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Environmental Noise Assessment

Prepared: 11th March 2024

Report No	22711-1-R1
Client	Karen Gardener Architects
Site	9 Primrose Lane Rhos Swansea SA8 3ES

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1. Quality Management

Report Number	22711 – 1 – R1
Issue	Revision 1 – changes to 3D noise model, BS4142 assessment and context
Prepared	11 th March 2024
Prepared By	
Authorised By	

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3. Executive Summary

3.1.1. An environmental noise assessment has been carried out for a proposed residential development at 9 Primrose Lane, Rhos, Swansea, SA8 3ES ("Proposed Development").

3.2. Measurement, Assessment and Evaluation

3.2.1. The survey was carried out to BS7445-1:2003,¹ BS7445-2:1991² and BS4142:2014³

3.3. Scope

- 3.3.1. This report covers all aspects of the noise survey, including:
- the identification of acoustic design criteria;
 - the identification of specific sound sources;
 - an objective sound pressure level survey of the existing site;
 - calculation of the specific sound level;
 - calculation of appropriate acoustic feature corrections and determination of the rating level;
 - assessment of the specific sound sources based on guidance contained in BS4142:2014; and
 - the design of any mitigation to meet the required internal noise criteria.

3.4. Results Summary

- 3.4.1. The numerical BS4142 assessment outcome of +1dB during the daytime is a minor exceedance which would not be perceptible by the general population. The outcome indicates that the proposed specific sound source will have a low impact on the existing residential receivers.
- 3.4.2. The results of the 3D noise model are likely to be an over prediction of the specific source, based on several worst-case assumptions.

¹ BS7445-1:2003 "Description and measurement of environmental noise – Part 1: Description of quantities and procedures"

² BS7445-2:1991 "Description and measurement of environmental noise – Part 2: Guide to the acquisition of data pertinent to land use"

³ BS4142:2014 "Methods for rating and assessing industrial and commercial sound"

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5. Background

5.1. Planning Policy Wales

- 5.1.1. Planning Policy Wales (PPW) sets out the land use planning policies of the Welsh Government. The primary objective of PPW is to ensure that the planning system contributes towards the delivery of sustainable development and improves the social, economic, environmental and cultural well-being of Wales.
- 5.1.2. PPW puts an emphasis on how the type of noise can have a different impact. For example, natural sounds such as running water or birds chirping are considered to be positive sounds that contribute to a tranquil environment, whereas noise pollution, from road traffic noise for example, can affect health or be considered a nuisance.
- 5.1.3. The aim of PPW with regards to noise is to provide an appropriate soundscape in order to contribute to a positive experience to the local residents and to reduce average population exposure to noise pollution and to take any opportunity to reduce or minimise exposure to noise pollution.
- 5.1.4. PPW states that in proposing new developments, planning authorities and developers must:
 - Address any implication arising as a result of its association with, or location within, noise action planning priority;
 - Not create areas of an inappropriate soundscape; and
 - Seek to incorporate measures which reduce overall exposure to noise pollution and create appropriate soundscapes.
- 5.1.5. To assist decision making it will be important that the most appropriate level of information is provided and it may be necessary for a noise assessment to be undertaken by a suitably qualified and competent person on behalf of the developer.
- 5.1.6. Good design, for example setting back buildings from roads to avoid canyon effects and using best practice in terms of acoustic design to ensure the appropriate and intended acoustic environment of completed developments should be incorporated at an early consideration in the design and planning process. Other mitigation measures must be capable of being effectively implemented for their intended purpose and could include those related to:
 - Traffic management and road safety
 - Reducing real or perceived noise levels by absorbing and scattering noise and introducing natural sounds to soften man-made noise, provide areas of relative tranquillity, and reduce exposure by putting a buffer between sources of pollution and receptors.
- 5.1.7. When proposing new strategies for development and when allocating sites in development plans it will be important to avoid instances where incremental development of infrastructure, housing, commercial and industrial development creates or exacerbate health and amenity inequalities by introducing more sensitive receptors into an area or by making existing occupiers more vulnerable to noise. This may particularly be the case when proposing high density developments adjacent to transport hubs or where development pressure to meet short-term needs may have detrimental long-term effects and care must be taken not to exacerbate health inequalities whilst recognising accessibility needs.
- 5.1.8. Proposed developments should be designed wherever possible to prevent adverse effects to amenity, health and the environment but as a minimum to limit or constrain any effects that do occur.

6. Introduction

6.1.1. An environmental noise assessment has been carried out for a proposed residential development at 9 Primrose Lane, Rhos, Swansea.

