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CAMPUS WEST, WELWYN GARDEN CITY

PLANT NOISE ASSESSMENT - JUNE 2021 UPDATE

On behalf of:

Press & Starkey

hepworth acoustics

Report No: P21-118-R02v4
June 2021

CAMPUS WEST, WELWYN GARDEN CITY

PLANT NOISE ASSESSMENT

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CONTENTS

1.0 INTRODUCTION

1.1 Hepworth Acoustics Ltd was commissioned by Press & Starkey to carry out a noise impact assessment in connection with a planning application for proposed new externally mounted plant at the Campus West in Welwyn Garden City.

1.2 The original version of this report (ref: 'P21-118-R02v1') dated March 2021, provided an assessment of the potential noise impact from the proposed plant upon the nearest dwellings and provided recommendations for noise mitigation measures. This report update has been prepared to take into account the changes to the proposals since our original report was issued.

1.3 The findings of the original report indicated that there was the potential for the operation of the proposed Air Source Heat Pumps (ASHPs) during the night-time (i.e. 23:00-07:00) to result a significant adverse noise impact at the nearest residential properties. We understand that the noise mitigation measures that would be needed in order for the ASHP to operate during night-time hours would be prohibitively costly. Based on these initial findings, the proposals have been refined, the proposals have been reduced from two ASHPs to one, the proposed location of the ASHP has been moved further from the nearest dwellings on Scholars Mews, and the ASHP will be programmed so that it will not operate during night-time hours.

1.4 Therefore, on the basis that the ASHP will not operate during night-time hours, we have carried out additional background noise surveys in order to assess the potential noise impact from daytime and evening operations of the proposed ASHP.

1.5 The location of the Campus West is shown in Figure 1 within the context of the surrounding area.

1.6 The proposals are for one new air source heat pump to be installed on the roof of the main building, along with new PV arrays spread over the roof of the main, Roller City and Library buildings. The proposed location of the new ASHP and PV arrays are shown in Figure 2.

1.7 The nearest residential properties to the proposed new plant are the houses on Scholars Mews to the north as indicated in Figure 1.

1.8 This assessment has included:

- Background noise surveys outside the nearest residential properties.
- Calculation of the likely plant noise levels outside the nearest residential properties.

- A BS 4142:2014+A1:2019 assessment of likely plant noise impact.
- Recommendations for noise mitigation measures.

1.9 All recommendations made in this report have been provided for acoustic purposes only. All other aspects of the proposals should be checked by relevant specialists (e.g. fire, structural, mechanical & electrical, etc.).

1.10 The various noise units and indices referred to in this report are described in Appendix I. All noise levels mentioned in the text have been rounded to the nearest decibel, as fractions of decibels are imperceptible.

2.0 BRITISH STANDARD 4142:2014+A1:2019

2.1 British Standard 4142:2014+A1:2019, *Methods for rating and assessing industrial and commercial sound* (referred to hereafter as BS 4142), is appropriate guidance for assessing and controlling the potential noise impact from noise sources such as mechanical services plant installations.

2.2 BS 4142 requires a 'rating' level ($L_{Ar,Tr}$) to be calculated from the operation of the noise source and compared with the background sound level ($L_{A90,T}$) which is measured in the absence of the noise source, evaluated over a 1-hour period for daytime operations and a 15-minute period for night-time operations.

2.3 The rating level ($L_{Ar,Tr}$) is based on the 'specific' sound level ($L_s = L_{Aeq,Tr}$) attributed to the operating noise source, with 'character corrections' added for sound sources where 'certain acoustic features can increase the significance of impact' at residential locations.

2.4 The character correction applied to the specific sound level in order to obtain the rating level can take into account tonality, intermittency, impulsivity and characteristics otherwise distinctive against the prevailing noise climate in the area of the residential properties.

2.5 An initial estimate of the potential noise impact from the operating noise source is determined by comparing the difference between the background level and the rating level at the residential locations.

