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Starbucks, Reading

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Spaces Austen House
Station View
Guildford
Surrey
GU1 4AR

Office Tel: 01483 924687
Email: hello@pulsaracoustics.co.uk
Website: <https://pulsaracoustics.co.uk/>
Company Registration No. 13768586
VAT Registration No. 396633356



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Limitations			
This report has been prepared for the titled project and client in accordance with our agreed scope of work, document reference: PAL-01064/SC1, dated 25 November 2022.			
This report should not be used or relied upon for any other project or purpose without the written authorisation of Pulsar Acoustics Ltd. Pulsar Acoustics Ltd accepts no responsibility or liability for the consequences of this document if it is used for a purpose other than for the project to which it was intended. The findings and opinions included herein are based on measurements and information gathered prior to the date the report was issued. If additional information becomes available which may affect our comments, recommendations or conclusions, then Pulsar Acoustic Ltd should be informed. We then reserve the right to review the information, assess any new potential concerns, and modify our advice accordingly.			



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1.0 - Introduction

A new Starbucks is being constructed in Reading Link Retail Park, Rose Kiln Lane, Reading, with Application No: 220737.

As part of the design new building services plant items are proposed, and as such an acoustic assessment is required to satisfy Reading Borough Council Planning Condition 22.

Pulsar Acoustics has therefore been commissioned to undertake an acoustic assessment of the proposed plant items, comment on its acceptability with reference to the council proposed criteria, and recommend acoustic mitigation measures if necessary.

2.0 - Site Description and Proposal

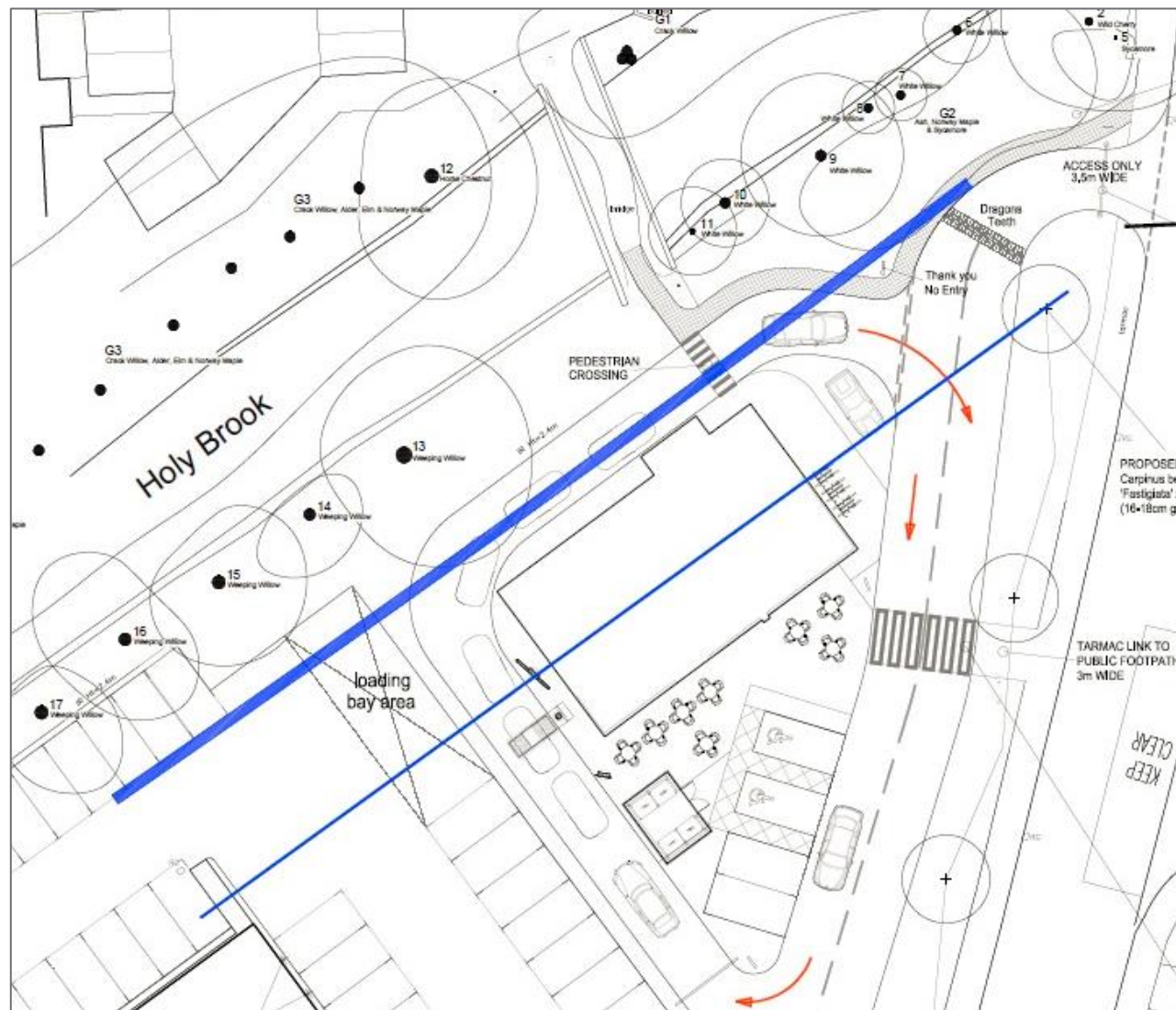
A new Starbucks is being constructed in the car park of the existing Matalan shop. The approximate outline is indicated in red on the Google Map aerial photo below.

