

ATELIER CRESCENDO

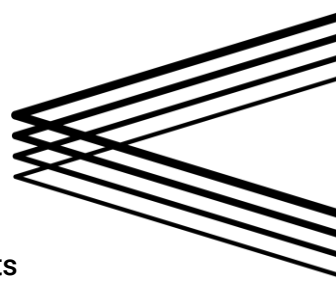
DAY ARCHITECTURAL LTD

**ENDOSCOPY UNIT,
WYTHENSHAW HOSPITAL**

**PLANT NOISE IMPACT ASSESSMENT REPORT
REVISION B**

03/10/2024





<i>Document Version</i>	<i>Date</i>	<i>Author</i>	<i>Comments</i>
<i>A</i>	18/04/2024	Marc Fuzellier-Hart	-
<i>B</i>	03/10/2024	Marc Fuzellier-Hart	Number of AHUs changed from five to four.

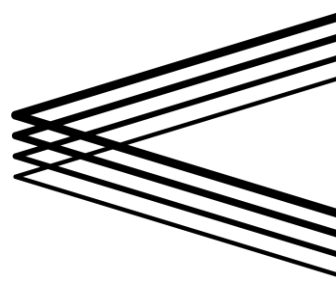
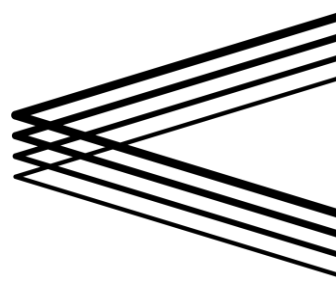


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1 **EXECUTIVE SUMMARY**

A new Endoscopy unit is proposed at Wythenshawe Hospital, Manchester.

As part of the proposals, 4 new Air Handling Units are proposed at roof level.

Therefore, Atelier Crescendo have been appointed to undertake a plant noise impact assessment the new units may have on the nearest noise sensitive receptors.

A fully automated background noise survey has been carried out to establish the existing background noise levels at the nearest noise sensitive receptors.

Following the review of the proposals and calculations, the assessment shows that the noise levels (presented in Table 5) generated by the AHUs proposed at roof level are lower than the plant noise emission limits (presented in Table 4) and therefore achieve the requirements set by the Local Authority.

Detailed calculations are available upon request.



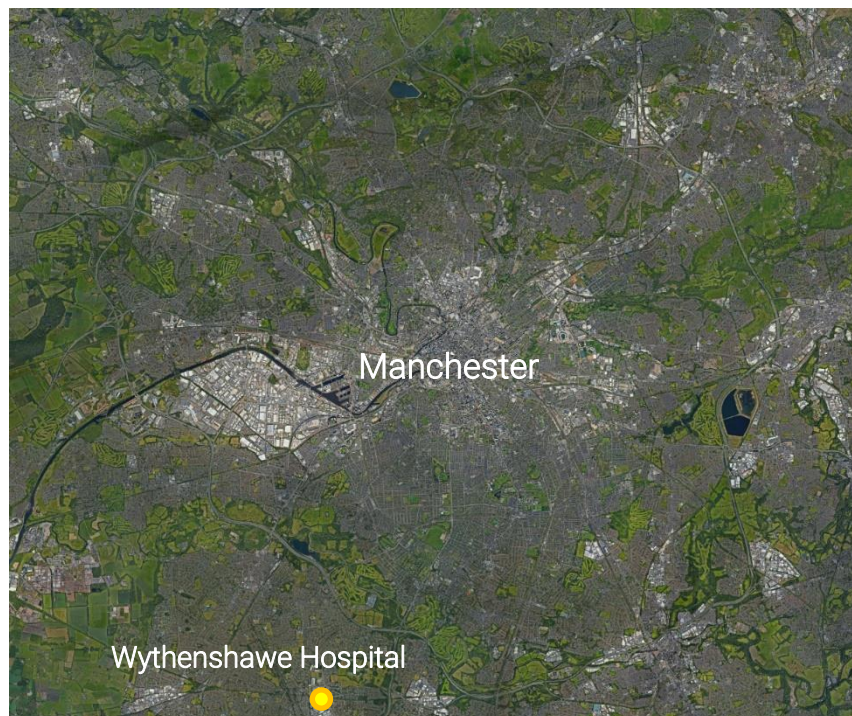
2 SITE DESCRIPTION AND PROPOSALS

2.1 LOCATION

The site is located at Wythenshawe Hospital and falls within the jurisdiction of Manchester City Council.