2.6 Regarding the outcome of the initial estimate, BS 4142 states that:

- Typically, the greater this difference, the greater the magnitude of impact;
- A difference of around +10 dB or more is likely to be an indication of a significant adverse impact, depending on the context;
- A difference of around +5 dB is likely to be an indication of an adverse impact, depending on the context; and,
- The lower the rating level is relative to the measured background level, the less likely it is that the operation will have an adverse impact or a significant adverse impact. Where the rating level is does not exceed the background sound level, this is an indication of the specific sound source having low impact, depending on the context.

2.7 BS 4142 states that all pertinent factors must be taken into account regarding the context in which the noise occurs, including but not limited to:

- The absolute level of sound.
- The character and level of the residual sound compared to the character of the specific sound; and,
- The sensitivity of the receptor and whether dwellings or other premises used for residential purposes will incorporate design measures that ensure good internal and/or outdoor acoustic conditions such as acoustic screening.

2.8 As BS 4142 is applicable guidance for assessing plant noise, appropriate design targets for noise from proposed plant at this site would be to control the rating level ($L_{Ar,Tr}$) from any new externally mounted plant to within the existing representative background sound levels ($L_{A90,T}$) at the nearest dwellings.

3.0 AMBIENT NOISE SURVEY

3.1 Attended noise surveys were carried out to quantify the representative background sound levels at the nearest dwellings during sample daytime and evening periods.

3.2 Whilst BS 4142 considered the daytime to be a single period between 07:00 and 23:00 and does not make a distinction for the evening, in this case we have based our assessment on separate daytime (07:00-19:00) and evening (19:00-23:00) periods, as the evening hours can be noticeably quieter.

3.3 The noise surveys were carried out on Wednesday 9 June 2021, between 14:06 and 16:23 for the daytime period and between 19:53 and 22:07 for the evening period.

3.4 The noise surveys were carried out at the nearest dwellings to the proposed new plant (Location A: On Scholars Mews), as shown in Figure 1.

3.5 The majority of the COVID-19 lockdown restrictions were lifted during the time of the noise survey, hence, there is considered to be no appreciable effect on the background noise climate.

3.6 The sound level measurements were taken in 15-minute periods in 'free-field' conditions, at a microphone hight 1.4m above the local ground. Calibration checks were carried out both before and after the noise survey with no variance in calibration level.

3.7 Weather conditions during the noise surveys were suitable for sound level measurements. Full details of the weather conditions and the measurement equipment used can be seen in Appendix II.

3.8 The results of the ambient noise surveys can be seen in full in Appendix II and a summary showing the range of results is shown in Table 1.

Table 1: Range of Noise Survey Results (dB)

Location	Period	$L_{Aeq,15\ min}$	$L_{A90,15\ min}$
Location A: On Scholars Mews	Daytime	43-47	39-41
	Evening	45-46	36-40

3.9 The noise climate in the area during the hours of the noise surveys fairly was quiet. The main contributions to the noise climate were distant road traffic noise and bird noise.

4.0 ASSESSMENT OF PLANT NOISE

Plant Noise Design Targets

4.1 The objective is to quantify a background sound level which is representative of the noise climate during the period of interest; Section 8.1 of BS 4142 states "*the objective is not simply to ascertain a lowest measured background sound level, but rather to quantify what is typical during particular time periods.*".

4.2 The arithmetic mean of the measured background sound levels is 40 dB $L_{A90,15\ min}$ during the daytime and 38 dB $L_{A90,15\ min}$ during the evening at Location A, which we have adopted as the representative background sound levels during these periods.

4.3 On this basis, the plant noise design targets at Scholars Mews for the new plant are shown in Table 2.

Table 2: Plant Noise Design Targets at Location A: Scholars Mews (dB)

Daytime (07:00-19:00)	Evening (19:00-23:00)
40 $L_{Ar,1h}$	38 $L_{Ar,1h}$

Proposed New Equipment

4.4 Where the original proposals included two ASHPs, the new proposals include only one ASHP which is to be mounted on the south side of the main building further from the dwellings on Scholars Mews (in line with our original recommendations) as shown in Figure 2, along with PV arrays and associated inverters which are to be installed across the three roofs.

