



ACOUSTIC
CONSULTANTS LTD

Noise Impact Assessment

**Cefn Isaf Flats, Merthyr Tydfil
Proposed Residential Development**

Reference: 10352/JA

Client:

MERTHYR
VALLEYS HOMES

Document Control

Version:	Revision Description:	Date:	Author:	Reviewed by:	Approved by:
1.0	First Issue	02/08/2023	Sam Frankcom	James Abbass	Blake Lucas
Rev2	PPW Edition 12	09/02/2024	Sam Frankcom	James Abbass	Blake Lucas
Rev3	ASHP Assessment	22/04/2024	Sam Frankcom	James Abbass	Blake Lucas
Rev4	ASHP Assessment	23/05/2024	Sam Frankcom	James Abbass	Blake Lucas

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.

Table of Contents

1.	Introduction	4
2.	The Site & Proposals	5
3.	Planning & Noise	7
4.	Assessment Criteria	11
5.	Baseline Noise Survey	14
6.	Noise Exposure Category	18
7.	Proposed External Plant	19
8.	Noise Modelling	22
9.	Plant Noise Assessment	24
10.	Summary and Conclusions	27
11.	Appendix 1 – Glossary of Acoustic Terminology	28

1. Introduction

Merthyr Valley Homes appointed Acoustic Consultants Limited to undertake a noise and vibration assessment for the proposed residential development in Merthyr Tydfil.

A site noise survey was undertaken to determine the existing noise levels at the site, representative of the proposals.

Relevant assessment criteria have been identified including British Standard 8233:2014 (BS8233), Approved Document O (Wales) (ADO), and British Standard 4142:2014+A1:2019, which are used to achieve planning aims in Planning Policy Wales (PPW) and Technical Advice Note 11 (TAN11).

The author of this report is a Technician Member of the Institute of Acoustics with over two years of experience in the field of noise and is suitably qualified to undertake this assessment. The report has been reviewed by a full Member of the Institute of Acoustics with over 5 years' experience in acoustics. The report has been approved by a full Member of the Institute of Acoustics with over 16 years' experience in acoustics.

2. The Site & Proposals

The proposed site is an existing residential building in Cefn-Coed-y-Cymmer, Merthyr Tydfil, that is no longer in use. It is proposed to demolish the existing structure and develop new residential apartment blocks on the site.

To the west of the site is a roundabout-junction where the A465 and A470 meet. The A465 is approximately 430m to the west and the A470 is approximately 250m to the southwest. Roads that border the site boundary itself include Pontycapel Road to the north and Wern Road to the west and south.

The surrounding area is primarily residential accommodation and has Ysgol Y Graig Community Primary School to the north of the site. There is also Goedre'r Coed Field approximately 100 meters to the east which is for general community use, sport matches and small-scale events such as a school sports day.

The proposed development will include two residential blocks that will be 5 stories high and contain 44 new residential dwellings.

The figures below detail the site location in context and the proposed site layout.