The approximate site location is indicated on Figure 1 below.

Figure 1 - Approximate site location (in yellow)



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2.2 SITE DESCRIPTION & PROPOSALS

As part of the creation of a new Endoscopy Unit at Wythenshawe Hospital, 4 new Air Handling Units (AHUs) are proposed on the roof of the hospital. More exactly to the north of the site, above unit B63 near entrance 5 as shown on the Figure 2 below.

The nearest noise sensitive receptors are patient rooms at minimum 10 meters from the location proposed for the AHUs.

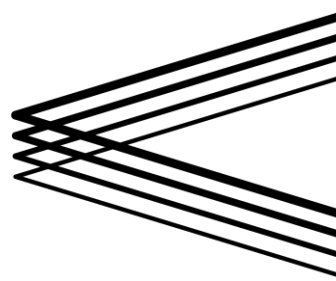
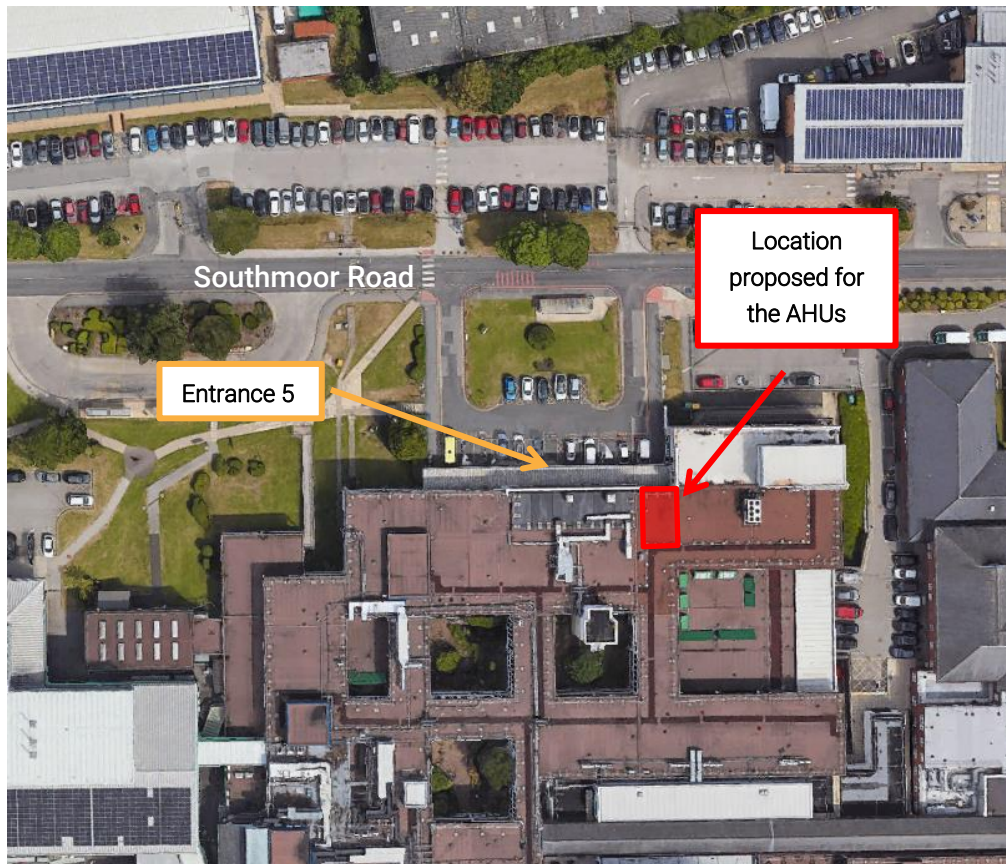
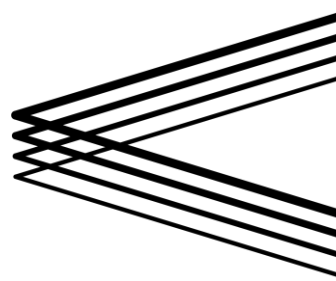


Figure 2 - Site description



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3 LEGISLATION AND GUIDELINES

3.1 LOCAL AUTHORITY REQUIREMENTS

The site falls within the jurisdiction of Manchester City Council.

