ACOUSTIC CONSULTANTS LTD

Environmental Noise Assessment

Specsavers
2 Worthing Road, Horsham

Reference: 10665/PJW

Client


Document Control					
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The report has been prepared in good faith, with all reasonable skill and care, based on information provided or available at the time of its preparation and within the scope of work agreement with the Client. We disclaim any responsibility to the Client and others in respect of any matters outside the scope of the above. The report is provided for the sole use of the named Client and is confidential to them and their professional advisors. No responsibility is accepted to other parties.

The report limits itself to addressing solely on the noise, acoustic, and vibration aspects as included in this report. We provide advice only in relation to noise, vibration and acoustics. It is recommended that appropriate expert advice is sought on all the ramifications (e.g. CDM, structural, condensation, fire, legal, etc.) associated with any proposals in this report or as advised and concerning the appointment. It should be noted that noise predictions are based on the current information as we understand it and, on the performances noted in this report. Any modification to these parameters can alter the predicted level. All predictions are in any event subject to a degree of tolerance of normally plus or minus three decibels. If this tolerance is not acceptable, then it would be necessary to consider further measures.

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1. Introduction

Specsavers appointed Acoustic Consultants Ltd to undertake a noise impact assessment for the proposed Specsavers store, located at 2 Worthing Road, Horsham.

This report provides a noise assessment of mechanical plant associated with the store, and their effects on the nearest existing noise sensitive receivers (NSRs).

The noise impact assessment has been undertaken in accordance with the guidance in the National Planning Policy Framework (NPPF), Noise Policy Statement for England (NPSE), Planning Practice Guidance (PPG) and British Standard 4142:2014 (BS4142).

2. The Site

The site is an existing commercial building located at 2 Worthing Road, Horsham.

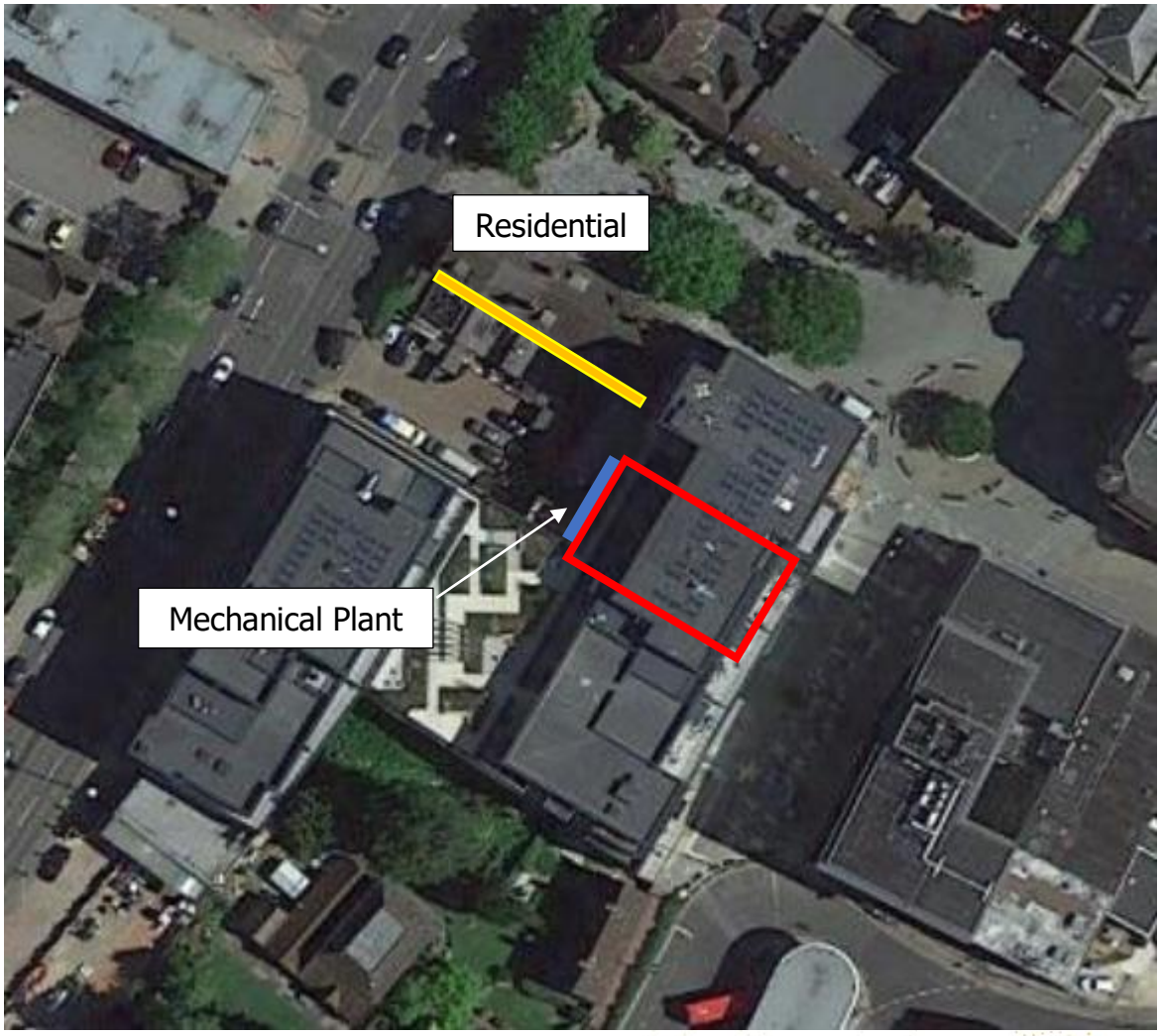
The site lies in a mixed-use area. Directly to the West and South-west of the property are new build residences which contain commercial properties on the ground floors. To the North of the propose mechanical plant area are commercial properties with residential properties on the upper floors.