4.5 The PV arrays themselves do not produce noise of any consequence, but noise from their inverters has been included in the assessment. A summary of the proposed plant is shown in Table 3 along with the manufacturer noise emission data.

Table 3: Summary of Proposed Plant Noise Emissions

Reference	Model	Description of Noise Source	Location	dB
ASHP 01	i-FX-N-G05 /SL-A /0652	External Air Source Heat Pump	North-western area of Main Building Roof	95 L_{wA}
Inverter (Library)	Solis-30K-5G	External Inverter	Library Roof	30 L_{pA} @ 1m
Inverter (Main)	Solis-25K-5G	External Inverter	Main Building Roof	30 L_{pA} @ 1m
Inverter (Roller)	Solis-50K	External Inverter	Roller City' Roof	60 L_{pA} @ 1m

Plant Noise Levels at Nearest Dwellings

4.6 Taking into account the attenuation of sound over distance, assuming steady operation of all plant systems simultaneously and at full capacity, the calculated plant noise level is 45 dB $L_{Aeq,1h}$ at Scholars Mews in the daytime or evening.

4.7 No noticeable acoustic character features of the plant noise (e.g. tones, impulsivity) are anticipated at the residential location, as the units will be modern systems and are to be installed by suitably qualified building services engineers.

4.8 As the calculated plant noise levels are based on the equipment operating continuously over the entire assessment period it is also inappropriate to include any penalty for intermittency.

4.9 Therefore, the resulting noise rating level is 45 dB $L_{Ar,1h}$ at Scholars Mews.

4.10 Therefore, based on the proposals, the noise rating level would be 5 to 7 dB above the design targets adopted for Scholars Mews. Unless suitable noise mitigation can be achieved, according to BS 4142 this could potentially result in an 'adverse impact', although not amounting to a 'significant adverse impact', at the nearest dwellings.

4.11 The main contributions to the plant noise levels at the nearest dwellings would be from the ASHP; the inverters would operate within 24 dB $L_{Ar,15h}$ at the nearest dwellings which is well within the plant noise design targets. Therefore, the noise mitigation measures only need apply to the ASHP.

Recommendations

4.12 As shown above, a reduction in the plant noise level from the ASHP is required in order to meet the design targets and ensure that there is no unreasonable noise impact upon the local residents.

4.13 A 2.6 m high absorptive acoustic barrier around the ASHP would be capable of reducing the plant noise at the nearest dwellings to 40 dB $L_{Ar,1h}$, which would be within the daytime background level and only 2 dB above the evening background level. This would be considered only a 'low impact' on the nearest dwellings during the evening in the event the plant is operating at 100% capacity. (Note an absorptive acoustic barrier is a purpose made high mass barrier with an acoustically absorbing inner facing).

4.14 A 2.8 m high absorptive acoustic barrier around the ASHP would be capable of reducing the plant noise at the nearest dwellings to 38 dB $L_{Ar,1h}$, which would be within the daytime and evening background levels.

4.1 On this basis, we recommend installing a proprietary absorptive acoustic barrier as indicated in Figure 3, with a minimum height of 2.6m but ideally a height of 2.8 m. The absorptive material should be applied to the inner face of the barrier facing the ASHP.

4.2 We have based our noise barrier attenuation calculations on the acoustic barrier standing at a distance of 2m from the casing of the ASHP, which we understand from the manufacturer data is the minimum free area required. Nevertheless, the stand-off area will need to be checked and confirmed by the Building Services Engineer.

4.3 We have marked-up the minimum recommended surround to protect the Scholars Mews dwellings in Figure 3 for illustrative purposes.

4.1 Acoustic barriers should have a minimum mass per unit area of 15 $kg.m^{-2}$, and should be a solid construction with no holes or gaps. Specialist suppliers of acoustic barriers include Jacksons Fencing (www.jacksons-fencing.co.uk) and GRAMM Barriers (www.grammbarriers.com).