6.2. Proposed Development

6.2.1. An image showing the proposed location and layout of the Proposed Development is given in Figure 1.

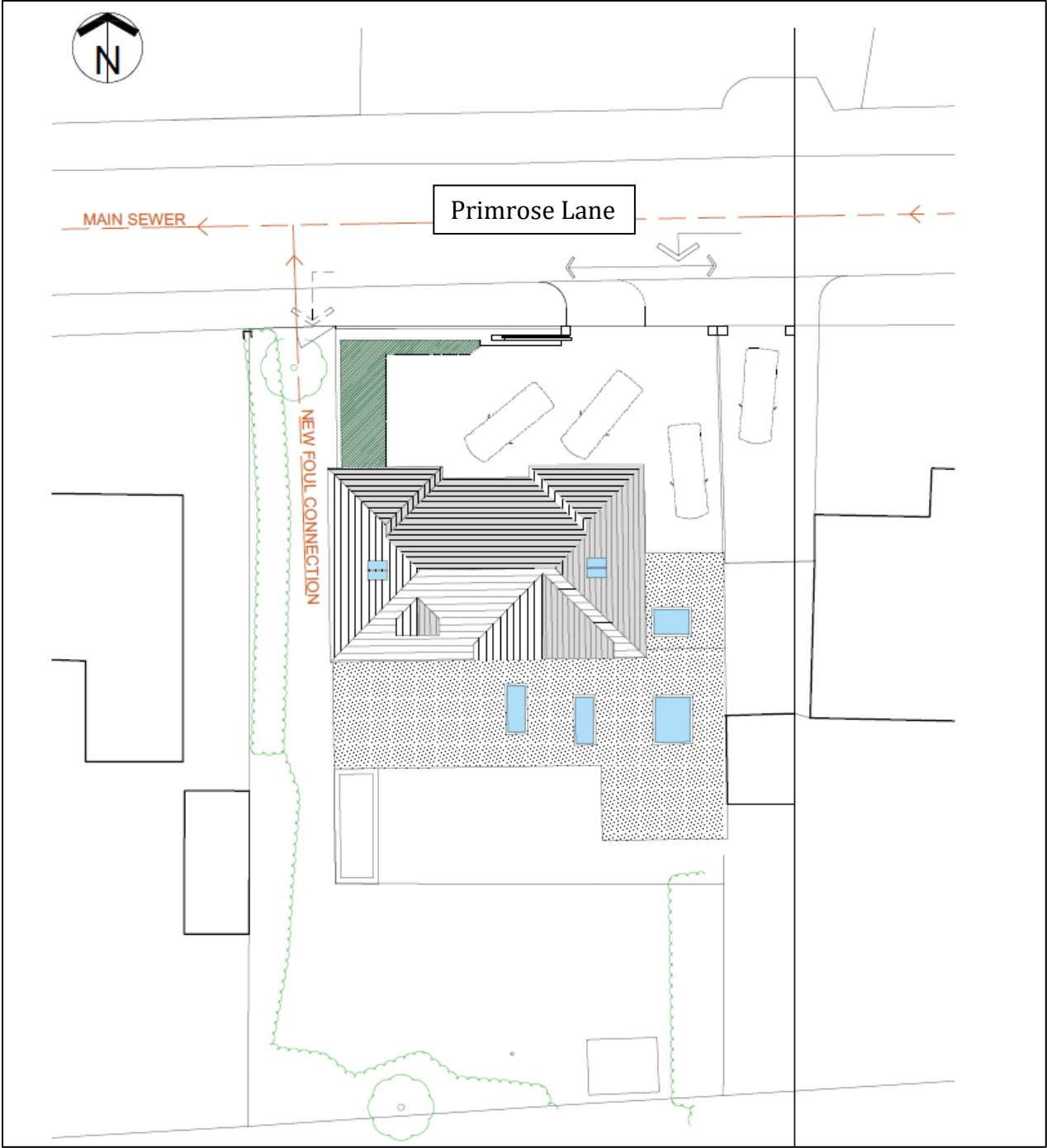


Figure 1 - Plan showing the location and layout of the Proposed Development

6.3. Specific Sound Sources

It is proposed that an air source heat pump will be installed as part of the development. The manufacturer’s sound level data has been provided and is given in Table 1. The equipment will be operated at the discretion of the occupants, it is therefore assumed the equipment could be operational at any time of day/night. It is noted that sound data is provided for various operating modes, and the worst case has been taken for the purpose of this assessment.

Vaillant aroTHERM plus (12kW)			
Sound Power (dB)	Sound Pressure Level (dB(A))		
60	1m	3m	5m
	52	42	38

Table 1 – Specific sound sources associated with the proposed development

Structure borne sound and vibration

6.3.1. This assessment considers the impact of the specific source on the nearest residential receiver. It is not expected that the proposed equipment and the neighbouring existing residential building are structurally connected. This unit is intended for use in residential areas and is therefore expected to be suitably isolated to minimise structure borne sound and vibration transmission.