Figure 1: Site location (red) in context

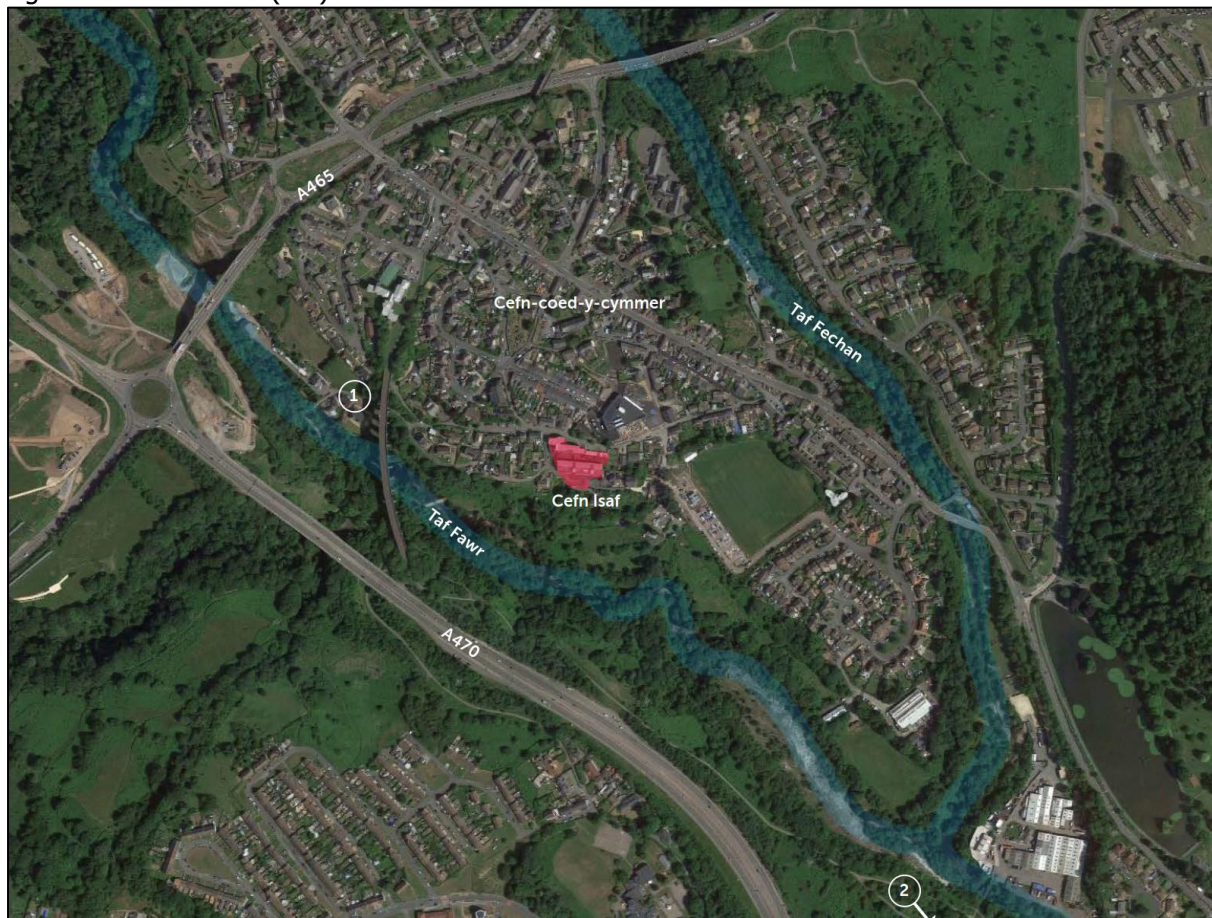


Figure 2: Proposed site layout



3. Planning & Noise

3.1. Planning Policy Wales (PPW)

Planning Policy Wales (PPW) Edition 12 dated February 2024 sets out the land use planning policies of the Welsh Government. Section 1 states:

1.1 Planning Policy Wales (PPW) sets out the land use planning policies of the Welsh Government. It is supplemented by a series of Technical Advice Notes (TANs), Welsh Government Circulars, and policy clarification letters, which together with PPW provide the national planning policy framework for Wales. PPW, the TANs¹, MTANs² and policy clarification letters comprise national planning policy.

The most relevant statements for noise affecting a residential use are provided in Section 6.7 and summarised below:

"6.7.1 Clean air and an appropriate soundscape, contribute to a positive experience of place as well as being necessary for public health, amenity and well-being. They are indicators of local environmental quality and integral qualities of place which should be protected through preventative or proactive action through the planning system. Conversely, air, noise and light pollution can have negative effects on people, biodiversity and the resilience of ecosystems and should be reduced as far as possible."

6.7.4 The planning system should maximise its contribution to achieving the well-being goals, and in particular a healthier Wales, by aiming to reduce average population exposure to air and noise pollution alongside action to tackle high pollution hotspots. In doing so, it should consider the long-term effects of current and predicted levels of air and noise pollution on individuals, society and the environment and identify and pursue any opportunities to reduce, or at least, minimise population exposure to air and noise pollution, and improve soundscapes, where it is practical and feasible to do so.