4.2 Nevertheless, in order to ensure that the noise impact assessment is representative, it is crucial that the proposed ASHPs are programmed so that they do not operate during night-time hours (i.e. 23:00-07:00).

5.0 SUMMARY & CONCLUSION

5.1 Hepworth Acoustics Ltd was commissioned by Press & Starkey to carry out a noise impact assessment in connection with a planning application for proposed new externally mounted plant equipment at the Campus West in Welwyn Garden City.

5.2 Noise surveys were carried out outside the nearest dwellings to determine the existing representative background sound levels in the area.

5.3 Appropriate plant noise design targets have been adopted based on the noise survey results to ensure that the plant noise level is controlled to within an acceptably low level.

5.4 The plant noise level at the nearest dwellings has been calculated based on the proposals.

5.5 Our calculations indicate that without suitable mitigation the proposals could potentially result in an 'adverse impact' upon the nearest residents.

5.6 We have therefore provided recommendations to install an acoustic barrier around the ASHP to ensure that the noise is controlling to within a 'low impact' and not amounting to an adverse noise impact. Our recommendations include the minimum height for an absorptive acoustic barrier around the ASHPs.

5.7 Nevertheless, in order to ensure that the noise impact assessment is representative, it is crucial that the proposed ASHPs are programmed so that they do not operate during night-time hours (i.e. 23:00-07:00).

Do not scale from this figure

Key:

X Noise survey locations

N

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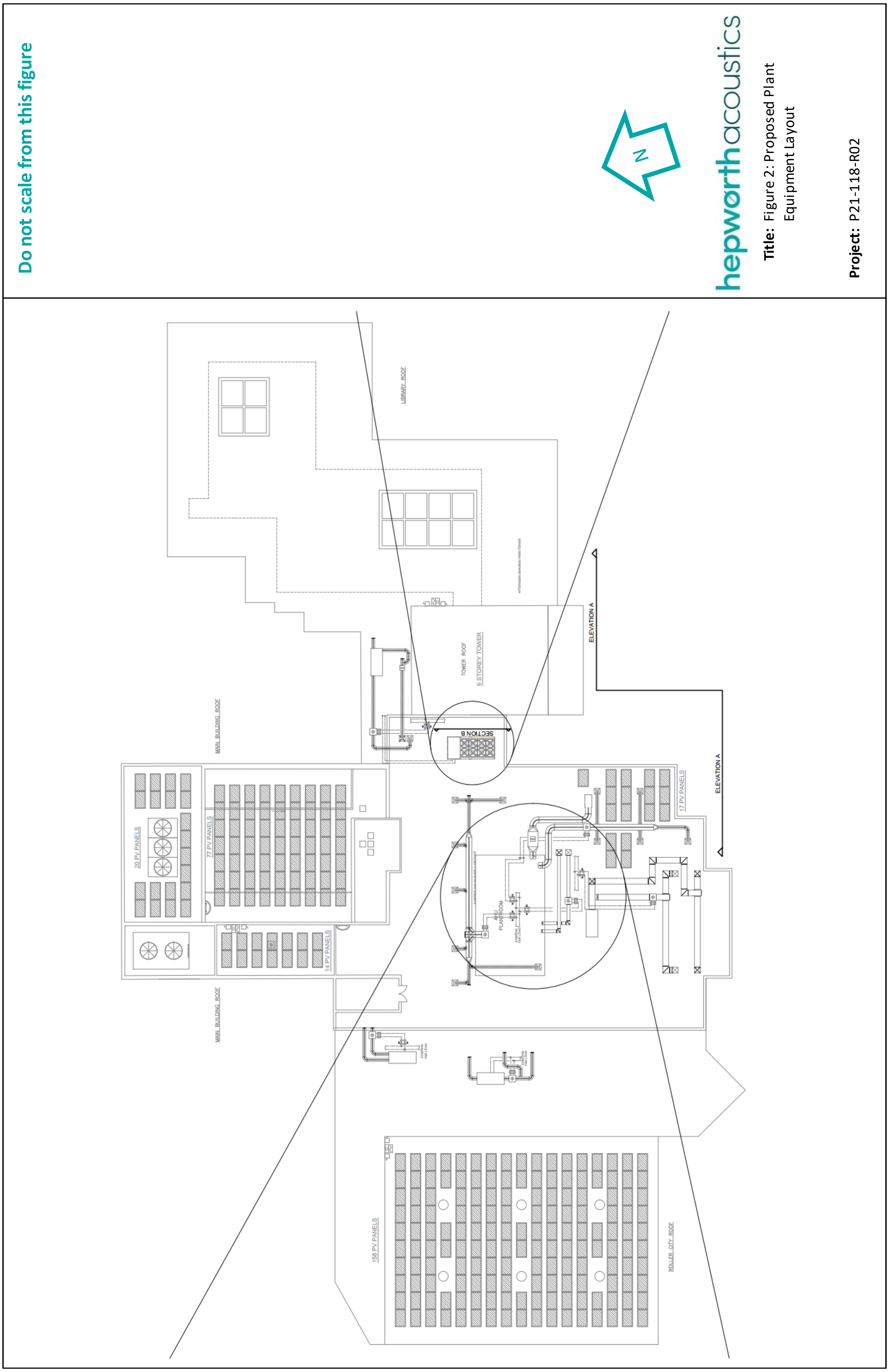
Title: Figure 1: Aerial View & Noise Survey Locations