Plant noise requirements are set in Planning & Noise – Technical Guidance (June 2022), issued by Manchester City Council, as follows:

“Noise from fixed plant, equipment or machinery can be very annoying and disruptive to people living nearby particularly where that item involved emits a noise with impulsive or tonal characteristics.

Many of the complaints Environmental Health receive about noise from plant, equipment and machinery specifically concern the character of the noise emitted. Any noise assessment needs to consider not only the overall level of noise emitted, but also its particular characteristics. The noise assessment should be based on BS 4142, and any application for fixed plant, equipment or machinery must demonstrate that:

*‘Externally mounted ancillary plant, equipment and servicing shall be selected and/or acoustically treated in accordance with a scheme designed so as to achieve a rating level of **5dB (LAeq) below the typical background (LA90)** level at the nearest noise sensitive location’.*

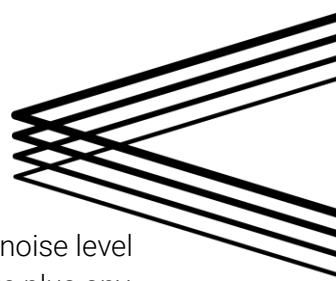
*By designing the sound pressure level of any plant items to generate a noise impact of at **least 5dB below the existing background level**, any plant noise impact should be of a negligible level which should not give rise to complaints from users or occupiers of existing noise-sensitive usages. See Appendix A with regards to the expectation of how to calculate a ‘typical’ background level.*

Past experience has shown that this criterion can be readily achieved. Where available, product specification data for new items should be submitted with the acoustic report.

Consultants should be using these to compare with data from the noise survey and propose mitigation where the levels are above those specified in the criterion. Where this information is not available a consultant may choose to measure the noise, levels generated by the equipment in question where the equipment has already been installed elsewhere (and in accordance with BS 4142).“

3.2 BRITISH STANDARD 4142 - METHOD FOR RATING AND ASSESSING INDUSTRIAL AND COMMERCIAL SOUND

BS 4142:2014 describes methods for rating and assessing the effects of outdoor sound levels, of an industrial and/or a commercial nature, “on people who might be inside or outside a dwelling or premises used for residential purposes upon which sound is incident”.



The impact of a specific sound is indicated by subtracting the existing background noise level from the rating level (i.e. noise level from the proposed items of plant/machinery/etc plus any acoustic feature corrections).

The standard states that:

- > “a difference of around +10dB or more is likely to be an indication of a significant adverse impact”;
- > “a difference of around +5dB is of marginal significance is likely to be an indication of an adverse impact”;
- > “where the rating level does not exceed the background sound level, this is an indication of the specific sound source having a low impact”.

The noise from the current redevelopment is expressed in terms of a rating level and given as a $L_{Aeq, T}$ noise level. The existing background noise level is expressed in terms of a $L_{A90, T}$ noise level.

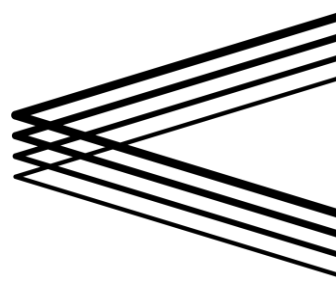
T is the assessment time interval, 1 hour for operations during day time (07:00 – 23:00) and 15-minutes for operations during night-time hours (23:00 to 07:00 hours).

BS 4142:2014 states that if a noise source contains an ‘acoustic feature’, such as tonality, intermittency or impulsiveness, a penalty should be applied.

A penalty of between 0 dB and +6 dB can be applied for tonality, and the standard states, *“Subjectively, this can be converted to a penalty of 2 dB for a tone which is just perceptible at the noise receptor, 4 dB where it is clearly perceptible, and 6 dB where it is highly perceptible”.*

A penalty of up to +9dB can be applied for impulsivity, and the standard states. *“Subjectively, this can be converted to a penalty of +3 dB for impulsivity which is just perceptible at the noise receptor, +6dB where it is clearly perceptible, and +9 dB where it is highly perceptible”.*