Road traffic from Albion Way (B2237) primarily determines the existing noise climate at the site.

Based on the site observations and available data from Rightmove, Primelocation and Zoopla, the closest noise sensitive residence is the upper floor apartment at 5 Bishopric Court.

The proposed site location and the closest noise sensitive receptors are provided below:

Figure 1: Proposed Site and Receptors



3. Planning and Noise

3.1. National Planning Policy Framework

The National Planning Policy Framework (NPPF) was published in March 2012 and revised in December 2023. Section 15 entitled 'Conserving and enhancing the natural environment' addresses noise as a requirement of planning. Paragraph 180 states:

"180. Planning policies and decisions should contribute to and enhance the natural and local environment by:

e) preventing new and existing development from contributing to, being put at unacceptable risk from, or being adversely affected by, unacceptable levels of soil, air, water or noise pollution or land instability. Development should, wherever possible, help to improve local environmental conditions such as air and water quality, taking into account relevant information such as river basin management plans; and f) remediating and mitigating despoiled, degraded, derelict, contaminated and unstable land, where appropriate."

Paragraph 191 states:

"191. 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. "

The document does not prescribe any assessment methodology or criteria to assess the adverse effect of noise and refers you to the NPSE.

3.2. Noise Policy Statement for England

The NPPF refers to the Noise Policy Statement for England (NPSE). This was published in March 2010 and aims to provide clarity regarding current policies and practices to enable noise management decisions to be made within the wider context, at the most appropriate level, in a cost-effective manner and in a timely fashion and applies to all forms of noise including environmental noise, neighbour noise and neighbourhood noise.

The NPSE sets out the long term vision of Government noise policy. This long term vision is supported by three noise policy aims as follows:

"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."*

The NPSE introduces the concept of "Significant adverse" and "Adverse" impacts of noise which relate to the noise policy aims. These are applied as follows:

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 for England (NPSE) states that noise levels above the Lowest Observed Adverse Effect Level are acceptable in planning where reduced to a minimum.

With regard to where there is potential for noise impact it states the following in relation to the second noise policy aim:

"The second aim of the NPSE refers to the situation where the impact lies somewhere between LOAEL and SOAEL. It 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 (paragraph 1.8). This does not mean that such adverse effects cannot occur."

The NPSE does not provide any assessment criteria for the noted effect levels and each case must be considered on its merits.

The NPSE does, however, emphasise that in dealing with noise Local Planning Authorities are required to take a balanced approach in considering the benefits of development as against any adverse effects which arise. Paragraph 2.18 of the NPSE is particularly relevant in this respect and states:

"There is a need to integrate consideration of the economic and social benefits of the activity or policy under examination with proper consideration of the adverse environmental effects, including the impact of noise on health and quality of life. This should avoid noise being treated in isolation in any particular situation, i.e. not focusing solely on the noise impact without taking into account other related factors."

The planning need is outside the scope of noise and acoustics and will need to be addressed by others.

3.3. Planning Practice Guidance, Noise

The Planning Practice Guidance (PPG) on noise referred to here is based on the current version (January 2019) as provided on the Planning Guidance Website. It states that, *"Noise needs to be considered when new developments may create additional noise and when new developments would be sensitive to the prevailing acoustic environment."*

It provides generic guidance on how to determine the noise impact and what factors could be a concern.

It includes the option types to mitigate any adverse effects of noise stating that there are four broad types of mitigation. These are engineering, layout, using planning conditions or obligations and noise insulation.

Paragraph 5 of the PPG provides a table identifying the effect level and examples of effect relating to the impact effect levels provided in the NPSE. The table is duplicated below:

Table 1: PPG Noise – Perception of Effect Levels

Perception	Examples of Outcomes	Increasing Effect Level	Action
No Observed Effect Level			
Not present	No Effect	No Observed Effect	No specific measures required
No Observed Adverse Effect Level			
Present and not intrusive	Noise can be heard, but does not cause any change in behaviour, attitude or other physiological response. Can slightly affect the acoustic character of the area but not such that there is a change in the quality of life	No Observed Adverse Effect	No specific measures required
Lowest Observed Adverse Effect Level			
Present and intrusive	Noise can be heard and causes small changes in behaviour, attitude or other physiological response, e.g. turning up volume of television; speaking more loudly; where there is no alternative ventilation, having to close windows for some of the time because of the noise. Potential for some reported sleep disturbance. Affects the acoustic character of the area such that there is a small actual or perceived change in the quality of life.	Observed Adverse Effect	Mitigate and reduce to a minimum
Significant Observed Adverse Effect Level			
Present and disruptive	The noise causes a material change in behaviour, attitude or other physiological response, e.g. avoiding certain activities during periods of intrusion; where there is no alternative ventilation, having to keep windows closed most of the time because of the noise. Potential for sleep disturbance resulting in difficulty in getting to sleep, premature awakening and difficulty in getting back to sleep. Quality of life diminished due to change in acoustic character of the area.	Significant Observed Adverse Effect	Avoid
Present and very disruptive	Extensive and regular changes in behaviour, attitude or other physiological response and/or an inability to mitigate effect of noise leading to psychological stress, e.g. regular sleep deprivation/awakening; loss of appetite, significant, medically definable harm, e.g. auditory and non-auditory.	Unacceptable Adverse Effect	Prevent

The table does not provide any objective assessment which equates to the noted effect levels. However, the PPG identifies that where noise is audible, it is not necessarily intrusive. The effect and impact on people are based primarily on the level of noise.