Project: P21-118-R02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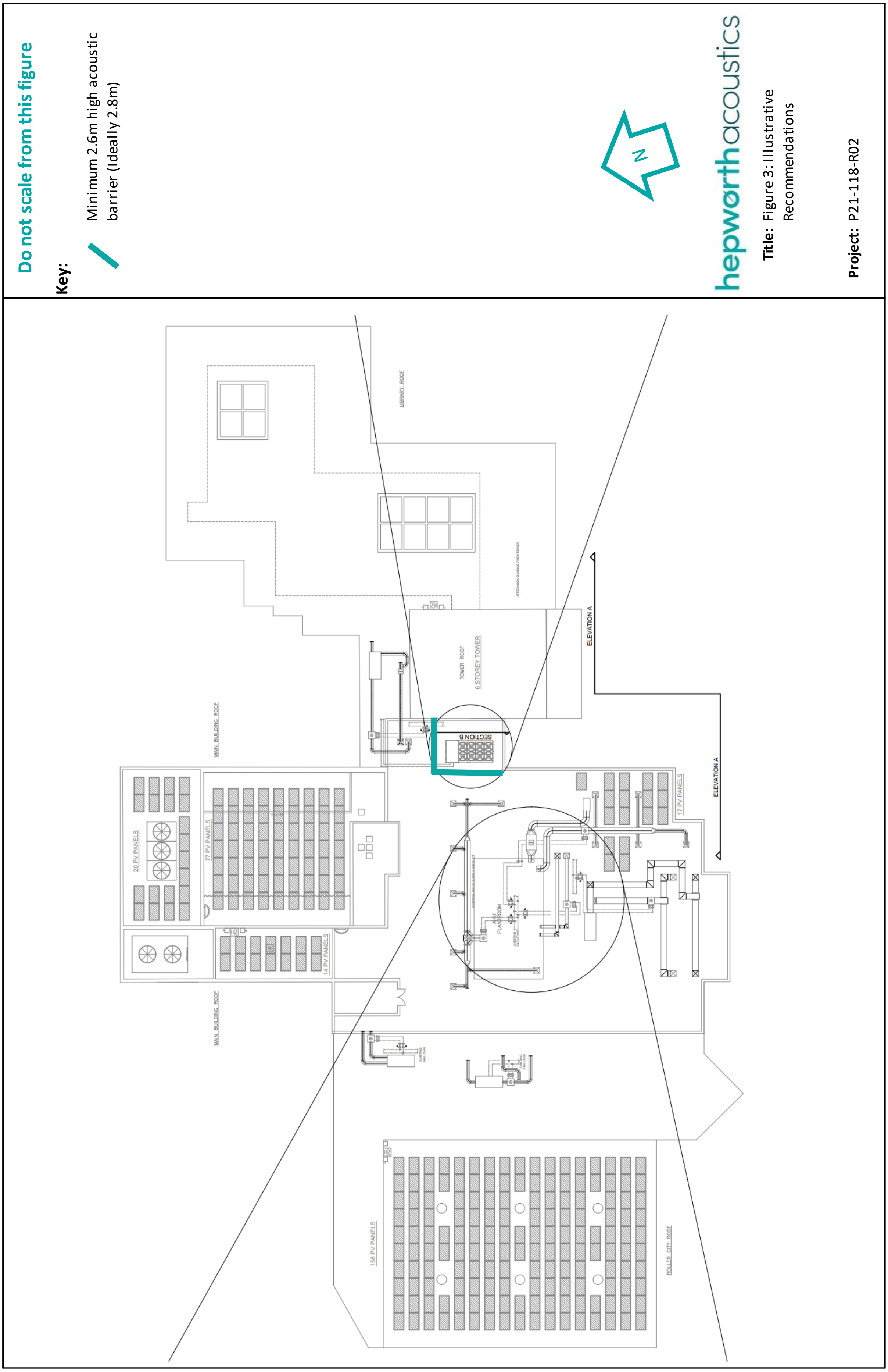
hepworthacoustics
N
Title: Figure 2: Proposed Plant Equipment Layout
Project: P21-118-R02
LIBRARY ROOF
TOWER ROOF
6 STOREY TOWER
ELEVATION A
SECTION B
MAIN BUILDING ROOF
20 PV PANELS
77 PV PANELS
14 PV PANELS
17 PV PANELS
PLANTROOM
158 PV PANELS
ROLLER CITY ROOF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Key:
Minimum 2.6m high acoustic barrier (Ideally 2.8m)
N
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Title: Figure 3: Illustrative Recommendations
Project: P21-118-R02
LIBRARY ROOF
TOWER ROOF
6 STOREY TOWER
ELEVATION A
SECTION B
MAIN BUILDING ROOF
20 PV PANELS
77 PV PANELS
14 PV PANELS
17 PV PANELS
158 PV PANELS
ROLLER CITY ROOF