A penalty of +3dB can be applied for intermittency, and the standard states: *“When the specific sound has identifiable on/off conditions, the specific sound level ought to be representative of the time period of length equal to the reference time interval which contains the greatest total amount of on time. This can necessitate measuring the specific sound over a number of shorter sampling periods that are in combination less than the reference time interval in total, and then calculating the specific sound level for the reference time interval allowing for time when the specific sound is not present. If the intermittency is readily distinctive against the residual acoustic environment, a penalty of 3 dB can be applied.”*



4 BACKGROUND NOISE SURVEY

A background noise survey was undertaken from Monday 30 October until Tuesday 31 October 2023, during day (07:00 – 19:00), evening (19:00 – 23:00) and night-time (23:00 – 07:00) periods, to determine the representative background noise levels around the site and inform the assessment of the noise generated by the new AHUs.

The survey consisted of unmanned measurements.

This Chapter summarises the survey methodology and the results.

4.1 MEASUREMENT LOCATION

The noise level measurements were undertaken at a single location as described in the Table 1 below and shown on Figure 3 below.

Table 1 - Description of the measurement location

Measurement Location	Description
1	The sound level meter was located on the roof of Wythenshawe Hospital, away from the existing plant as much as possible. The microphone was positioned at approximately 1.5 m above the roof. This location was selected to obtain the representative background noise levels at the window of the nearest patient rooms (i.e. below the location proposed for the AHUs).

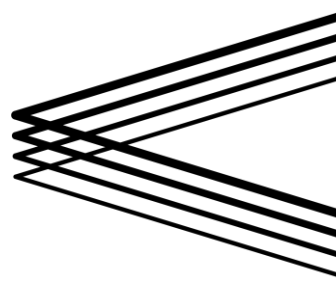
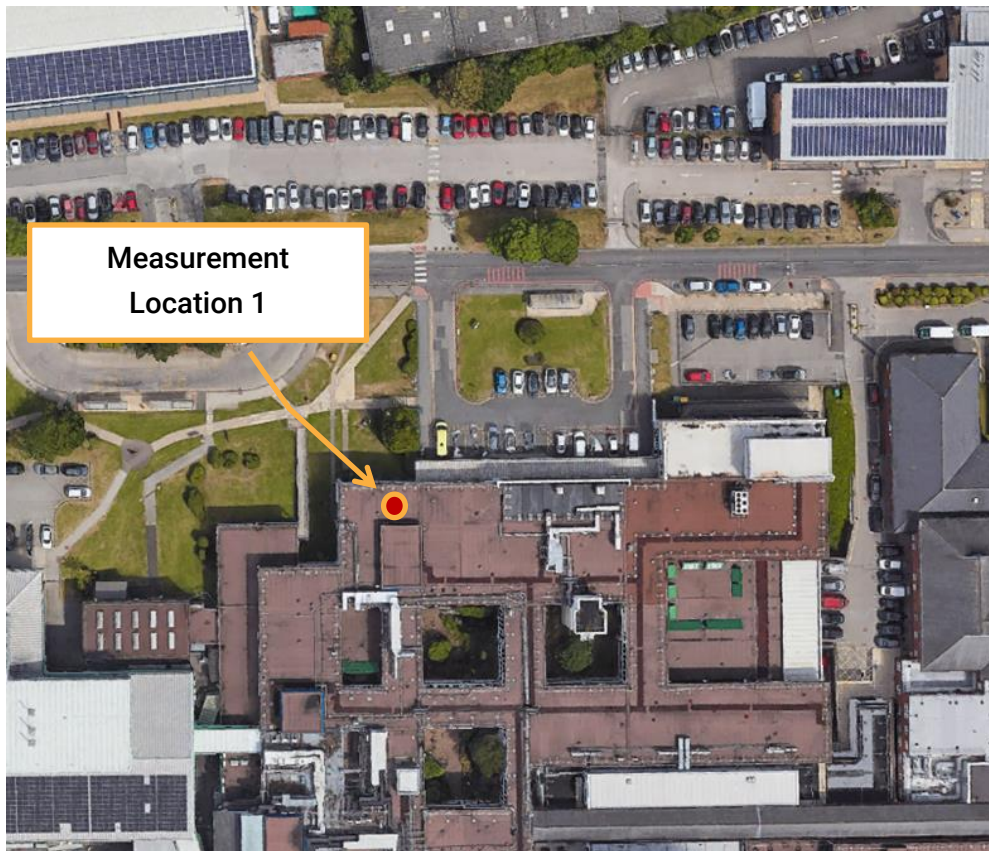


Figure 3 - Noise measurement location



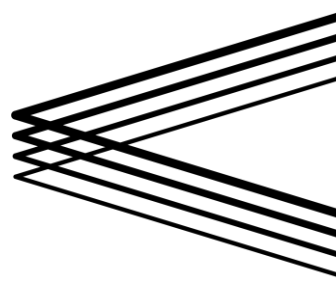
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4.2 MEASUREMENT EQUIPMENT

The Table 2 below presents the details of the instrumentation used to undertake the measurements.