4. Assessment Methodology

For industrial and commercial noise, the most relevant guidance is provided within British Standard 4142:2014+A1:2019. The methods described in the British Standard use outdoor sound levels to assess the likely effects of sound upon people who might be inside or outside a dwelling or other premises used for residential purposes.

The initial estimate principle is that of establishing the 'difference' between the 'rating level' and the 'background sound level'. The 'rating level' is the 'specific sound level' of the source over a period of one hour during the day (07:00 to 23:00 hours) and over a period of 15 minutes during the night (23:00 to 07:00 hours). Clause 9 entitled 'Rating Level' states:

"Certain acoustic features can increase the significance of impact over that expected from a basic comparison between the specific sound level and the background sound level. Where such features are present at the assessment location, add a character correction to the specific sound level to obtain the rating level."

An acoustic character correction should be added to the 'specific sound level' if it exhibits any tonality, impulsivity, other specific characteristics and/or intermittency at the assessment location. The value of the character correction varies, dependent on the prominence of the character of the sound source at the assessment location. In Clause 11 of the Standard, entitled 'Assessment of the Impacts', it states:

"Obtain an initial estimate of the impact of the specific sound by subtracting the measured background sound level (see Clause 8) from the rating level (see Clause 9), and consider the following.

- *Typically, the greater this difference, the greater the magnitude of the 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.*
- *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."*

Based on the initial assessment outcomes of BS4142, and depending on context, it is our opinion that the NOEL, LOAEL and SOAEL levels stated in the Noise Policy Statement for England would generally fall within the following categories when considered in conjunction with the effect levels of the PPG Noise.

Table 2: BS4142 Difference in Relation to Effect Levels

BS4142 Assessment Difference	Corresponding Effect Level*	Action*
≤-10 dB	No Observed Effect	No specific measures required
-9.9 dB to 0 dB	No Observed Adverse Effect	No specific measures required
	Lowest Observed Adverse Effect Level	
0.1 dB to 5 dB	Observed Adverse Effect	Mitigate and reduce to a minimum
	Significant Observed Adverse Effect Level	
5.1 dB to 10 dB	Significant Observed Adverse Effect	Avoid
≥10.1 dB	Unacceptable Adverse Effect	Prevent

* BS4142 states that "where the initial estimate of the impact needs to be modified due to the context, take all pertinent factors into consideration". Therefore, the assessment levels and effect levels above are not definitive and can be modified due to context.

It should be noted that the numerical outcome only represents the initial estimate of impact, as stated in the first paragraph of Clause 11, and that contextual matters should be considered before determining what the potential impact is. This paragraph states:

> *The significance of sound of an industrial and/or commercial nature depends upon both the margin by which the rating level of the specific sound source exceeds the background sound level and the context in which the sound occurs. An effective assessment cannot be conducted without an understanding of the reason(s) for the assessment and the context in which the sound occurs/will occur. When making assessments and arriving at decisions, therefore, it is essential to place the sound in context.*
>
> *Obtain an initial estimate of the impact of the specific sound by subtracting the measured background sound level (see Clause 8) from the rating level (see Clause 9).*
>
> *NOTE 1 More than one assessment might be appropriate.*

The second part of Clause 11 sets out three contextual matters that should be taken into account once the initial numerical estimate has been determined. It is important to note that the three listed is not exhaustive and all pertinent factors should be considered.

5. Baseline Noise Monitoring

A baseline noise survey was undertaken on the 10th of January 2024, as part of a noise impact assessment for the proposed mechanical plant associated with the store. The current background and ambient noise climate are largely controlled by existing mechanical plant from adjacent premises.

5.1. Monitoring Equipment

Sound pressure levels were measured using a class 1 sound level meter with a half inch condenser microphone using the 'fast' setting. The equipment is checked annually using a quality assurance system meeting the requirements of British Standard EN ISO/IEC 17025/2005 and in accordance with British Standard EN 10012:2003 and traceable to the National Standards. This equipment was checked and calibrated as noted below and the certificates are available for inspection on request. The table below provides the equipment and calibration status:

Table 3: Monitoring Equipment

Equipment Description / Manufacturing / Type	Serial Number	Date of Calibration	Calibration Certificate Number
SLM, NTI, XL2	A2A-17200-E0	10/05/2022	UK-22-029
Pre-Amp, NTI, MA220	8848	10/05/2022	UK-22-029
Microphone, NTI, MC230A	A22973	10/05/2022	UK-22-029
Calibrator, B&K, 4231	2665006	04/12/2023	1507280-1

The measuring systems were checked for calibration before and after the tests and no significant drift exceeding 0.1 dB was detected.