7. Assessment Criteria

7.1. BS4142:2014

- 7.1.1. BS4142 provides methods for rating and assessing **specific sound sources** of an industrial and/or commercial nature, which includes: industrial and manufacturing processes, fixed services plant, sound generated by the loading/unloading of goods and sound from mobile plant/vehicles associated with industrial/commercial premises (e.g. fork-lift trucks). The **assessment location** is outside a residential receptor.
- 7.1.2. The standard is specifically precluded from being used to assess the likely impact inside a building or from the assessment of various sound sources for which other (more relevant) guidance exists, including: music/entertainment noise, noise from people and construction noise.
- 7.1.3. The foundation of the assessment is to establish the following quantities, either by measurement or prediction:
- **Ambient sound:** The overall sound at the assessment location
 - **Residual sound:** The ambient sound without the specific sound source operating
 - **Specific sound:** The ambient sound with the specific sound source operating, corrected for residual sound
 - **Background sound:** Residual sound present for 90% of the time
- 7.1.4. How these quantities relate to the sound that would be measured during a survey has been illustrated in Figure 2.

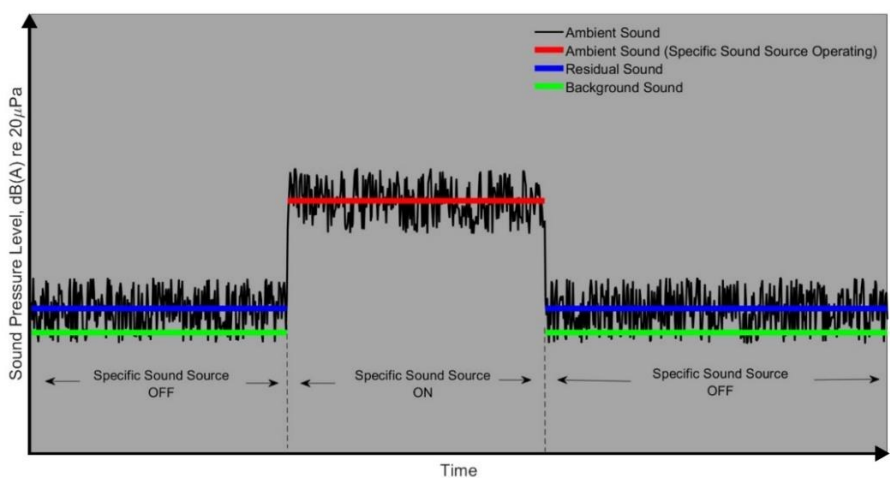


Figure 2 –
Diagrammatic
illustration of the
definitions of ambient,
residual, specific and
background sound

- 7.1.5. Once the specific sound level has been determined, this must be corrected for the presence of acoustic features that are audible at the assessment location to determine the **rating level**:
- Rating Level = Specific Sound Level + Character Corrections**
- 7.1.6. Normally it is possible to carry out a subjective assessment of characteristics, based on the following correction guidelines:
- **Tonality:** +2dB for a 'just perceptible' tone, +4dB for 'clearly perceptible', and rising to +6dB for 'highly perceptible' tones.
 - **Impulsivity** (rapidity of change and overall change in level): +3 dB for 'just perceptible' impulsivity, +6dB for 'clearly perceptible', rising to +9 dB for 'highly perceptible' impulsivity.
 - **Intermittency:** if the on/off-time of the specific sound is readily distinctive at the noise- sensitive receivers, +3dB.

- 7.1.7. It should be noted that, where one feature is clearly perceived as dominant, it may be appropriate to apply a single correction. Where multiple features are likely to affect perception and response, each should be added arithmetically.
- 7.1.8. An estimate of the magnitude of the impact is evaluated by subtracting the measured background sound level at the assessment location from the rating level

Assessment Level = Rating Level – Background Sound Level

- 7.1.9. Typically, the greater the difference between the background and rating level, the greater the magnitude of impact, although BS 4142 emphasises that this is highly context-specific. As an initial estimate, BS4142 states that:
 - A difference (between the background and rating level) of around +10 dB or more is likely to be indicative of significant adverse impact, depending on context
 - A difference (between the background and rating level) of around +5 dB or more is likely to be indicative of adverse impact, depending on context
 - Where the rating level does not exceed the background level, this is an indication that the specific sound will have a low impact, depending on context
- 7.1.10. Where the initial estimate of the impact needs to be modified due to the context, other factor should be considered, including: absolute sound levels, the character and level of the residual sound and the sensitivity of the receiver, which includes the effect of building façade sound insulation.