Table 2 - Details of measurement instrumentation

<i>Equipment</i>	Manufacturer & Model	Serial Number	Calibration Due Date
<i>Sound level meter</i>	Svantek Type 971a	133607	20/02/2024
<i>Pre-amplifier</i>	Svantek SV 18A	103491	
<i>Microphone</i>	Svantek Type 7152	85914	



<i>Equipment</i>	Manufacturer & Model	Serial Number	Calibration Due Date
<i>Calibrator</i>	Svantek SV33B	139040	23/02/2024

The sound level meter was located in an environmental case with the microphone connected to the sound level meter via an extension cable. The microphone was fitted with a Svantek windshield.

The equipment was calibrated prior to and on completion of the survey. No significant deviations occurred (no more than 0.1 dB).

4.3 SURVEY RESULTS

For the purpose of the assessment, Table 3 below details the lowest background noise levels measured during daytime (07:00–19:00), evening time (19:00–23:00) and night-time (23:00–07:00) periods.

Table 3 - Results of background noise survey

<i>Time period</i>	Minimum Background Noise Levels
	$L_{A90,T}$
	(T=1 hour for daytime and 15 min for night-time periods)
<i>Daytime</i> (07:00 – 23:00)	51 dB
<i>Evening time</i> (19:00 – 23:00)	49 dB
<i>Night-time</i> (23:00 – 07:00)	48 dB

Figure 4 below presents a time history graph with the 15-minute A-weighted (dBA) L_{90} , L_{eq} and $L_{max,f}$ measured throughout the duration of the survey.

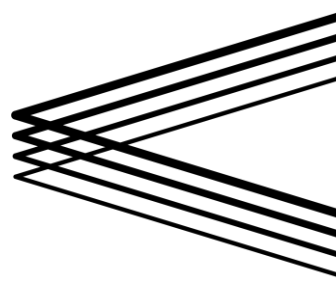
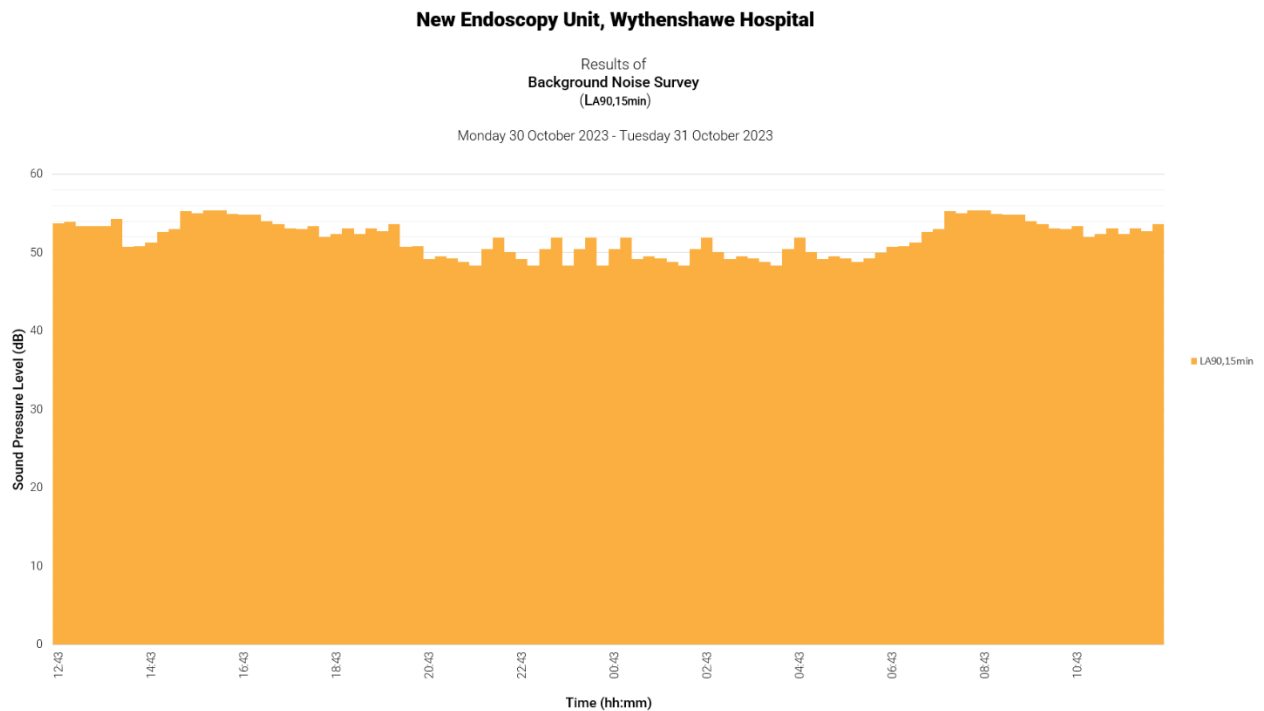


