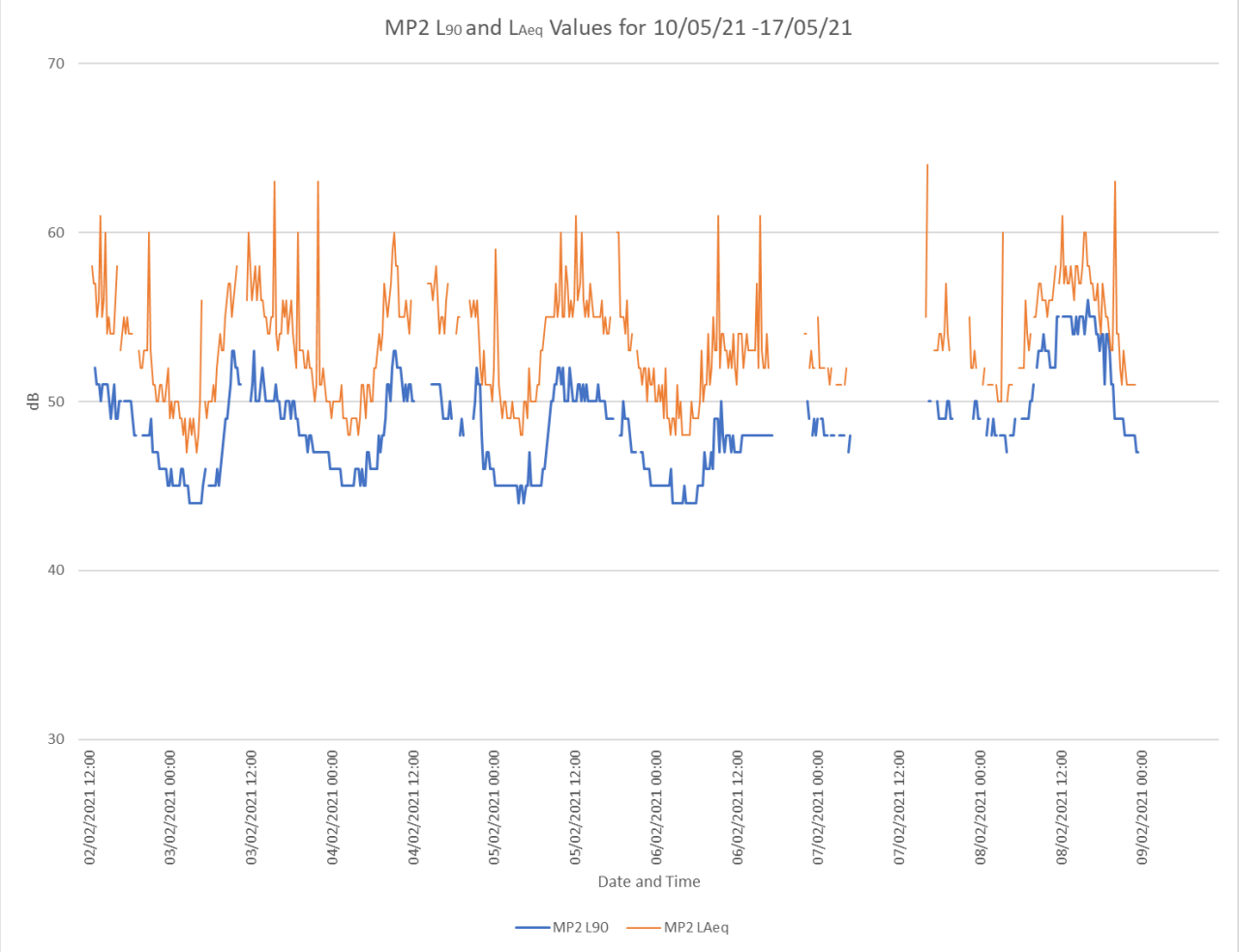


Figure D.5 MP2 L_{Aeq} and L_{90} – Data removed due to adverse weather.