5.2. Weather Conditions

The monitoring was carried out in generally dry conditions with average wind speeds generally below 4 m/s and temperatures of approximately 1 degree Celsius. These conditions are not expected to have significant adverse effects on the measured levels.

A summary of the weather during the monitoring period is presented below:

Table 4: Weather Summary

Date	Wind Speed (m/s)	Average Air Temperature (°C)	Precipitation (time/hrs)	Cloud Cover (%)
10/01/2024	4	~ 1	0.00	~ 10

5.3. Monitoring procedure

A noise monitoring exercise was undertaken between 15:00 and 15:30 on the 10th January 2024. Attended measurements were used to determine the existing noise climate at the nearest NSRs to the plant.

Due to the nature of the background noise being completely dictated by the existing mechanical plant from adjacent properties, a period of 30 minutes during the daytime was deemed suitable as the existing noise climate will not change throughout the day. The proposed mechanical plant will only be operation during the day, and therefore no assessment of night-time noise levels has been undertaken.

The monitoring location is shown in the figure below. The meter was located to the rear of the property where the mechanical plant is proposed to be installed. The microphone was at a height of 1.5m above ground level and was at least 1m from the building façade.

Figure 2: Measurement Location



5.4. Measured Noise Levels

The measured data for the baseline noise survey consists of the Equivalent Noise Level ($L_{Aeq,\ 15min}$) and the Background Noise Level ($L_{A90,\ 15min}$). A summary of the modal background sound levels and typical equivalent noise levels are presented below.

Table 5: Summary of the measured noise levels (façade levels)

Time Period	$L_{Aeq\ (15\ minutes)}$ dB		$L_{A90\ (15\ minutes)}$ dB	
	Range	Typical	Range	Modal
Daytime	62- 62	62	55-56	55

A full summary of the measured daytime levels is displayed in the chart below, with night-time measurements excluded from the data.

From the above data we have determined the following typical free-field background sound level and residual level respectively at the noise sensitive receivers around the proposed site to be:

- Background - 55 dB $L_{A90\ (1\ hour)}$
- Residual - 62 dB $L_{Aeq\ (1\ hour)}$

6. Noise Modelling

6.1. Proposed Plant

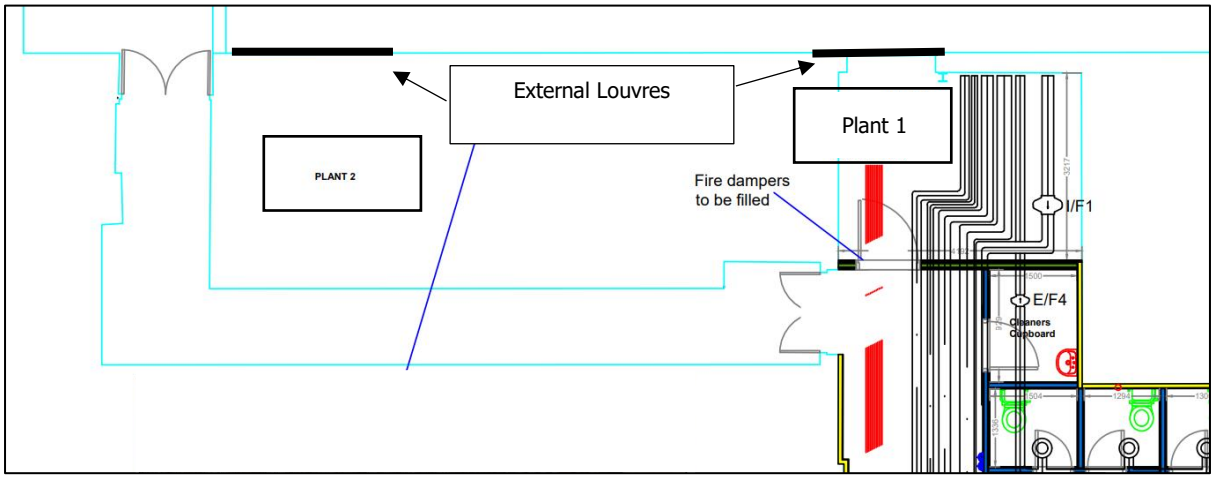
We have been advised that the proposed plant is as follows; we have assessed and set out attenuation requirements, where needed. It should be noted that any changes to the following schedule, or changes to the location or layout of the plant units will affect the predicted levels at the receiver points around the site and, as such, would need reassessing.

Table 6: Plant Noise Data (serving store)

Plant type	Make & Model	No.	Octave Band sound power level (dB) in Hz							Sound Power Level (dBA)	Plant Location
			63	125	250	500	1k	2k	4k		
VRV Units	Daikin REYQ-10	1	87	82	79	77	72	72	67	79	First Floor – Louvre 1
	Daikin REYQ-16	1	94	90	86	86	77	75	73	86	First Floor – Louvre 2

The following figure show the proposed layout for the mechanical plant.

Figure 3: Layout plan for the proposed units



Due to the mechanical plant being located in a plant room with external facing louvres, the sound power level of the mechanical plant units, the assumed size of the mechanical plant room and the assumed size of the louvres has been used to calculate the sound power level of the mechanical plant noise from the louvres.

In order to determine the mechanical plant noise, break out from the existing louvres, two calculations have been undertaken, one for each of the mechanical plant rooms.