Figure 4 - Time history graph



4.4 METEOROLOGICAL CONDITIONS

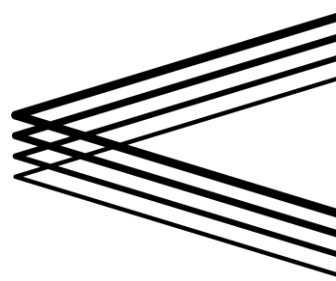
At the beginning and the end of the unmanned measurements, the weather conditions during the noise survey were noted to be dry and the sky was clear. The wind speeds perceived to be below 5 m/s. The ground was identified to be dry under foot.

The local temperature was recorded as approximately 10°C during the day and approximately 2°C during the night.

These conditions were considered conducive for undertaking accurate and reliable background noise measurements around the site.

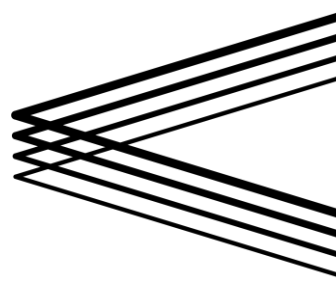


Note: Rainfalls were recorded during short periods. Therefore, noise levels measured during these periods were discounted from the assessment.



4.5 DISCUSSION OF NOISE CLIMATE

During attendance, the site was noted to be moderately loud and the dominant noise source was noted to be plant located on the roof of the hospital and distance road traffic.



5 PLANT NOISE ASSESSMENT

5.1 OVERVIEW

As discussed in Section 2.2, 5 new AHUs are proposed to serve the new Endoscopy Unit.

Therefore, this section presents a detailed noise impact assessment of the AHU noise on the nearest noise sensitive receptors.

5.2 PROPOSALS

4 new AHUs are proposed to be installed at roof level and will be located at minimum 10 meters away from the nearest noise sensitive receptors, i.e. patient rooms on the floor levels below.

All units will be located in an enclosure made of 25 mm double metal skinned panels with mineral wool (min. 60 kg/m³) and 1500 mm long attenuators (with a free area of 35%) will be fitted to all inlets and outlets.