Rose Kiln Lane is to the east, there are residential dwellings to the north, and the Matalan store is to the south west.





The layout plan below has been taken from Sorbon Estates architectural drawing RLRPRKL_PLN_1.



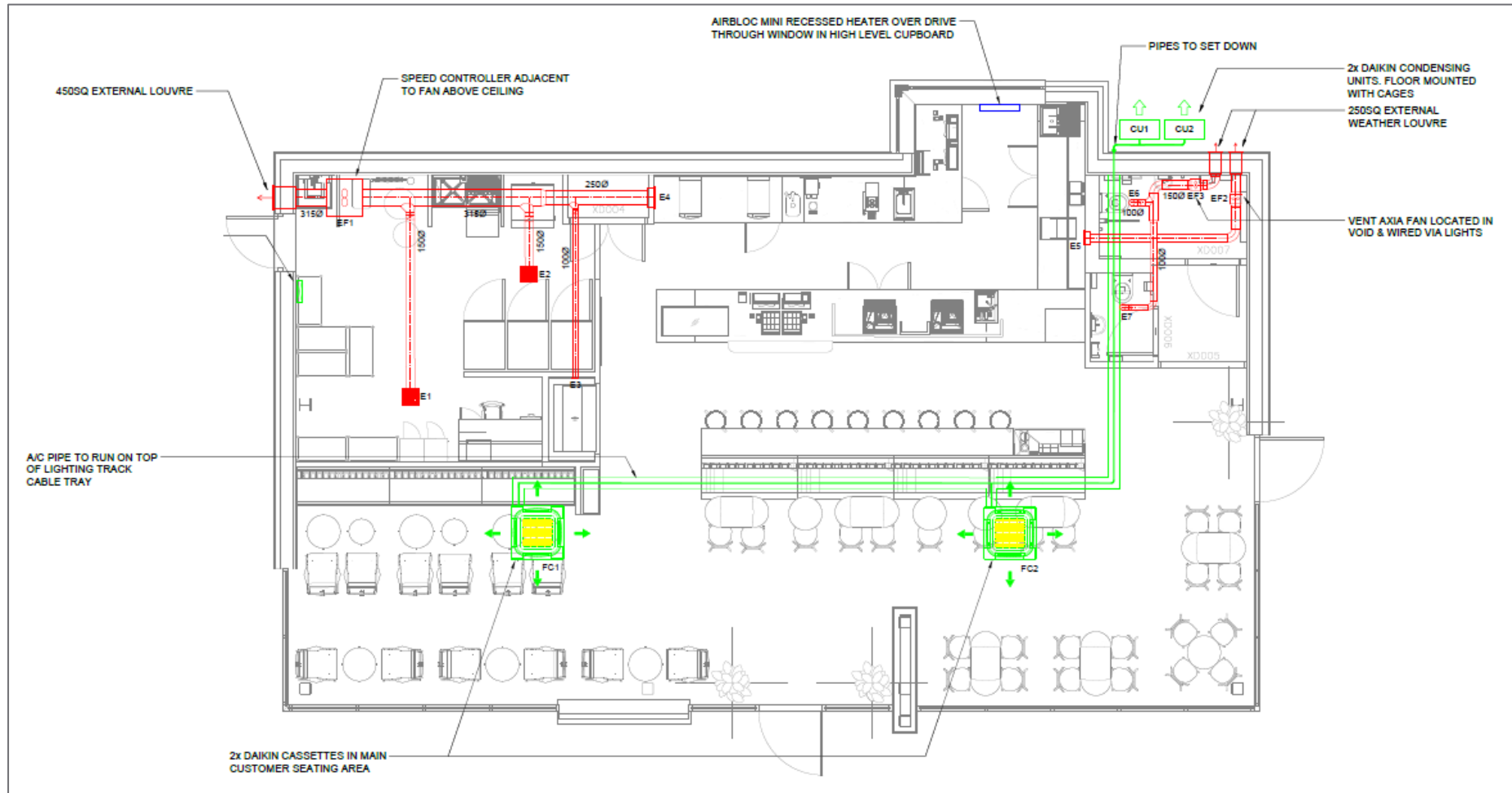


We have overlaid the architectural drawing over the Google Map to enable us to measure the approximate distances to the nearest noise sensitive residential windows.





The image below presents the proposed building services layout. The outlet grille for extract fan EF1 is approximately 35m away from the nearest noise sensitive window. Condenser units CU1 and CU2 are approximately 36m away from the nearest noise sensitive window. The outlet grilles for extract fans EF2 and EF3 are also around 36m away from the nearest noise sensitive window.





3.0 - Industry Guidance & Criteria

An acoustic assessment is required to satisfy Reading Borough Council Planning Condition 22. The wording below is copied from the decision notice.

“22. No mechanical plant shall be installed until a noise assessment of the proposed mechanical plant has been submitted and approved by the Local Planning Authority. The assessment shall be carried out for in accordance with BS4142:2014 methodology. The predicted specific sound level (LAeq,TR) (with reference to BS:4142) as measured at a point 1 metre external to the nearest noise-sensitive facade shall be at least 10dB below the pre-existing background sound level, LA90,T when all plant/equipment (or any part of it) is in operation. The predicted rating level, LAr,Tr (specific sound level plus any adjustment for the characteristic features of the sound) as measured at a point 1 metre external to the nearest noise-sensitive façade (habitable window of a dwelling) shall not exceed the pre-existing background sound level, LA90,T when all plant/equipment (or any part of it) is in operation. The plant shall thereafter only be installed in accordance with the assessment and shall thereafter be maintained so that it operates to the same standard.

Reason: To safeguard the amenities of the adjoining premises and the area generally, in accordance with Policy CC8 and EN17 of the Reading Borough Local Plan 2019.”

We understand there is also a BREEAM requirement POL-05 for the project, which suggests plant noise should be designed to be 5dBA below background.

The BREEAM requirement (5dB below) is less stringent than the Council criteria (10dB below), therefore we would expect the BREEAM assessor to accept this report as evidence for BREEAM compliance with POL-05.



4.0 - Measurements

4.1 - Methodology

Sound level measurements were undertaken to determine the existing noise climate on site.