The first plant room containing mechanical plant unit REYQ10 and louvre 1 is as follows and is calculated on the information supplied assuming that the dimensions of the plant room is 2m x 3.2m x 3.8m with a louvre sized 1m x 2.5m.

Table 7: Internal Plant Noise Level & Breakout – Plant Room 1

Room Dimensions									
Width (m)	2								
Length (m)	3.2								
Height (m)	3.8								
Absorption Coefficient	**Hz**	**Hz**	**Hz**	**Hz**	**Hz**	**Hz**	**Hz**	**Hz**	**m²**
per octave band	**63**	**125**	**250**	**500**	**1000**	**2000**	**4000**	**8000**	**Area**
Concrete	0.01	0.01	0.01	0.02	0.02	0.02	0.03	0.03	**49.8**
	0.5	0.5	0.5	1.0	1.0	1.0	1.5	1.5	
Opening	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	**2.5**
	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	-
							TOTAL	AREA	**52.3**
Total sound absorbtion (sq.m)	**3.0**	**3.0**	**3.0**	**3.5**	**3.5**	**3.5**	**4.0**	**4.0**	
Room Volume (m cubed)	24.32								
(0.16 * V)	3.8912								
Reverberation Time	1.30	1.30	1.30	1.11	1.11	1.11	0.97	0.97	**Secs**
Frequency	63	125	250	500	1000	2000	4000	8000	
T_s (500 / 1000 / 2000Hz)	**1.11**	**Secs**							

	Sound Power Level / dB										
Source Name	63	125	250	500	1000	2000	4000	8000	dB(A)	Distance to receiver	Q Factor
ASHP 2	87	82	79	77	72	72	67	62	79.2	0.5	2

Sound Pressure Level in Room:

Frequency	63	125	250	500	1000	2000	4000	8000	dB(A)
Cumulative Sound Power Level	87	82	79	77	72	72	67	62	79.2
Equivalent Absorption Area	3.0	3.0	3.0	3.5	3.5	3.5	4.0	4.0	
Room Constant	3.2	3.2	3.2	3.7	3.7	3.7	4.3	4.3	
Direct Sound Pressure Level	85.0	80.0	77.0	75.0	70.0	70.0	65.0	60.0	77.3
Reverberant Sound Pressure Level	88.0	83.0	80.0	77.3	72.3	72.3	66.7	61.7	79.6
Combined Sound Pressure Level	89.8	84.8	81.8	79.3	74.3	74.3	68.9	63.9	81.6
Area of plane	5								
Lw on room	101	96	93	90	85	85	80	75	93
Distance attenuation over 5m (plane source).									
a over pie	1.2								
b over pie	0.6								
s-a attenuation	101	96	93	90	85	85	80	75	93
a-b attenuattion (1m)	101	96	93	90	85	85	80	75	93
b-r attenuation (3m)	91	86	83	81	76	76	70	65	83
account for reflections	**94**	**89**	**86**	**84**	**79**	**79**	**73**	**68**	**86**

Level used in CadnaA

The second plant room containing mechanical plant unit REYQ16 and louvre 2 is as follows and is calculated on the information supplied assuming that the dimensions of the plant room is 4.1m x 3.2m x 3.8m with a louvre sized 2m x 2.5m.

Table 8: Internal Plant Noise Level & Breakout – Plant Room 2

Room Dimensions									
Width (m)	4.1								
Length (m)	3.2								
Height (m)	3.8								
Absorption Coefficient	Hz	Hz	Hz	Hz	Hz	Hz	Hz	Hz	m²
per octave band	63	125	250	500	1000	2000	4000	8000	Area
Concrete	0.01	0.01	0.01	0.02	0.02	0.02	0.03	0.03	76.7
	0.8	0.8	0.8	1.5	1.5	1.5	2.3	2.3	
Opening	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	5.0
	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	-
							TOTAL	AREA	81.7
Total sound absorbtion (sq.m)	5.8	5.8	5.8	6.5	6.5	6.5	7.3	7.3	
Room Volume (m cubed)	49.856								
(0.16 * V)	7.97696								
Reverberation Time	1.38	1.38	1.38	1.22	1.22	1.22	1.09	1.09	Secs
Frequency	63	125	250	500	1000	2000	4000	8000	
T_{60} (500 / 1000 / 2000Hz)	1.22	Secs							

	Sound Power Level / dB										
Source Name	63	125	250	500	1000	2000	4000	8000	dB(A)	Distance to receiver	Q Factor
ASHP 2	94	90	85	85	77	75	73	71	85.5	0.5	2
Sound Pressure Level in Room:											
Frequency	63	125	250	500	1000	2000	4000	8000	dB(A)		
Cumulative Sound Power Level	94	90	85	85	77	75	73	71	85.5		
Equivalent Absorption Area	5.8	5.8	5.8	6.5	6.5	6.5	7.3	7.3			
Room Constant	6.2	6.2	6.2	7.1	7.1	7.1	8.0	8.0			
Direct Sound Pressure Level	92.0	88.0	83.0	83.0	75.0	73.0	71.0	69.0	83.5		
Reverberant Sound Pressure Level	92.1	88.1	83.1	82.5	74.5	72.5	70.0	68.0	83.1		
Combined Sound Pressure Level	95.1	91.1	86.1	85.8	77.8	75.8	73.6	71.6	86.3		
Area of plane	5										
Lw on room	105	101	96	95	87	85	83	81	96		
Distance attenuation over 5m (plane source).											
a over pie	1.2										
b over pie	1.3										
s-a attenuation	105	101	96	95	87	85	83	81	96		
a-b attenuattion (1m)	105	101	96	95	87	85	83	81	96		
b-r attenuation (3m)	96	92	87	86	78	76	73	71	87		
account for reflections	99	95	90	89	81	79	76	74	90	Level used in CadnaA	