7.2. Local Planning Authority Criteria

- 7.2.1. The local planning authority has provided specific noise-related planning requirements for the Proposed Development. The noise-related requirements have been reproduced in Figure 3.

*“The applicant is to submit a noise impact assessment for the proposed development.
The noise rating level emitted from external plant serving the approved use shall not be greater than the existing background noise level. The noise levels shall be determined at the nearest noise-sensitive premises or at another location that is deemed suitable by the Local Planning Authority. Measurements and assessments shall be made in accordance with 'BS 4142:2019 Method for rating and assessing industrial and commercial sound.'”*

Should the Noise Impact Assessment identify the need for an acoustic barrier; then the specification of the sound reduction capacity of the barrier shall be included in the Noise Impact Assessment”.

Figure 3 – Noise related planning requirements provided by the local planning authority

8. Survey

8.1. Measurement Locations

8.1.1. Fixed position monitoring took place at to determine the typical ambient sound levels and the typical background sound levels. The monitoring equipment was located 1.5m from the ground and at least 3m from the next nearest reflecting surface. The monitoring position is shown in Figure 4.

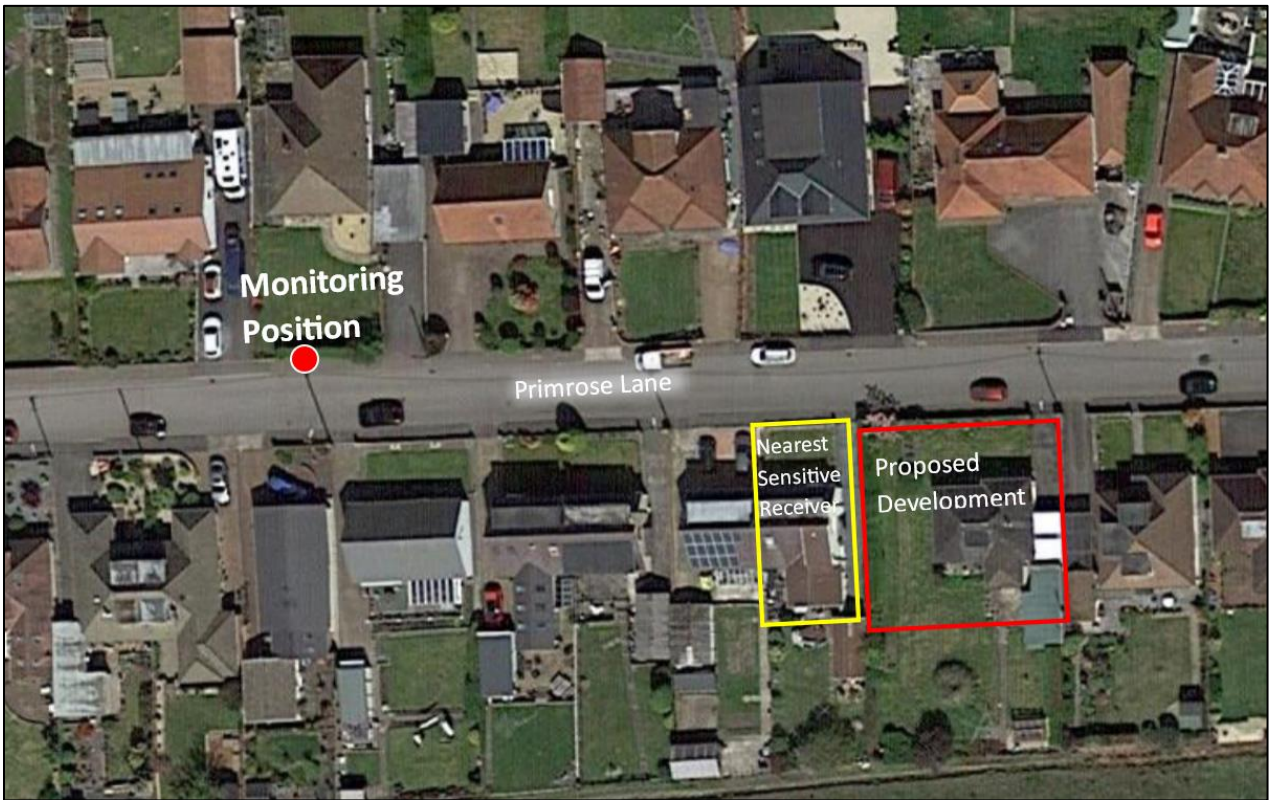


Figure 4 - Noise monitoring locations on site.

8.1.2. The measurement instrumentation used during the survey is detailed in the appendix. The acoustic equipment was calibrated to comply with Section 4.2 of BS7445-1:2003⁴ before and after the surveys. The calibration details are also detailed in the appendix.