Appendix I: Noise Units & Indices

Sound and the decibel

A sound wave is a small fluctuation of atmospheric pressure. The human ear responds to these variations in pressure, producing the sensation of hearing. The ear can detect a very wide range of pressure variations. In order to cope with this wide range of pressure variations, a logarithmic scale is used to convert the pressure values into manageable numbers. Although it might seem unusual to use a logarithmic scale to measure a physical phenomenon, it has been found that the human response to sound most closely follows a logarithmic relationship. The dB (decibel) is the logarithmic unit used to describe sound (or noise) levels. The usual range of sound pressure levels is from 0 dB (at the threshold of hearing) to 120 dB (at the threshold of pain).

Due to the logarithmic nature of decibels, when two sounds of the same level are combined together, the total sound level is (under normal circumstances) 3 dB higher than each of the individual sound levels e.g. 60 dB plus 60 dB = 63 dB. In terms of perceived 'loudness', a 3 dB(A) variation in sound level is a relatively small (but nevertheless just noticeable) change. An increase in sound level of 10 dB(A) generally corresponds to a doubling of perceived loudness. Likewise, a reduction in sound level of 10 dB(A) generally corresponds to a halving of perceived loudness.

The ear is not equally sensitive to sound at all frequencies. It is less sensitive to sound at low and very high frequencies, compared with the frequencies in between. Therefore, when measuring a sound made up of different frequencies, it is often useful to 'weight' the frequency spectrum appropriately, so that the measurement correlates better with what a person would actually hear. This is usually achieved by using a mathematical filter called the 'A' weighting, which is built into sound level meters. Sound levels measured using the 'A' weighting are denoted dB(A) or dBA.