6.2. Modelling Parameters

The plant noise emission has been modelled in the noise modelling software Cadna:A by DataKustik. The modelling software calculates sound levels based on the inputted sound emission values, source and receiver locations, and primarily distance, barrier and ground attenuation. Calculations are undertaken using the General Method of Calculation from ISO 9613. The parameters within the Cadna:A model are as follows and are considered reasonable assumptions:

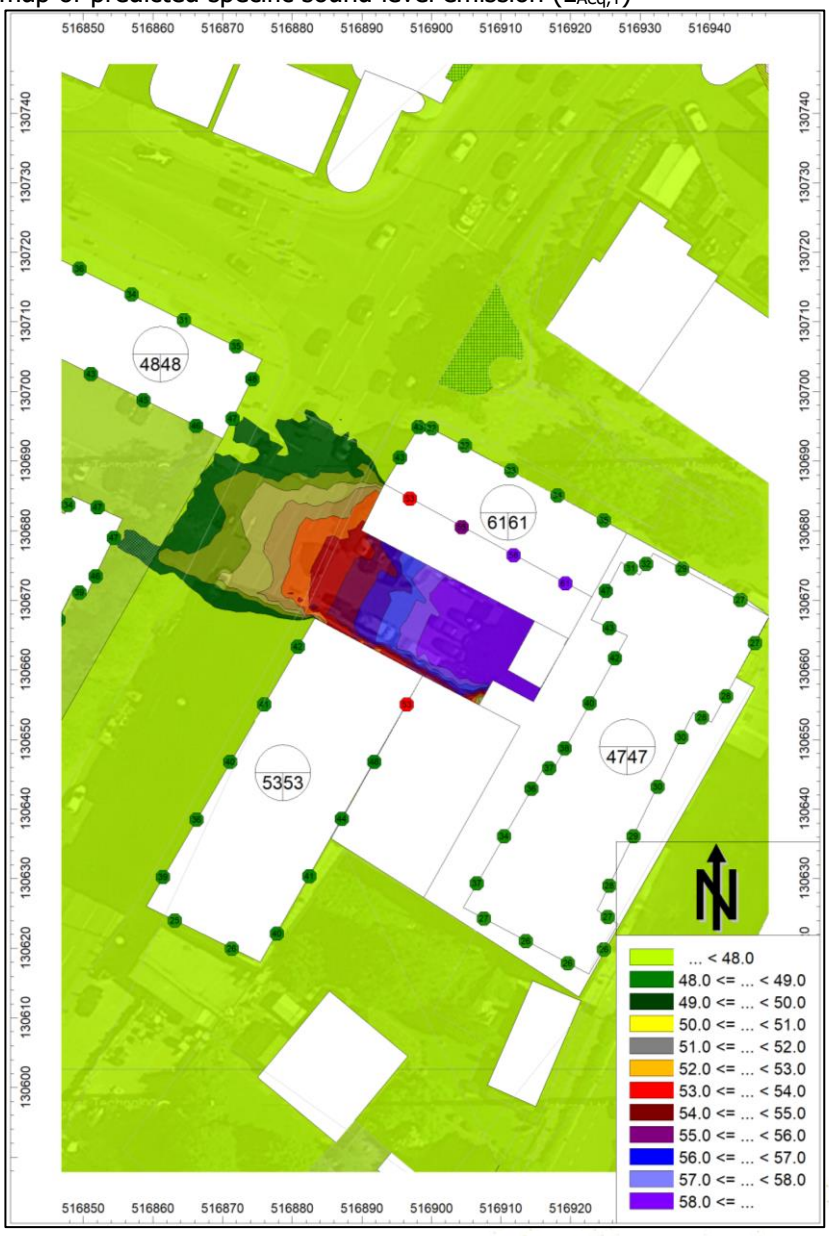
- The existing buildings have been based on Google Street View imagery and reasonable assumptions.
- The order of reflections is 3, and all buildings are considered reflective.

- The ground across the site and surrounding area is considered hard and reflective.
- The topography of the site is assumed to be flat.
- The predictions are based on all plant operating continuously.
- The predicted building noise map level at each receiver is the highest predicted level per storey of each façade.
- The noise map is predicted at second storey height (4.5m).
- The plant room louvre is considered to be 5.5m above the ground level.

6.3. **Modelling Results**

Noise maps of the plant specific sound levels are provided below for the daytime plant operation. The below figure presents the predicted mechanical plant noise at the noise sensitive receivers.

Figure 4: Noise map of predicted specific sound level emission ($L_{Aeq,T}$)



7. Noise Assessment

7.1. Predicted Specific Sound Level

The predicted cumulative specific sound level is 61 dB $L_{Aeq,T}$ at the worst-case noise sensitive receptor. These are the levels determined at the noise sensitive receivers without any character corrections applied.

7.2. Background Sound Level

The representative background sound level determined from the baseline survey is 55 dB $L_{A90,1hour}$ during the day.