8.2. Noise Climate

8.2.1. The technician noted that the noise climate was not dominated by any continuous noise sources at the time of the survey. The noise climate was generally dominated by birdsong, with transient noise from local traffic occasionally.

8.3. Meteorology

8.3.1. During the survey the weather information was noted. This is summarised in Table 2.

	4 th January 2024	5 th January 2024
Roads(Wet/Dry)	Dry	Dry
Wind Speed (ms ⁻¹)/Direction	1 / S	3 / NW

Table 2 - Meteorological data noted during the survey

⁴ BS7445-1:2003 “Description and measurement of environmental noise – Part 1: Guide to quantities and procedures”

8.4. Measurement and Timescale

8.4.1. Unattended monitoring was carried out between 4th January 2024 and 5th January 2024. The measurements that have been made are summarised in Table 3.

Monitoring position	Date	Type	Quantity
1	4 th January 2024 to 5 th January 2024	Unattended	L _{Aeq} / L _{A90}

Table 3 – Measurements made at the site of the Proposed Development

8.4.2. Sound pressure measurements were subsequently averaged into hourly, daytime and night-time periods. The acoustic measurements and their interpretation have been in accordance with BS 7445: Parts 1, and 2⁵. All sound pressure levels are in dB (re 20µPa).

8.5. Results Summary

Average Sound Pressure Levels

8.5.1. The fixed position external measurement results are summarised in Table 4.

Measurement location	Daytime dB, L _{Aeq,16hr}	Night-time dB, L _{Aeq,8hr}
1	53.4	44.0

Table 4 - Summary of the external sound pressure levels measured

Background Sound Levels

8.5.2. Figure 5 shows the results of the data analysis in terms of the frequency of occurrence of each data value during the daytime and the night-time.

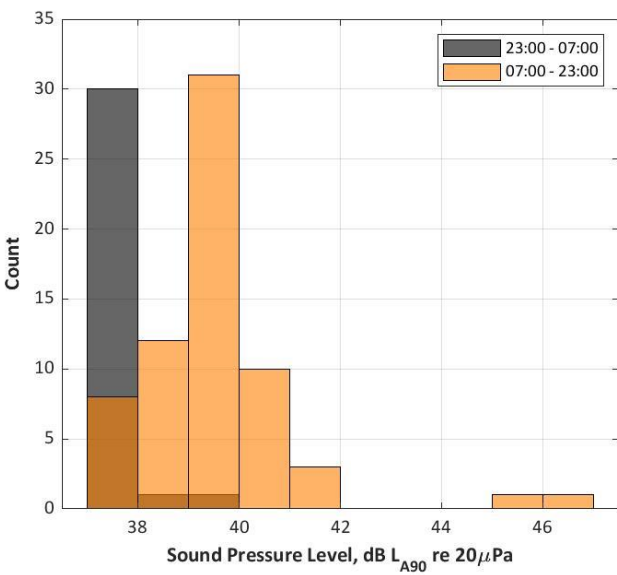


Figure 5 – Distribution of background sound levels during the daytime (07:00-23:00), and the night-time (23:00-07:00)

8.5.3. As can be seen in Figure 5 the background sound levels ranged between 37dB L_{A90,15min} and 47dB L_{A90,15min} during the daytime period, and that the background sound levels ranged between 37dB L_{A90,min} and 40dB L_{A90,min} during the night-time period.