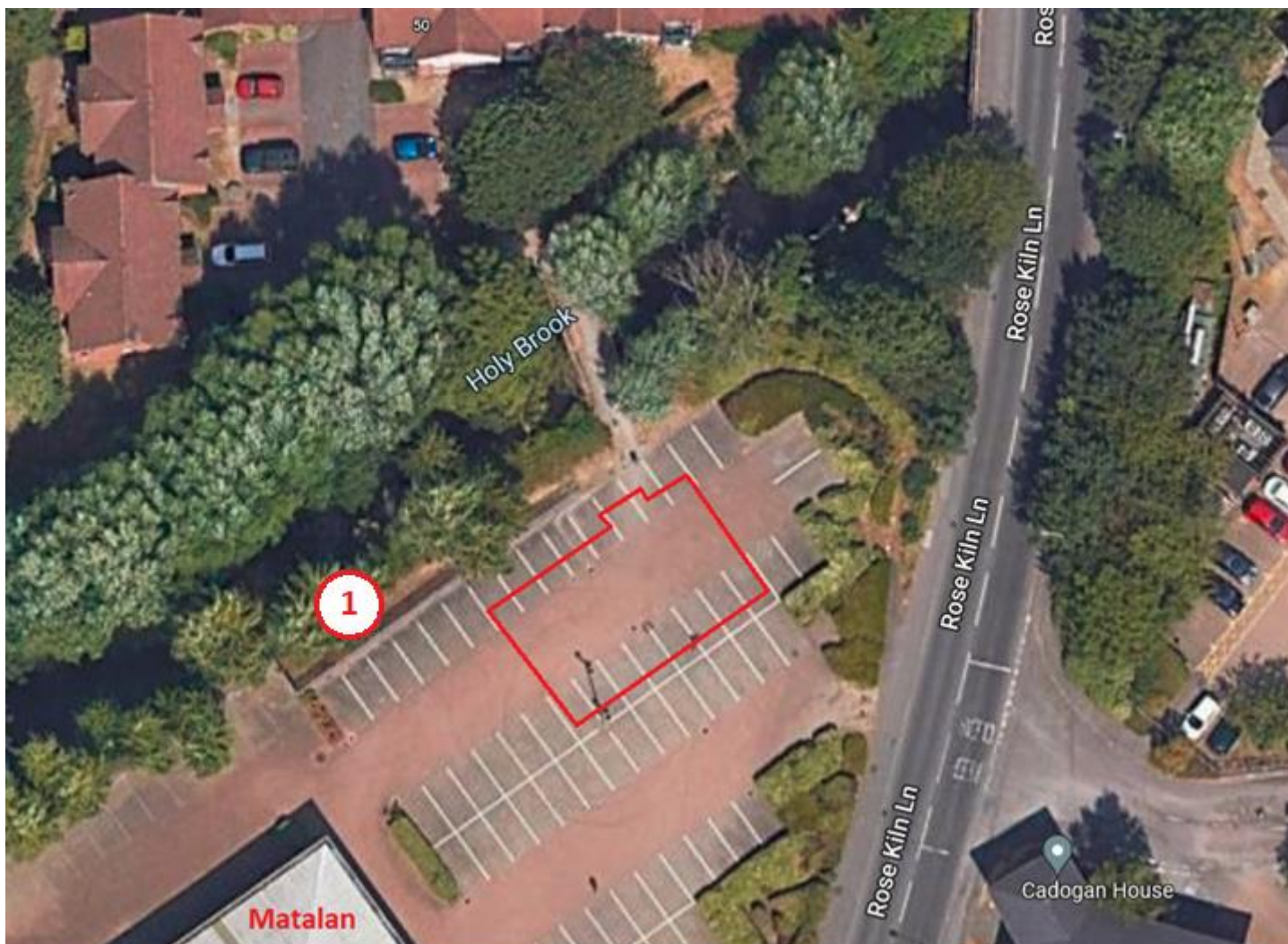
A fixed position sound level meter was set up from around 11:00 hours on 07 December 2022, to 11:00 hours on 08 December 2022. The sound level meter was set to log many statistical parameters in 15-minute intervals, including dBA L90 for comparison to the council planning condition.

The following equipment was used to undertake the survey.

Position	Item	Make	Model	Serial Number	Annual IEC Calibration
1	Sound Level Meter - Class 1	Larson Davis	LD-LXT	0003615	28 February 2022
	Preamplifier - Class 1	Larson Davis	PRMLXT1L	027681	28 February 2022
	Microphone - Class 1	Larson Davis	PCB377B02	W133370	28 February 2022
	Hand Held Calibrator - Class 1	G.R.A.S.	GRAS-42AG	280968	17 November 2022

The equipment calibration was spot checked using the hand-held calibrator before and after the survey and no significant change was found. (No more than 0.1dB).