6.7.5 In taking forward these broad objectives the key planning policy principle is to consider the effects which proposed developments may have on air or soundscape quality and the effects which existing air or soundscape quality may have on proposed developments. Air Quality and soundscape influence choice of location and distribution of development and it will be important to consider the relationship of proposed development to existing development and its surrounding area and its potential to exacerbate or create poor air quality or inappropriate soundscapes. The agent of change principle says that a business or person responsible for introducing a change is responsible for managing that change. In practice, for example, this means a developer would have to ensure that solutions to address air quality or noise from nearby pre-existing infrastructure, businesses or venues can be found and implemented as part of ensuring development is acceptable.

6.7.6 In proposing new development, planning authorities and developers must, therefore:

- address any implication arising as a result of its association with, or location within, air quality management areas, noise action planning priority areas or areas where there are sensitive receptors;*
- not create areas of poor air quality or inappropriate soundscape; and*
- seek to incorporate measures which reduce overall exposure to air and noise pollution and create appropriate soundscapes.*

6.7.7 To assist decision making it will be important that the most appropriate level of information is provided and it may be necessary for a technical air quality and noise assessment to be undertaken by a suitably qualified and competent person on behalf of the developer."

6.7.8 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;*
- ensuring progress towards a shift to low or zero emissions means of road transport, such as electrical charging points;*
- supporting low or zero emissions public transport;*
- providing active travel infrastructure; and*
- incorporating green infrastructure, where it can improve air quality by removing air pollution and aiding its dispersal, reduce 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.*

6.7.14 Proposed development 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. In circumstances where impacts are unacceptable, for example where adequate mitigation is unlikely to be sufficient to safeguard local amenity in terms of air quality and the acoustic environment it will be appropriate to refuse permission.

6.7.19 The health imperative of good air quality and appropriate soundscapes in contributing to the overall character and quality of places and the health and well-being of people and wildlife should be fully recognised. It will not be appropriate to locate sensitive uses, such as hospitals, schools, care homes and housing adjacent to busy roads or other transport routes, where there are no connectivity benefits to be gained and where health and amenity impacts associated with increased exposure of people to pollution will be unacceptable. Whilst some uses may be appropriate with

the aid of good design air quality and soundscape considerations can be overriding factors, especially for sensitive uses, if they cannot be adequately mitigated and impacts minimised.

6.7.20 Where sensitive developments need to be located close to existing transportation infrastructure for sustainable movement and access they should be designed, as far as practicable, to limit harmful substances and noise levels within and around those developments both now and in the future. This may include employing the principles of good acoustic design and the inclusion of active travel or travel management measures as part of development proposals. Such development, however, should preferably be located away from existing sources of significant noise, which may include aircraft noise or roads, particularly new roads or those with programmed route improvements.

6.7.21 Regard should be paid to current air quality and noise levels and the quality of the existing soundscape and account taken of any relevant local air quality action plan, noise action plan and/ or local or regional air quality strategy as part of development strategies and proposals in development plans and before determining planning applications.

6.7.24 The potential impacts of noise pollution arising from existing development, be this commercial, industrial, transport related or cultural venues (such as music venues, theatres or arts centres), must be fully considered to ensure the effects on new development can be adequately controlled to safeguard amenity and any necessary measures and controls should be incorporated as part of the proposed new development. This will help to prevent the risk of restrictions or possible closure of existing premises or adverse impacts on transport infrastructure due to noise and other complaints from occupiers of new developments. It will be important that the most appropriate level of information is provided and assessment undertaken.

PPW does not provide any quantifiable criteria and directs you to the Technical Advice Notes (TAN 11).

3.2. Technical Advice Note (Wales) - Noise

The relevant planning criteria for proposed residential development is in Technical Advice Note (Wales) 11 entitled "Noise" which was published in October 1997. The introduction states:

"This note provides advice on how the planning system can be used to minimise the adverse impact of noise without placing unreasonable restrictions on development or adding unduly to the costs and administrative burdens of business. It outlines some of the main considerations which local planning authorities should take into account in drawing-up development plan policies and when determining planning applications for development which will either generate noise or be exposed to existing noise sources".