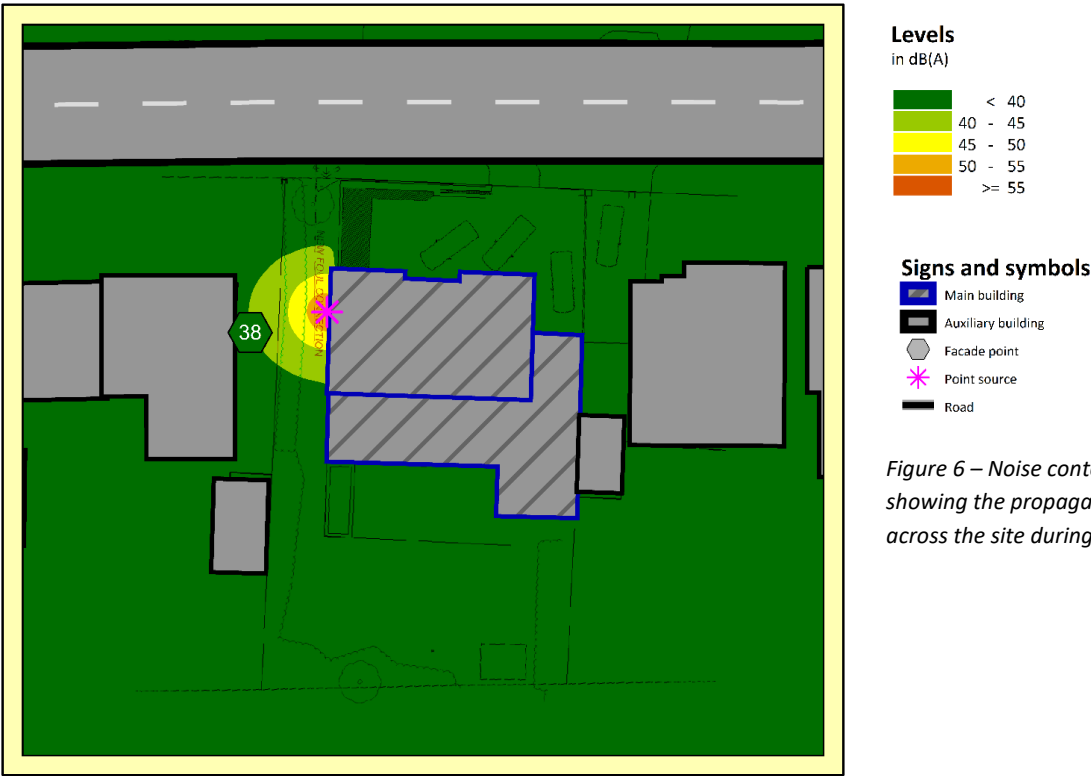
8.5.4. The typical background sound level has been taken to be 39dB L_{A90,15min} during the daytime and 37dB L_{A90,15min} for the night-time.

⁵ BS7445-2:1991 “Description and measurement of environmental noise – Part 2: Guide to the acquisition of data pertinent to land use”

9. 3D Noise Model

- 9.1.1. A 3D noise model has been constructed using SoundPLAN™ in order to predict the propagation of sound from the specific source to the nearest sensitive receiver. The calculation procedure has been used from ISO9613-2:1996⁶ to predict the propagation of sound taking into account reflections, distance, screening, atmospheric conditions and ground conditions.
- 9.1.2. Google Maps Data has been used to create the existing roads and buildings. Terrain data has also been taken from Google Maps.
- 9.1.3. The position of the noise sensitive receiver has been identified as an existing first floor window on the neighbouring property, overlooking the location of the proposed source. The receiver is located 1m from the façade. The propagation distance from source to receiver within the model is 5.42m. No screening has been taken into account in the calculation.
- 9.1.4. Ground absorption is set to 0.6 which represents conditions between reflective hard ground and more absorptive soft ground. Atmospheric pressure is based on typical representative conditions given in ISO 9613-2. It should be noted that changes in atmospheric pressure and any ground attenuation will only have a significant impact over large distances. The propagation distance from source to receiver is 5.42m. Over such short distances the effects of atmospheric changes and ground absorption would be considered negligible.
- 9.1.5. The specific source has been modelled as a point source, located 0.2m from the façade based on sound radiating from the centre of mass of the unit. The sound power of the source is taken from manufacturer's sound data shown in Table 1.
- 9.1.6. For the purpose of this assessment, it has been assumed the plant will be operational continuously throughout the daytime and night-time periods at full duty, in the loudest operating mode. Distinguishable acoustic features of the specific source such as tonality are not considered in the model calculations. Acoustic features such as tonality, impulsivity and intermittency are covered in Section 10.1.
- 9.1.7. The results of the model have been illustrated in noise contour map in Figure 6.

⁶ ISO9613-2:1996 "Acoustics – Attenuation of Sound During Propagation Outdoors – Part 2: General Method of Calculation"



9.1.8. The results of the 3D noise model show that the specific source level is predicted to be 38dB $L_{Aeq,T}$ at an external position, 1m from the façade of the nearest sensitive receiver.

10. BS4142 Assessment

10.1. Rating Level

- 10.1.1. The proposed specific sound source has been specified but are not yet installed. The sources have been assessed based on the likely character of the sound at the boundary with nearest sensitive receiver. The adjustments to the specific sound levels for acoustic features have been added subjectively and are based on experience of similar items of heating and ventilation plant. These acoustic character corrections have been discussed in the following sections.

Tonality

- 10.1.2. It is expected that that source will generally generate broadband sound under normal operation. However, it is possible for types of equipment such as heating, air and ventilation plant to also produce modest tones at times. Given the short distance between the source and the receiver it is possible that any tones could be perceptible at the assessment location. However, given the difference between predicted level of the specific source and the residual acoustic environment, it is not likely that this will be clearly distinguishable.
- 10.1.3. A correction of +2dB has been applied for tonality.

Impulsivity

- 10.1.4. It is not expected that the proposed specific sources will generate any impulsive sound under normal operation.
- 10.1.5. No correction for impulsivity has been applied.