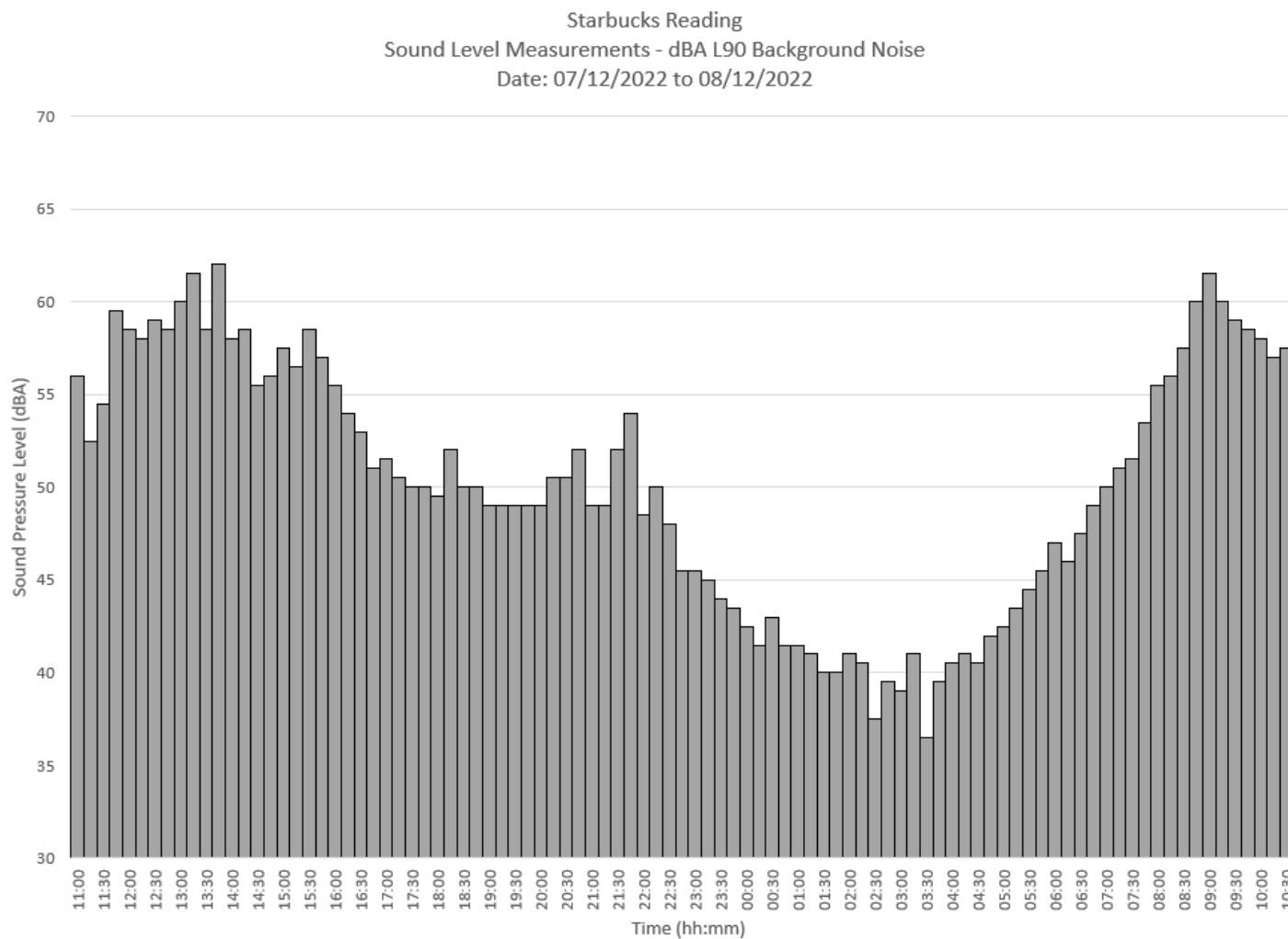
The approximate measurement position is indicated on the site plan below. The sound level meter was located at the rear of site. The microphone was attached to an extension pole which protruded above the boundary fence at a height of approximately 2.5m above ground. We believe the location of the sound level meter was suitably representative of the ambient background noise levels incident around the neighbouring property.





4.2 –Measurement Data

The dBA L90 sound level data has been plotted on the time history graph below.





The Starbucks is proposed to be open from around 6am to 10pm. The lowest dBA L90 measured between these hours was 46dBA.

As described in the planning condition, the predicted plant noise level required at a point 1 metre external to the nearest noise-sensitive façade, should be 10dBA below the existing L90 background sound level. Therefore the design criteria is 36dBA when all plant items are in operation.

5.0 - Plant Noise Assessment

The proposed plant items are described in the table below.

Description	Make	Model
Extract fan - EF1	Soler & Palau	315mm - TD-2000/315N-3V
Extract fan - EF2	Soler & Palau	150mm - TD-500/150-3V
Extract fan - EF3	Soler & Palau	150mm - TD-500/150-3V
External condenser unit - CU1	Daikin	AZAS125MV1
External condenser unit - CU2	Daikin	AZAS125MV1

The following table presents the manufacturer's sound pressure (Lp) level data for the Daikin condenser units CU1 and CU2, which are located approximately 36m away from the nearest noise sensitive residential facade.

Description	Octave Band Frequency (Hz) Sound Pressure Level (dB, Lp)								dBA
	63	125	250	500	1000	2000	4000	8000	
Daikin AZAS125MV1 - Cooling	56	56	52	53	48	43	39	34	54
Daikin AZAS125MV1 - Heating	55	63	58	55	51	47	43	36	57

The proposed Soler & Palau extract fans have three speed settings (high/medium/low), and has sound level data for 9 measured working points of airflow (m³/h) and pressure (Pa). The high-speed setting correlates with working points 1/2/3, the medium-speed correlates with working points 4/5/6, and the low-speed correlates with working points 7/8/9.