Table 1 provides Noise Exposure Categories (NECs), which relate to proposed residential developments near to a transportation and mixed noise sources. NECs are addressed in ranges according to the free-field equivalent noise levels ($L_{Aeq, T}$) measured at the position of the proposed dwellings.

Table 1: TAN 11 noise exposure categories

NOISE SOURCE	NOISE EXPOSURE CATEGORY			
	A	B	C	D
Mixed Noise				
07.00 - 23.00 hours	<55	55 – 63	63 – 72	>72
23.00 - 07.00 hours	<45	45 – 57	57 – 66	>66

The Technical Advice Note (Wales) 11 gives advice to Local Planning Authorities on assessing proposals for residential developments near a source of noise, depending upon which of the four Noise Exposure Categories the proposed site falls into:

NEC A. Noise need not be considered as a determining factor in granting planning permission, although the noise level at the high end of the category should not be regarded as desirable.

NEC B. Noise should be taken into account when determining planning applications and where appropriate, conditions imposed to ensure an adequate level of protection.

NEC C. Planning permission should not normally be granted. Where it is considered that permission should be given, for example because there are no alternative quieter sites available, conditions should be imposed to ensure a commensurate level of protection against noise.

NEC D. Planning permission should normally be refused.

In addition, it states: *"Night-time noise levels (23.000 - 07.00): sites where individual noise events regularly exceed 82 dB L_{Amax} (S time weighting) several times in any hour should be treated as being in NEC C, regardless of the $L_{Aeq, 8h}$ (except where the $L_{Aeq, 8h}$ already puts the site in NEC D)."*

Where the Noise Exposure Category for a site falls into NEC B, C or D mitigation will be necessary to control external noise observed within a dwelling.

4. Assessment Criteria

Where a site falls into NEC B – D, the following criteria should apply. If a site falls into NEC A, no specific noise control measures would be required.

4.1. British Standard 8233:2014

BS8233:2014 entitled 'Guidance on sound insulation and noise reduction for buildings', provides advice on noise as it affects buildings of all types, giving consideration to various common sources of noise. This is considered relevant when assessing noise from external noise sources as it effects the proposed residential properties under background ventilation conditions.

The standard outlines design guidance in general terms and provides criteria for the indoor ambient noise levels (IANLs) for different types of room. These are stated in terms of the 'equivalent continuous sound pressure level' over the reference time period, the $L_{Aeq, T}$. The IANLs specified by British Standard 8233 that are relevant to this development are as follows.

Table 2: British Standard 8233:2014 Internal Noise Criteria

Activity	Location	Daytime (07:00 to 23:00)	Night-time (23:00 to 07:00)
Resting	Living Room	35 dB $L_{Aeq,16 \text{ hour}}$	-
Dining	Dining Room/area	40 dB $L_{Aeq,16 \text{ hour}}$	-
Sleeping (daytime resting)	Bedroom	35 dB $L_{Aeq,16 \text{ hour}}$	30 dB $L_{Aeq,8 \text{ hour}}$

The British Standard does not provide any internal noise criteria for maximum noise levels.

Section 3.4 of the WHO Guidelines state *"For a good sleep, it is believed that indoor sound pressure levels should not exceed approximately 45 dB L_{Amax} more than 10-15 times per night (Vallet & Verbey 1991)"*. We would consider this criteria applicable.

4.2. Overheating Ventilation – Approved Document O

Welsh Approved Document O does not set out noise thresholds above which overheating should be considered and states the following:

"When the removing excess heat as part of the overheating strategy, noise levels in bedrooms should be kept to a minimum during the sleeping hours of 23:00 – 07:00. Building control bodies may accept as evidence that this requirement is satisfied:

a. documentation to demonstrate that the local planning authority did not consider external noise to be an issue at the site at the planning stage or;

b. if the local planning authority did consider external noise to be an issue that should be controlled through a condition at planning stage, then documentation to demonstrate that the proposals for heat removal (during the sleeping hours of 23.00 – 07.00) are accommodated within or do not conflict with documentation provided to the local planning authority to satisfy any related planning permission condition(s). (For example any expectation that windows on one or more façade, or in certain rooms, will need to be kept closed during noise-sensitive periods.)”