Intermittency

- 10.1.6. Given the nature of the equipment, and taking into consideration that the operation is determined by the end user's requirements, it is not expected that the specific sources will operate for 100% of the time. In this case, given that the specific source level is generally lower than the residual level, it is not expected that any on/off conditions of the specific source will be readily distinctive against the residual acoustic environment, even when the source is not operating continuously.
- 10.1.7. Therefore no correction for intermittency has been applied.

10.2. Assessment

10.2.1. The BS4142 assessment is detailed in Table 5.

	Level, dB	
	Daytime (07:00-23:00)	Night-time (23:00-07:00)
Background sound level, dB LA90,15min	39	37
Specific sound level, dB(A)	38	38
Acoustic feature corrections		
Tonality	+2	+2
Impulsivity	0	0
Intermittency	0	0
Other	0	0
Rating level		
Specific sound level + corrections	40	40
Assessment Level		
Rating level – Background sound level	+1	+3
“Where the rating level does not exceed the background sound level, this is an indication of the specific sound source having a low impact. A difference of around +5dB or more is likely to be an indication of an adverse impact, depending on the context”		

Table 5 - The assessment procedure from BS4142

10.2.2. The rating level is an initial estimate which considers the impact on existing background sound levels, and is not always representative of the impact on the receiver directly. Where the initial estimate of the impact is modified due to context, other factors should be considered, including: absolute sound levels, any barriers or acoustic screening, the character and level of the residual sound and the sensitivity of the receiver, which includes the effect of building façade sound insulation.