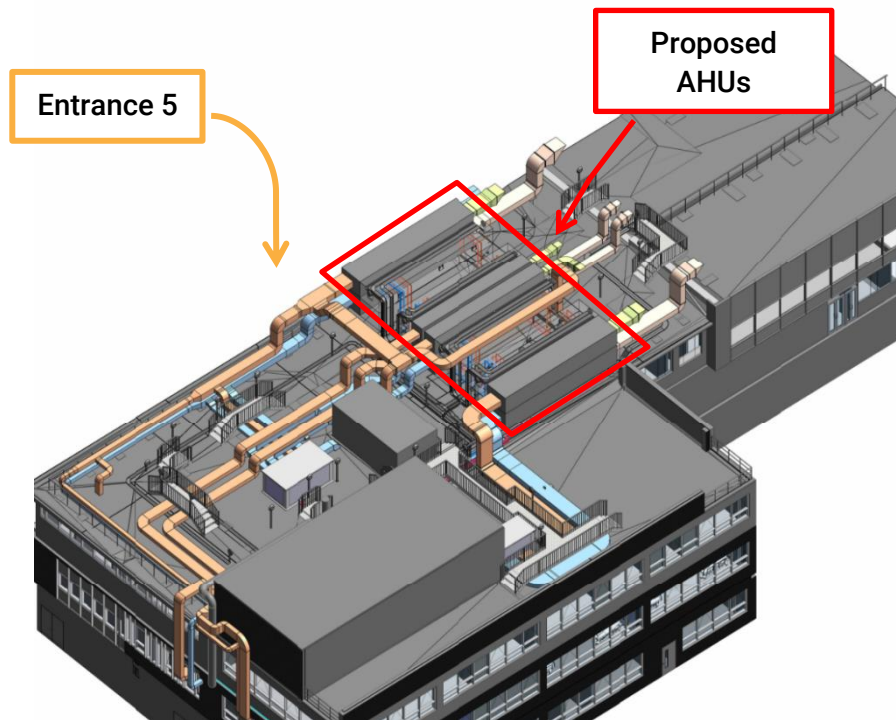
The location of each element is shown on Figure 5 below.

The maximum sound power or pressure levels of the proposed equipment are presented in Appendix B.

The proposed operation of Cardio Respiratory unit is between 07:00 and 19:00 hours. Therefore, the plant are likely to be operated during this time period as well.

It is understood that all other plant or equipment installed externally will be quiet.

Figure 5 – Location of the proposed AHUs



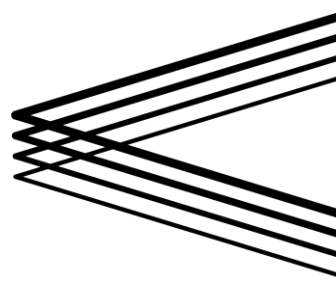
5.3 PLANT NOISE EMISSION LIMITS

As discussed in Section 3.1, noise generated by new AHUs associated with the new Endoscopy Unit should be controlled so that it is no greater than 5 dB below the prevailing background noise levels at the nearest noise sensitive properties.

Based on this and the results of the background noise survey (presented in Section 4.3), Table 4 below presents the cumulative plant noise emission limits not to be exceeded at the nearest residential properties for daytime (07:00 – 19:00) evening time periods (19:00 – 23:00) and night time (23:00 – 07:00) periods.

Table 4 – Plant Noise Emission Limits

Time period	Plant Noise Emission Limits (to be achieved at 1m from any noise sensitive window)
	$L_{Ar,Tr}^*$
Daytime (09:00 – 19:00)	46 dB
Evening time (19:00 – 23:00)	44 dB



<i>Time period</i>	Plant Noise Emission Limits (to be achieved at 1m from any noise sensitive window)
	$L_{Ar,Tr}^*$
Night-time (23:00 – 07:00)	43 dB

*Tr=1hour for daytime and evening time periods; T=15min for night-time period

5.4 PLANT NOISE CALCULATIONS

Based on the proposals presented in Section 5.2, calculations have been undertaken to predict the plant noise emission levels at the nearest noise sensitive receptors, i.e. patient rooms on the floor levels below.

For the calculations, it has been assumed that the plant can be operated continuously over minimum 1 hour.

The calculations consider distance, directivity and screening losses.

In line with BS 4142:2014 methodology, the noise from all the plant has been assessed to be free from tonality or irregularity.

Table 5 below presents the results of the calculations. Details of the calculations are available upon request.

*Table 5 – Plant Noise Emission Levels at the nearest noise sensitive receptors,
i.e. patient rooms on the floor levels below.*

<i>Receptor</i>	Worst-case Plant Noise Emission Levels (at 1m from any noise sensitive window)
	$L_{Ar,1hr/15min}$
Nearest noise sensitive receptors, i.e. patient rooms on the floor levels below.	43 dB

5.5 CONCLUSION

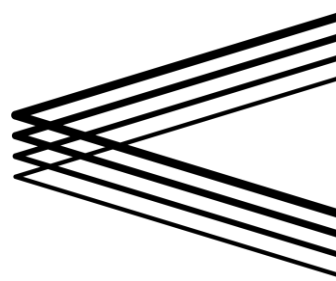
The calculated plant noise emission level, presented in Table 5, is lower than the plant noise emission limits presented in Table 4.