7.3. Character Correction

Character corrections should be added to the 'specific sound level' if it exhibits any *tonality, impulsivity, other specific characteristics and/or intermittency* at the assessment location. Based on our site visit and knowledge of such heating units, corrections to be applied are as follows:

- *Tonality* – From our experience of other Specsavers sites their plant is not usually tonal however the supplier and installer of the proposed plant should ensure any tonality is not distinguishable at the noise-sensitive receivers in the area.
- *Impulsivity* – Plant such as this is not normally impulsive.
- *Intermittency* – We have applied a +3dB character correction for intermittency.
- *Other Sound Characteristics* – We do not believe any correction is due to other characteristics given the existing noise climate is dictated by existing mechanical plant.

7.4. Estimate of Impact

Therefore, the British Standard 4142:2014 initial estimate at the most sensitive location is as follows:

Table 9: British Standard 4142:2014 initial estimate.

Parameter	Closest Noise Sensitive Receptors
	Daytime
Background Sound Level, $L_{A90,T}$	55 dB
Specific Sound Level, $L_{Aeq,T}$	61 dB
Character Correction	+3 dB
Rating Level, $L_{Ar,T}$	64 dB
Assessment Difference	+9 dB

The initial impact is an indication that the proposed plant location will be unacceptable and of a significant observed adverse effect at the closest noise sensitive receptors However, the context of the site must also be considered.

7.5. Context

With regard to context, British Standard 4142:2014 states:

Residual Sound Levels

British Standard 4142:2014 also states:

> *"The character and level of the residual sound compared to the character and level of the specific sound. Consider whether it would be beneficial to compare the frequency spectrum and temporal variation of the specific sound with that of the ambient or residual sound, to assess the degree to which the specific sound source is likely to be distinguishable and will represent an incongruous sound by comparison to the acoustic environment that would occur in the absence of the specific sound. Any sound parameters, sampling periods and averaging time periods used to undertake character comparisons should reflect the way in which sound of an industrial and/or commercial nature is likely to be perceived and how people react to it."*

We have compared the lowest residual noise climate, i.e. *the ambient sound at the assessment location when the specific sound source (plant) is suppressed to such a degree that it does not contribute to the ambient sound,* to the specific sound level (plant noise) and rating level (plant noise level with character correction applied). This is summarised below:

Table 10: Comparison with residual noise climate

Parameter	Level at NSR
Lowest Residual Sound Level -	62 dB $L_{Aeq(15\ minutes)}$
Specific Sound Level -	61 dB $L_{Aeq(15\ minutes)}$
Rating Sound Level -	64 dB $L_{Aeq(15\ minutes)}$

As can be seen, the rating sound level (with character) is +2 dB above the lowest residual noise climate. Resultantly plant noise would be distinguishable over the residual noise climate and would likely blend in with the typical residual level at the noise sensitive receivers.

Based on a comparison with the residual level, we would consider plant noise to be of a negligible impact at the noise-sensitive receivers.

7.6. Summary of assessment

We would consider the noise impact of the proposed condenser plant to fall within the Significant Observed Adverse Effect Level (SOAEL) of the PPG and NPSE when assessing using the initial estimate of impacts.

When considering a comparison against the existing residual noise level it has been determined that, given the noise climate consist of largely mechanical plant noise and road noise, that the proposed plant noise would not be dominant over the residual noise climate and therefore would not cause any change in behaviour or attitude; as such, this achieves the aims of the National Planning Policy Framework (NPPF).

7.7. Proposed Mitigation

Due to the initial estimate of impacts indicating that there could be the potential for a significant adverse effects, mitigation will be required to reduce any potential impacts.

For the mitigation to successfully reduce the mechanical plant noise to either equal to or below the background noise level of 55 dB $L_{A90,}$ the mitigation will be required to achieve a reduction to the mechanical plant noise of 9 dB(A) or more.

The simplest form of mitigation is to choose mechanical plant that is quieter than the currently proposed units. For this to be a successful form of mitigation, the maximum required noise level of the mechanical plant should be as follows:

Table 11: Maximum mechanical plant noise levels

Plant Location	Octave Band sound power level (dB) in Hz							Sound Power Level (dBA)
	63	125	250	500	1k	2k	4k	
Plant Room 1	78	73	70	68	63	63	58	68
Plant Room 2	85	81	77	77	68	66	64	77

Where quieter mechanical plant is not a suitable option, mitigation could be provided through the replacement of the existing louvres with acoustic louvres. Where this is the case, the louvres must provide a minimum sound reduction from internal level to external level of 9 dB(A) or more.

We would consider the noise impact of the proposed plant, with the addition of the proposed mitigation, to fall within the No Observed Adverse Effect Level (NOAEL) of the PPG and NPSE when assessing using the initial estimate of impacts. The proposed plant noise, with mitigation, would not be dominant over the residual noise climate and therefore would not cause any change in behaviour or attitude; as such, this achieves the aims of the National Planning Policy Framework (NPPF).

8. Summary and Conclusions

Specsavers appointed Acoustic Consultants Ltd to undertake a noise impact assessment for the proposed Specsavers store located at 2 Worthing Road, Horsham.

This report provides a noise assessment of activities associated with the store, specifically plant noise on the nearest existing noise sensitive receivers.