We are unaware of the airflow and pressure levels likely in the system and have requested this information. However, this might not become available until the system is installed and commissioned. In the meantime, we have been told to use the middle speed setting and as such we have assumed and used the noise data for working point 5. Working point 5 is the middle point for airflow and pressure values for medium speed for each fan. The difference in noise level between working points 4/5/6 is only 3dB, which is a negligible difference, and as such the advice provided would likely be the same for each.

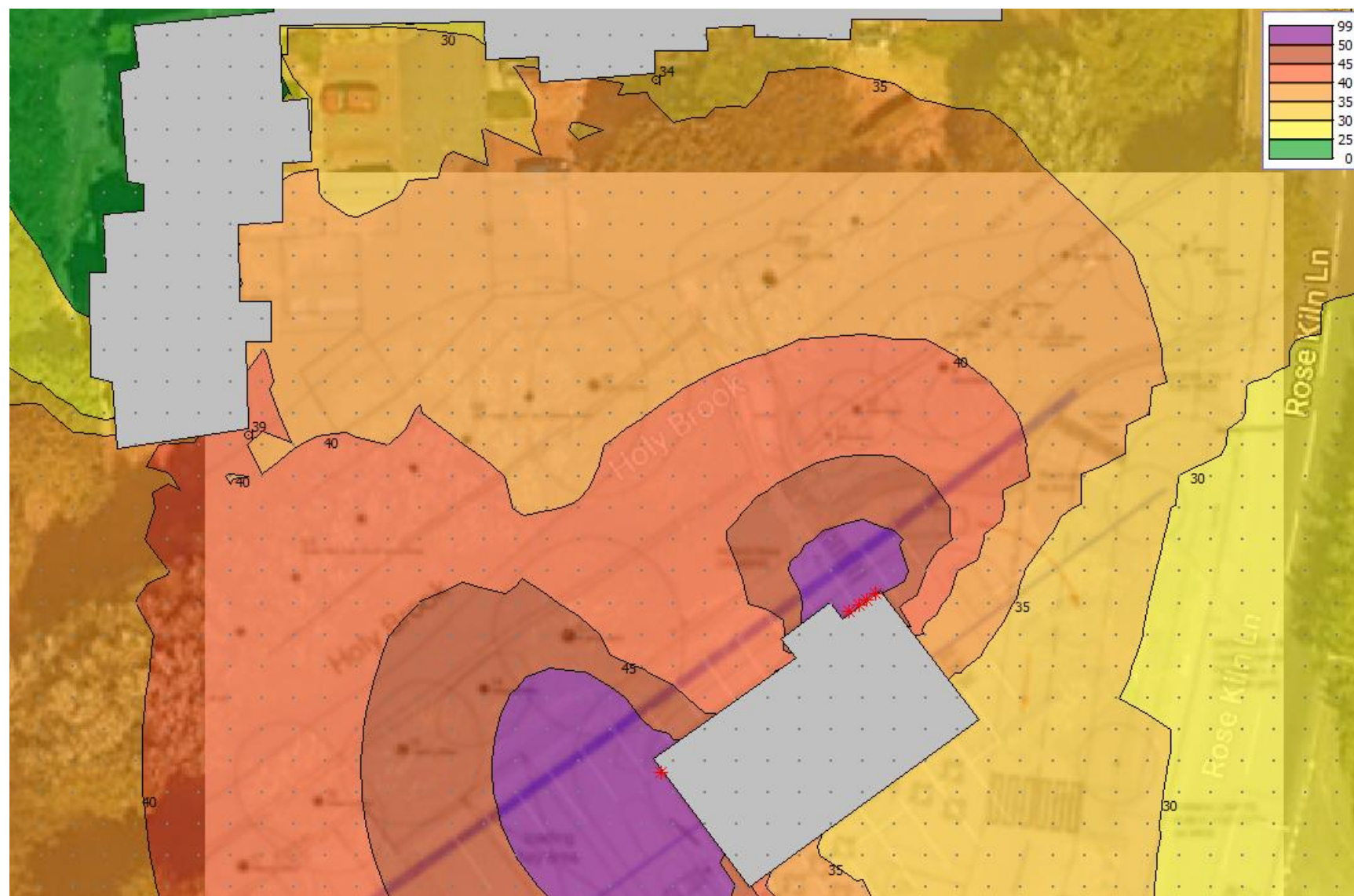
The table below presents the manufacturer's sound power (Lw) level, airflow (m³/h) and pressure (Pa) data for working point 5 of the Soler & Palau extract fans, EF1, EF2 and EF3.