In conclusion, the noise levels from the new AHUs, proposed at roof level for the new Endoscopy Unit are likely to achieve the Local Authority's requirements and, therefore, unlikely to cause any adverse impact on the nearest residential properties.

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APPENDIX A

ACOUSTIC TERMINOLOGY

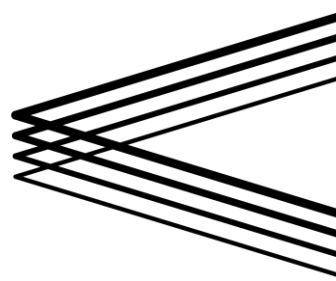


<i>Terminology</i>	<i>Description</i>
<i>Sound Pressure</i>	Sound, or sound pressure, is a fluctuation in air pressure over the static ambient pressure.
<i>Decibel (dB)</i>	Used as a measurement of sound pressure level. It is the logarithmic ratio of the noise being assessed to a standard reference level.
<i>A-weighting, dB(A)</i>	The human ear is more susceptible to mid-frequency noise than the high and low frequencies. To take account of this when measuring noise, the 'A' weighting scale is used so that the measured noise corresponds roughly to the overall level of noise that is discerned by the average human. It is also possible to calculate the 'A' weighted noise level by applying certain corrections to an un-weighted spectrum. The measured or calculated 'A' weighted noise level is known as the dB(A) level. Because of being a logarithmic scale noise levels in dB(A) do not have a linear relationship to each other. For similar noises, a change in noise level of 10dB(A) represents a doubling or halving of subjective loudness. A change of 3dB(A) is just perceptible.
<i>L_{eq,T}</i>	A noise level index called the equivalent continuous noise level over the time period T. This is the level of a notional steady sound that would contain the same amount of sound energy as the actual, possibly fluctuating, sound that was recorded.
<i>L_{max}</i>	L _{max} is the maximum sound pressure level recorded over the period stated. L _{max} is sometimes used in assessing environmental noise where occasional loud noises occur, which may have little effect on the L _{eq} noise level.
<i>L₉₀</i>	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, hence L ₉₀ is the level exceeded for 90% of the time and as such can be regarded as the background noise level'.
<i>Façade</i>	At a distance of 1m in front of a large sound reflecting object such as a building façade.
<i>Octave Band</i>	Octave Band A range of frequencies whose upper limit is twice the frequency of the lower limit.

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APPENDIX B

PLANT NOISE DATA



AHU reference	Element of AHU		Sound Power Levels (dB) in octave band centre frequency								dBA
			63	125	250	500	1000	2000	4000	8000	
AHU01	Supply	Inlet (outdoor)	80	89	80	76	66	63	59	54	78
		Outlet (supply)	78	90	83	78	77	74	70	66	
	Extract	Inlet (extract)	73	82	74	70	62	60	55	51	
		Outlet (exhaust)	71	84	76	73	73	71	67	63	78
	Surrounding (assumed at 1m)		61	70	58	54	47	42	34	41	57
AHU02	Supply	Inlet (outdoor)	80	89	80	76	66	63	59	54	78
		Outlet (supply)	78	90	83	78	77	74	70	66	
	Extract	Inlet (extract)	73	82	74	70	62	60	55	51	
		Outlet (exhaust)	71	84	76	73	73	71	67	63	78
	Surrounding (assumed at 1m)		61	70	58	54	47	42	34	41	57
AHU04	Supply	Inlet (outdoor)	73	75	77	75	70	66	64	61	76
		Outlet (supply)	72	78	82	77	78	76	72	69	
	Extract	Inlet (extract)	76	73	75	74	68	64	62	61	
		Outlet (exhaust)	74	76	81	76	77	74	71	68	81
	Surrounding (assumed at 1m)		57	58	57	53	48	44	36	44	55
AHU05	Supply	Inlet (outdoor)	74	74	78	76	70	66	64	62	77
		Outlet (supply)	73	77	83	78	79	76	73	70	
	Extract	Inlet (extract)	85	84	83	82	74	70	68	70	
		Outlet (exhaust)	81	82	87	84	84	81	77	77	88
	Surrounding (assumed at 1m)		64	62	62	60	54	49	41	52	61

*maximum sound power levels assumed