Appendix E. CadnaA Plant Noise Model

Figure E.1 3D View facing north towards Chenies Street Chambers

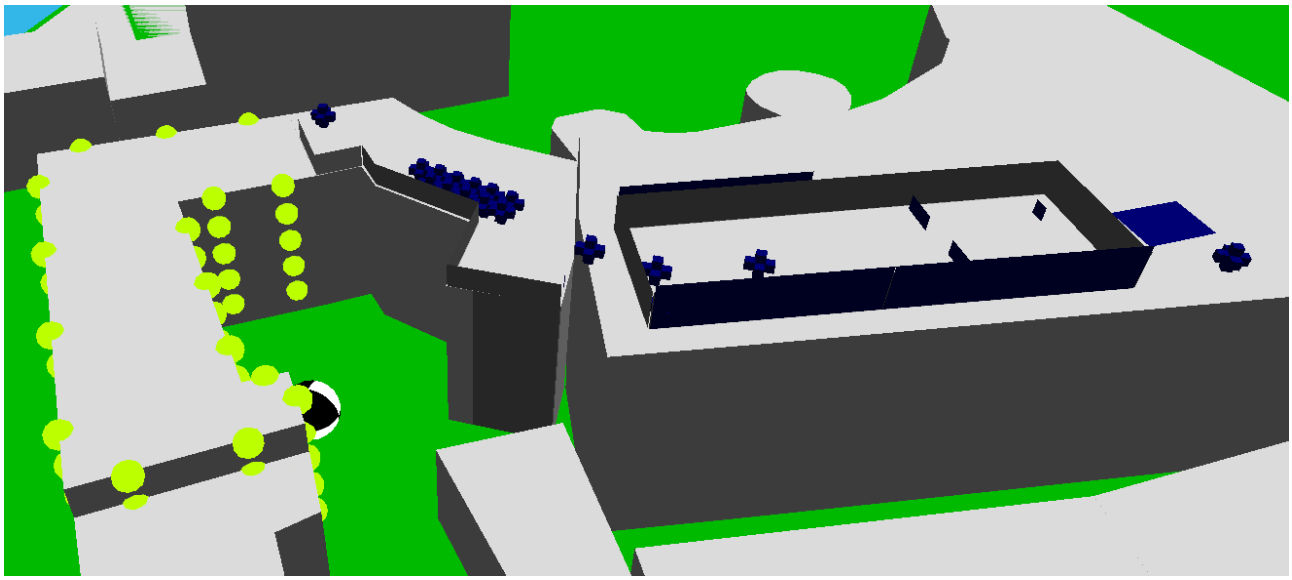


Figure E.2 3D View facing south towards Chenies Street

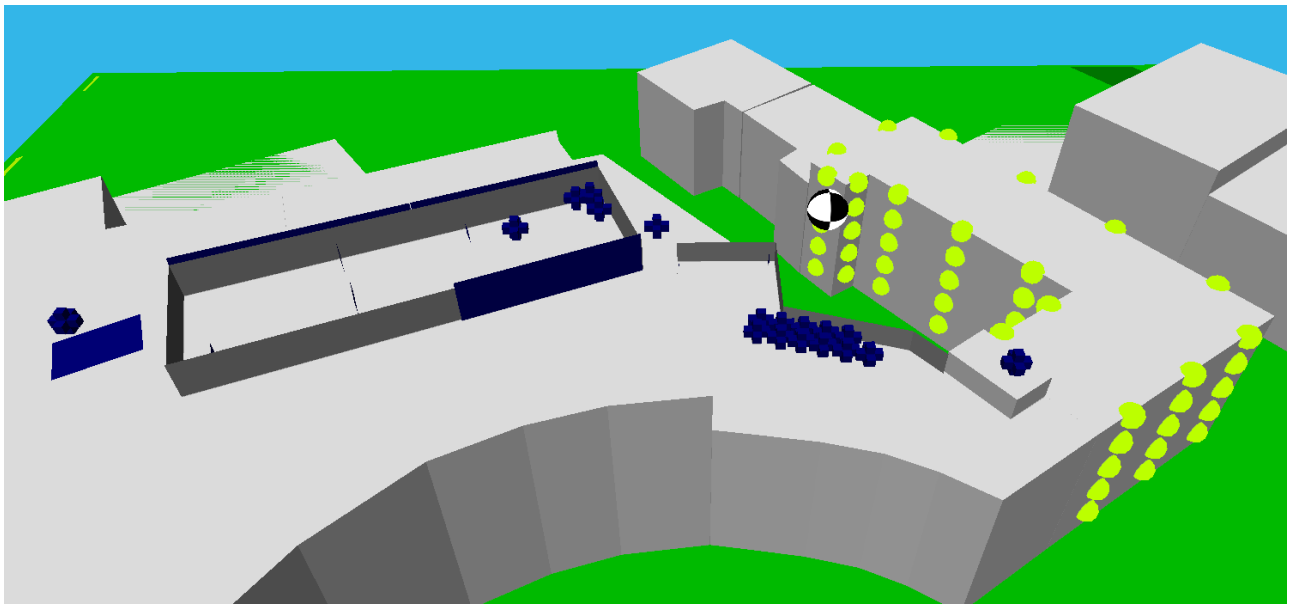