Description	Octave Band Frequency (Hz) Sound Power Level (dB, Lw)								dBA
	63	125	250	500	1000	2000	4000	8000	
315mm EF1 - 900 m ³ /h, 220Pa - Atmospheric Outlet	33	50	62	65	70	68	60	53	74
150mm EF2 - 400 m ³ /h, 50Pa - Atmospheric Outlet	29	32	47	53	56	55	47	38	60
150mm EF3 - 400 m ³ /h, 50Pa - Atmospheric Outlet	29	32	47	53	56	55	47	38	60

We have used the manufacturer's sound data described above within our in-house ventilation system analysis software, and created a noise model using DGMR iNoise. The noise model calculation methodology is based on '*ISO:9613 - Attenuation of sound during propagation outdoors*', and uses the recommendations of the quality standard '*ISO:17534 - Software for the calculation of sound outdoors*'.

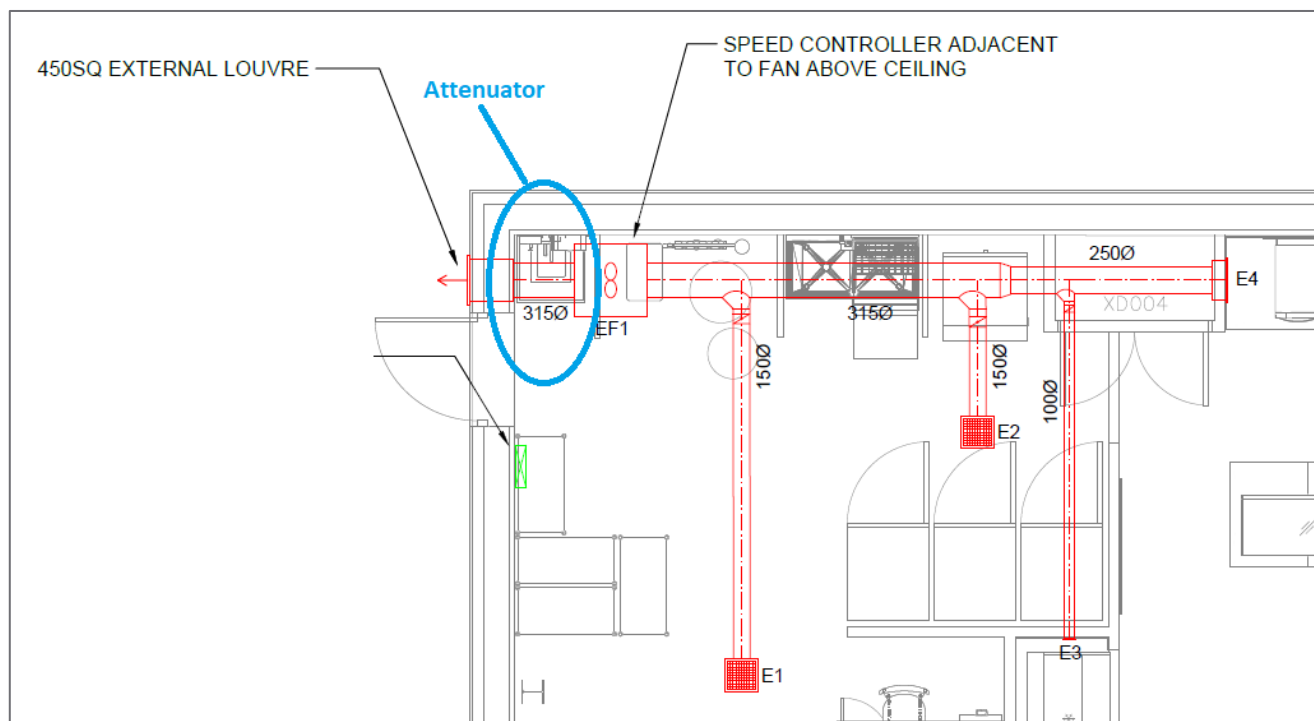
The modelling software has been used to predict the combined plant noise levels at the nearest residential facades, in the absence of any acoustic mitigation measures. The image below indicates that the predicted plant noise would be 34dBA at the residential façade to the north due to CU1, CU2, EF2 and EF3, and as such these items should comply with the criteria without any additional mitigation measures.

However, the noise model also determines that EF1 would be 39dBA at the residential façade to the northwest. This is 3dB higher than the required criteria and as such mitigation measures would be required.