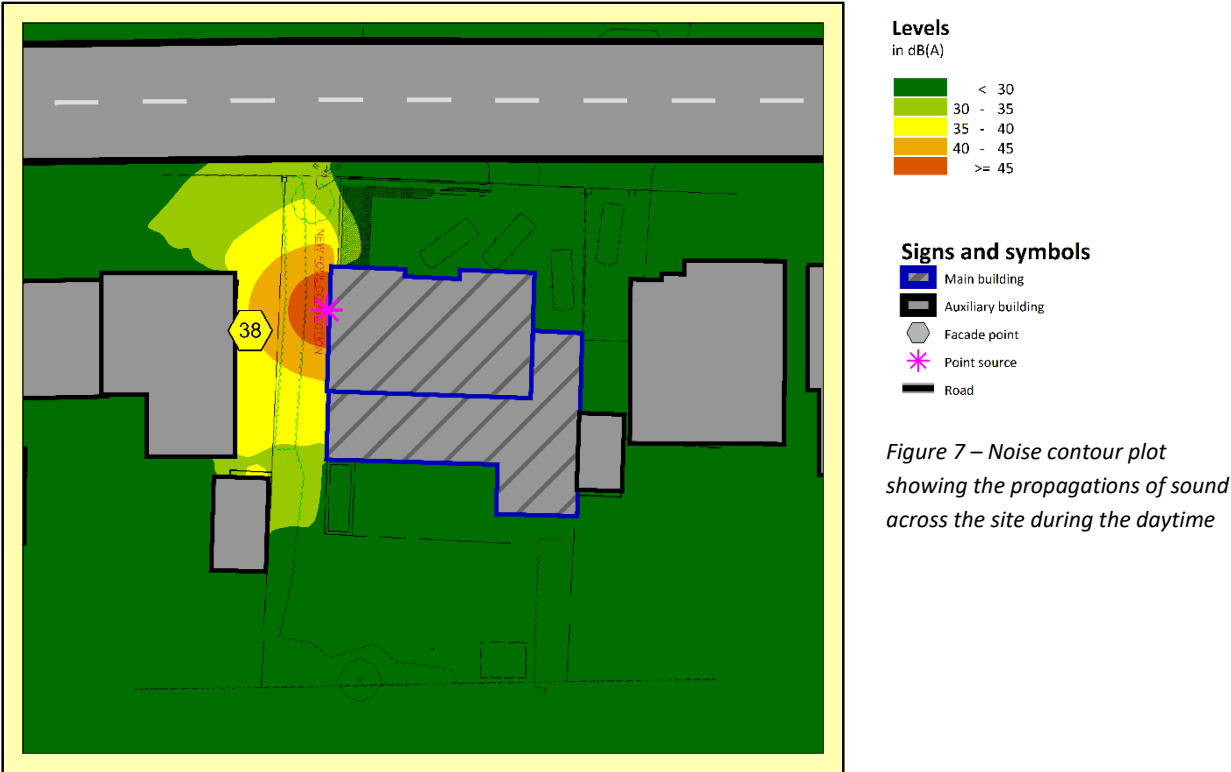
10.3. Context

- 10.3.1. In this situation the specific sound source is being introduced close to existing residential receivers. The impact of the specific sound is likely to have an increased impact compared to a situation where new residents are introduced close to existing sound sources such as mechanical plant.
- 10.3.2. The 3D noise model used to predict the impact of the source is likely to be a an overprediction, based on a series of worst-case assumptions. Realistically, not all of these conditions will apply and therefore any predicted impact can be slightly reduced. This assessment assumes continuous 24-hour operation which is unlikely to be the case. It also assumes the loudest mode of operation from the manufacturer’s data, which will ultimately be determined by the end user. In this case, the manufacturers data shows that more energy efficient modes produce less sound.
- 10.3.3. It is shown that, even with the worst-case considerations built into the assessment, the outcome during the daytime period exceeds the existing typical background level by 1dB, which is a minor exceedance and will not be perceptible to most people. Generally, a change of ±3dB is the minimum perceptible by most people⁷. In context of the assessment outcome, a difference of less than +5dB is a likely indication of low impact.

⁷ Engineering Noise Control (Second Edition); Bies and Hanson (1996)

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10.3.4. It is important to consider that the *assessment location* (external and at first-floor level, 1-metre from the façade in line with recommendations in BS4142) may not be a representative location for a typical residential receptor. In this case it is expected that realistically the receptor would be located either indoors, or further away from the source in the garden area to the rear of the property. The impact of the specific source on the receptor will be reduced as the distance between source and receiver is increased, as demonstrated by the noise contour map in Figure 7.



10.3.5. A useful comparison to make is to 30dB given as a guideline value for internal conditions in bedrooms at night for sleeping from BS8233:2014. Note that this does not include acoustic feature corrections tonality (+2dB).

10.3.6. It is not expected that a typical residential receptor will be at the assessment location during the night-time, therefore the numerical assessment outcome of +3 does not represent the impact of the specific source on a typical residential receptor during this period.

10.3.7. The absolute levels predicted at the façade should be considered. In this case, it is expected that internal conditions for sleeping (guideline values from BS8233:2014) will be met inside the receivers property despite the assessment outcome of the proposed source. It is not expected that the existing internal conditions would be adversely affected by the source.

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11. Conclusions

- 11.1.1. An environmental noise assessment has been carried out at the site of a proposed residential development at 9 Primrose Lane, Rhos, Swansea to determine typical ambient sound levels and the typical background sound levels. The typical background sound levels have been used to form a numerical assessment from BS4142:2014.
- 11.1.2. A numerical BS4142 assessment indicates that the specific sound will have a low impact on proposed new residential receivers and, generally, the lower the rating level is relative to the background sound level, the less likely it is that the specific sound source will have an adverse impact.
- 11.1.3. In this context the specific sound source is proposed close to existing residential receivers. The impact of the specific sound is likely to have an increased impact compared to a situation where new residents are introduced close to existing sources of a similar nature.
- 11.1.4. The impact of the specific source on the nearest sensitive receiver is a likely overprediction based on several worst-case assumptions, which are not all likely to apply in reality. The numerical assessment shows the source is predicted to exceed background by 1-3dB, which is a minor exceedance which would not be perceptible by the general population. The proposed source is not predicted to have an adverse impact on the internal living conditions of the nearest residential property.
- 11.1.5. We strongly recommend that this report be passed to the local planning authority for approval prior to any works being carried out.

12. Appendix

APPENDIX A: Summary Information

Required ISO Test Report Information (cross referenced where required)			
		Measurements carried out to:	Analysed to:
A	Standards	BS 7445-1: 2003 BS 7445-2: 1991	BS4142:2014
B	Organisation performed the measurements	noise.co.uk Ltd, The Haybarn, Newnham Grounds, Kings Newnham Lane, Bretford, Coventry, CV23 0JU.	
C	Name of Client	Karden Gardner Architects	
D	Full site address	9 Primrose Lane, Rhos, Swansea, SA8 3ES	
E	Date of surveys	Survey Date: 4 th January 2024 to 5 th January 2024	
F	Description & identification of Proposed Development	It is proposed to develop the site for residential use.	
G	Brief Description of details of Procedure & equipment	See Section 5 of this report.	

APPENDIX B: Technical Appendix

12.1.1. Measurements were made using the following equipment:

Monitoring Position	Sound Level Meter (Serial Number)	Calibrator (Serial Number)
1	SoftdB Piccolo 2 (PO221070105)	BSWA CA114 (590010)

12.1.2. The equipment has traceable calibration. The sound level meter was calibrated immediately prior to and immediately after the measurements were carried out.

Sound Level Meter	Before	After
SoftdB Piccolo 2 (PO221070105)	94.0 dB	94.0 dB

12.1.3. There was no adverse deviation.