After assessing the proposed plant at the existing dwellings, the noise in terms of BS4142:2014 will have a significant observed adverse impact.

With the inclusion of the proposed mitigation, the assessed plant will have no observed adverse impact.

We would consider that noise from the proposals, with the inclusion of the proposed mitigation, will achieve the aim of the National Planning Policy Framework (NPPF) and development noise will not cause any change in behaviour or attitude.

9. Appendix 1 – Glossary of Acoustic Terminology

A-weighted sound pressure pA – value of overall sound pressure, measured in pascals (Pa), after the electrical signal derived from a microphone has been passed through an A-weighting network.

A-weighted sound pressure level, L_{pA} - quantity of A-weighted sound pressure given by the following formula in decibels (dBA)

$L_{pA} = 10 \log_{10} (p_A/p_0)^2$

where:

p_A is the A-weighted sound pressure in pascals (Pa);
p_0 is the reference sound pressure (20 µPa)

Background sound level, $L_{A90,T}$– A-weighted sound pressure level that is exceeded by the residual sound assessment location for 90% of a given time interval, T, measured using weighting F and quoted to the nearest whole number of decibels

Break-in - noise transmission into a structure from outside.

Decibel (dB) – The decibel is the unit used to quantify sound pressure levels. The human ear has an approximately logarithmic response to acoustic pressure over a very large dynamic range (typically 20 micro-Pascals to 100 Pascals). Therefore, a logarithmic scale is used to describe sound pressure levels and also sound intensity and power levels. The logarithms are taken to base 10. Hence an increase of 10 dB in sound pressure level is equivalent to an increase by a factor of 10 in the sound pressure level (measured in Pascals). Subjectively, this increase would correspond to a doubling of the perceived loudness of sound.

Equivalent continuous A-weighted sound pressure level, $L_{Aeq,T}$ – value of the A-weighted sound pressure level in decibels of continuous steady sound that, within a specified time interval, T = t2 – t1, has the same mean-squared sound pressure as a sound that varies with time, and is given by the following equation:

$$L_{AeqT} = 10\lg_{10}\left\{(1/T)\int_{t_1}^{t_2}[p_A(t)^2/p_0^2]dt\right\} \quad (1)$$

where:

p_0 is the reference sound pressure (20 µPa); and
$p_A(t)$ is the instantaneous A-weighted sound pressure (Pa) at time t

NOTE The equivalent continuous A-weighted sound pressure level is quoted to the nearest whole number of decibels.

Facade level – sound pressure level 1 m in front of the façade. Facade level measurements of L_{pA} are typically 1 dB to 3 dB higher than corresponding free-field measurements because of the reflection from the facade.

Free-field level – sound pressure level away from reflecting surfaces. Measurements made 1.2 m to 1.5 m above the ground and at least 3.5 m away from other reflecting surfaces are usually regarded as free-field. To minimize the effect of reflections the measuring position has to be at least 3.5 m to the side of the reflecting surface (i.e. not 3.5 m from the reflecting surface in the direction of the source).

Octave and Third Octave Bands – The human ear is sensitive to sound over a range of frequencies between approximately 20 Hz to 20 kHz and is generally more sensitive to medium and high frequencies than to low frequencies within the range. There are many methods of describing the frequency content of a noise. The most common methods split the frequency range into defined bands, in which the mid-frequency is used as the band descriptor and in the case of octave bands is double that of the band lower. For example, two adjacent octave bands are 250 Hz and 500 Hz. Third octave bands provide a fine resolution by dividing each octave band into three bands. For example, third octave bands would be 160 Hz, 250 Hz, 315 Hz for the same 250 Hz octave band.

Sound pressure level – Sound pressure level is stated on many of the charts. It is the amplitude of the acoustic pressure fluctuations in a sound wave, fundamentally measured in Pascals (Pa), typically from 20 micro-Pascals to 100 Pascals, but commonly simplified onto the decibel scale.

Sound reduction index, R – laboratory measure of the sound insulating properties of a material or building element in a stated frequency band.

Specific sound level, $L_s = L_{Aeq,Tr}$ – equivalent continuous A-weighted sound pressure level produced by the specific sound source at the assessment location over a given reference time interval, T_r.

Structure-borne noise – audible noise caused by the vibration of elements of a structure, the source of which is within a building or structure with common elements.

Rating level, $L_{Ar,Tr}$ – Specific sound level plus any adjustment for the characteristic features of the sound.

Reverberation Time, T – The reverberation time is defined as the time taken for a noise level in an enclosed space to decay by 60 dB from a steady level once the noise source has stopped. It is measured in seconds. Often a 60 dB decay cannot be measured so the reverberation time is measured over a lesser range and corrected back to the time for a 60 dB drop assuming a constant decay rate. Common parameters are T20 (time taken for a 20 dB decay multiplied by three) and T30 (time taken for a 30 dB decay multiplied by two).

Vibration Dose Value, VDV – measure of the total vibration experienced over a specified period of time.

Estimated Vibration Dose Value, eVDV – estimation of the total vibration experienced over a specified period of time. This is usually based on the number of events and shortened measurement data.

Weighted sound reduction index, R_w – Single-number quantity which characterizes the airborne sound insulating properties of a material or building element over a range of frequencies. The weighted sound reduction index is used to characterize the insulation of a material or product that has been measured in a laboratory (see BS EN ISO 717-1).



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