We would suggest that installing an acoustic attenuator between the external louvre grille and the outlet side of EF1, as circled in the image below, should be more than capable of reducing the noise output by 3dBA.



We note the manufacturer Soler and Palau can provide a 315mm diameter 600mm length attenuator (silencer) with suitable acoustic performance.

- https://statics.solerpalau.com/media/import/documentation/EN_MOUNTING_ACC.pdf

We are unaware of any Starbucks brand specific roomside noise criteria. We would suggest provision should be made to dedicate replaceable lengths of ductwork on the roomside connections to the fans, such that roomside attenuators could also be installed if the users of the space deem the fans to be too loud.



For all items of external and internal building services, consideration should be made for resilient anti-vibration mounts/hangers to reduce the transfer of vibration and avoid detrimental structureborne sound radiating through a structure. Example anti-vibration products can be found within the S&P catalogue. It is recommended that the building services systems and anti-vibration products should be selected and installed as per CIBSE guidance.

6.0 - Conclusion

A new Starbucks is being constructed in Reading Link Retail Park, Rose Kiln Lane, Reading, with Application No: 220737. As part of the design new building services plant items are proposed, and as such an acoustic assessment is required to satisfy Reading Borough Council Planning Condition 22.

Pulsar Acoustics has been commissioned to undertake an environmental noise survey and acoustic assessment of the proposed plant items. External plant noise emission criteria have therefore been proposed based on the survey data and Planning Condition 22.

We have used manufacturer's data within our in-house ventilation systems calculations and noise modelling software, to build a colour noise map which predicts the noise impact on the nearest residential façades from the proposed items.

The calculations indicate that condenser units CU1 and CU2, and extract fans EF2 and EF3, should be capable of achieving the planning condition criteria without additional acoustic mitigation measures. However, the calculations indicate that EF1 would unlikely achieve the criteria and would require an acoustic attenuator providing a minimum sound reduction of 3dBA. We have therefore presented options for acoustic attenuators from the Soler and Palau fan manufacturer.

In conclusion, our assessment indicates that the Planning Condition 22 criteria should be achieved provided suitable mitigation measures are installed.

In addition, note the BREEAM POL-05 requirement (5dB below) is less stringent than the Council criteria (10dB below), therefore we would expect the BREEAM assessor to accept this report as evidence for BREEAM compliance with POL-05.



APPENDIX A - Acoustic Terminology

The following is an explanation for some of the acoustic parameters used in this report to describe the measurements and mitigation.

- **dB** The decibel is used as a measurement of sound pressure level. It is the logarithmic ratio of the noise being assessed to a standard reference level. This approach is advantageous for handling sound levels, where the ratio of the highest to lowest sound which humans could encounter, can be as high as 1,000,000 : 1. The ratio is considered with respect to the quietest and loudest sound we can hear. This is the threshold of hearing at the frequency of 1000Hz, which is taken as 20 μ Pa (2x10⁻⁵ Pa) of pressure for the average person. (A decibel is simply a ratio and is used in many other industries too, but most commonly in acoustic or electrical signal analysis.)
- **dBA** The human ear is more susceptible to mid-frequency noise than to higher and lower frequencies. To take account of this when measuring noise, the 'A' weighting scale is used so that the measured noise corresponds to the overall level of perception by the average human. It is also possible to calculate the 'A' weighted noise level by applying certain corrections to an un-weighted frequency spectrum (Hz). The measured or calculated 'A' weighted noise level is known as the dBA level.
- **L_{eq,T}** The equivalent continuous sound level in decibels, equivalent to the total sound energy measured over a stated period of time and is also known as the time-averaged sound level.
- **dBA L_{eq,T}** The A-weighted equivalent continuous sound level in decibels measured over a stated period of time 'T', and is sometimes written dB LA_{eq,T}.
- **L90** This parameter is the noise level exceeded for 90% of the period T (i.e. the quietest 10% of the measurement) and is often used to describe the background noise level.
- **dBA L_{max}** The maximum dBA noise level recorded during the measurement interval period.

When discussing sound levels as decibels we use a logarithmic scale, therefore the dBA values do not follow a linear relationship. When discussing similar noises, a change of 10dBA represents a doubling or halving of subjective loudness. A change of 3dBA is just perceptible by a human, but is a doubling/halving of sound energy. (i.e. 50dBA + 50dBA = 53dBA).

If you require a more detailed explanation for any of the acoustic principles or parameters discussed in this report please do not hesitate to ask.