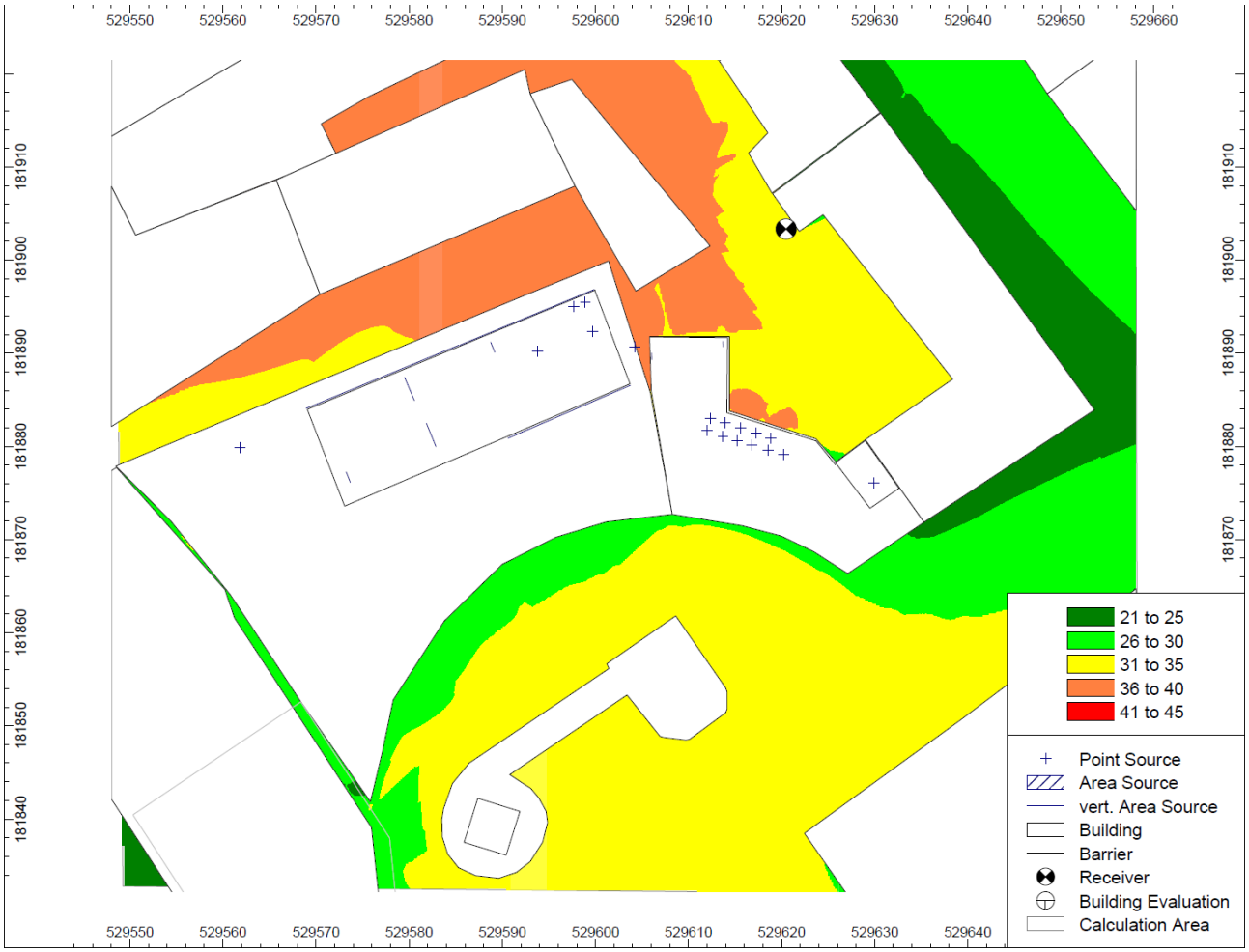


Figure E.3 2D Noise Contours Map showing specific plant noise level $L_{Aeq,}$ dB at the height of top windows of the residential buildings.



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