Frequency and Hertz (Hz)

As well as the loudness of a sound, the frequency content of a sound is also very important. Frequency is a measure of the rate of fluctuation of a sound wave. The unit used is cycles per second, or Hertz (Hz). Sometimes large frequency values are written as kiloHertz (kHz), where 1 kHz = 1000 Hz.

Young people with normal hearing can hear frequencies in the range 20 Hz to 20 kHz. However, the upper frequency limit gradually reduces as a person gets older.

Glossary of Relevant Sound & Vibration Terms

When a noise level is constant and does not fluctuate, it can be described adequately by measuring the dB(A) level. However, when the noise level varies with time, the measured dB(A) level will vary as well. In this case, it is therefore not possible to represent the noise with a simple dB(A) value. In order to describe noise where the level is continuously varying, a number of other indices can be used. The various indices used in this report, along with other relevant terms are described below.

L_p This is the 'Sound Pressure Level' which is a logarithmic ratio between a squared sound pressure quantity and the squared human threshold of hearing.

L_{pA} This is the A-weighted 'Sound Pressure Level', which is the Sound Pressure Level (L_p) adjusted to account for the average human hearing response at difference frequencies for a given sound pressure range.

L_W This is the 'Sound Power Level' which is a logarithmic ratio between a sound power quantity and the human threshold of hearing.

L_{WA} This is the A-weighted 'Sound Power Level', which is the Sound Power Level (L_w) adjusted to account for the average human hearing response at difference frequencies for a given sound power range.

$L_{Aeq,T}$ This is the A-weighted 'Equivalent Continuous Sound Level' which is an average of the total sound pressure measured over a specified time period. In other words, $L_{Aeq,T}$ is the level of a steady sound which has the same total (A-weighted) sound pressure as the real fluctuating noise, measured over the same time period. It is increasingly being used as the preferred parameter for most forms of environmental noise.

L_{Amax} This is the 'Maximum A-weighted Sound Level' that was measured during the monitoring period. L_{Amax} used in this report refers throughout to L_{Amax} measured using the fast time weighting of the sound level meter, $L_{Amax,f}$.

$L_{A90,T}$ This is the A-weighted sound level exceeded for 90% of a measurement time period. $L_{A90,T}$ is used as a measure of background sound level.

Appendix II: Noise Survey Results

Date(s)	Wednesday 9 June 2021
Equipment	Rion NA-28 'Class 1' sound analyser (S/N: 00960036) Rion NC-74 'Class 1' sound calibrator (S/N: 00430648) Kestrel 2500 Portable Weather Meter (S/N: 2556870) Tripod
Weather	Daytime: Dry, ~24°C with low winds <3 $m.s^{-1}$ and a clear sky Evening: Dry, ~19°C with low winds <2 $m.s^{-1}$ and a clear sky

Location A: On Scholars Mews

Time		Measured Sound Levels (dB)			Comments
Start	End	L_{Amax}	$L_{Aeq,T}$	$L_{A90,T}$	
Daytime					
14:06	14:21	61.5	46.8	41.0	Some distant road traffic noise. Bird noise. Distant vehicle reversing siren. Some distant aircraft noise. Some brief noise from resident down the road moving their bins.
14:21	14:36	66.1	46.8	41.0	Some distant road traffic noise. Bird noise. Distant vehicle reversing siren. Some distant aircraft noise. Distant child shouting. Brief very distant metallic bang no observed effect on L_{A90}.
16:08	16:23	56.2	42.6	39.0	Distant road traffic noise. Bird noise. Some distant aircraft noise. Some noise from children playing nearby.
Evening					
19:53	20:08	60.0	46.2	39.8	Distant road traffic noise. Bird noise. Some distant aircraft noise. Some distant lawn mower noise.
20:20	20:34	59.0	44.7	38.8	Distant road traffic noise. Bird noise. Some distant aircraft noise. Some low level distant noise from people celebrating in garden.
21:51	22:07	64.5	45.0	36.1	Distant road traffic noise. Some bird noise. Some distant aircraft noise. Some level noise from people celebrating in nearby garden. Some low level noise from residents talking in driveway, no noticeable effect on L_{A90}.