As no thresholds are set in the Welsh guidance, we would consider it reasonable to apply the limits set in the English Approved Document O if a site falls into NEC B-D only. The proposed criteria is as follows:

"3.3 Windows are likely to be closed during sleeping hours if noise within bedrooms exceeds the following limits.

a. 40dB $L_{Aeq,T}$, averaged over 8 hours (between 11pm and 7am).

b. 55dB L_{AFmax} , more than 10 times a night (between 11pm and 7am).

4.3. **British Standard 4142:2014+A1:2019**

For fixed plant (proposed ASHP), the relevant guidance is within British Standard 4142:2014+A1:2019 entitled 'Method for rating and assessing industrial and commercial sound' uses 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 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).

Section 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.

Section 11 of the British Standard, entitled 'Assessment of the Impacts', 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."*

5. Baseline Noise Survey

A baseline noise survey was undertaken at the site between the 22nd and 26th of June 2023.

5.1. Monitoring Equipment

Sound Pressure Levels were measured using three Class 1 sound level meters with half-inch condenser microphones, using the 'fast' setting. The equipment is checked regularly using a Quality System meeting the requirements of British Standard EN ISO/IEC 17025:2017 "General requirements for the competence of testing and calibration laboratories"; in accordance with British Standard EN 10012:2003 "Measurement management systems. Requirements for measurement processes and measuring equipment"; and traceable to the National Standards.

This equipment was checked and calibrated as shown in Table 3 and the certificates are available for inspection.

Table 3: Equipment and Calibration Status

Equipment Description / Manufacturer / Type	Serial Number	Date of Calibration	Calibration Certification Number
SLM, NTI, XL2	A2A-09705-E0	23/09/2021	39023
Pre-Amp, NTI, MA220	5332	23/09/2021	39023
Microphone, NTI, MC230A	A14374	23/09/2021	39022
Calibrator, NOR-1251	35230	30/11/2022	42658
SLM, Svantek, 977A	69510	09/03/2022	1501934-1
Pre-Amplifier, Svantek, SV12L	73650	09/03/2022	1501934-1
Microphone, ACO Pacific, 7052E	70151	09/03/2022	1501934-1
Calibrator, Larson Davis, CAL200	17892	17/04/2023	44016

5.2. Weather Conditions

The table below details the weather conditions present at the site during the survey period. The approximate details provided are taken from timeanddate.com. The weather was calm, dry, and clear with wind speeds less than 5m/s.

Table 4: Noise Survey Weather Conditions

Date	Wind Speed (m/s)	Wind Direction	Average Air Temperature (°C)	Precipitation (time/hrs)	Cloud Cover (%)
22/06/2023	≤5	W	15 - 22	0	25
23/06/2023	≤3	W	14 - 23	0	25
24/06/2023	≤4	S	18 - 25	0	50
25/06/2023	≤5	SE / W	16 - 24	0	25
26/06/2023	≤5	W	14 - 20	0	25

Weather conditions are not considered to have had an adverse effect on the collected data.

5.3. Monitoring Procedure

The existing baseline noise climate was monitored in two locations at the site. The monitoring positions are provided in the figure below.

Figure 3: Monitoring positions MP1 & MP2



5.3.1. Monitoring Position 1

Monitoring position 1 was situated in a façade position out of a second story window on the northern façade of the existing building. The principal noise sources include distant road traffic from the A465 and some playground activity from the school to the north.

It should be of note that during the survey period, road works were being undertaken at the A465/ A470 junction to the west. The monitoring position was shielded from construction noise, so collected data is not expected to have been adversely affected.

5.3.2. Monitoring Position 2

Monitoring position 2 was situated in a façade position out of a fourth story window on the southern façade of the existing building. The principal noise sources include distant road traffic to the west on the A465 and to the south on the A470.

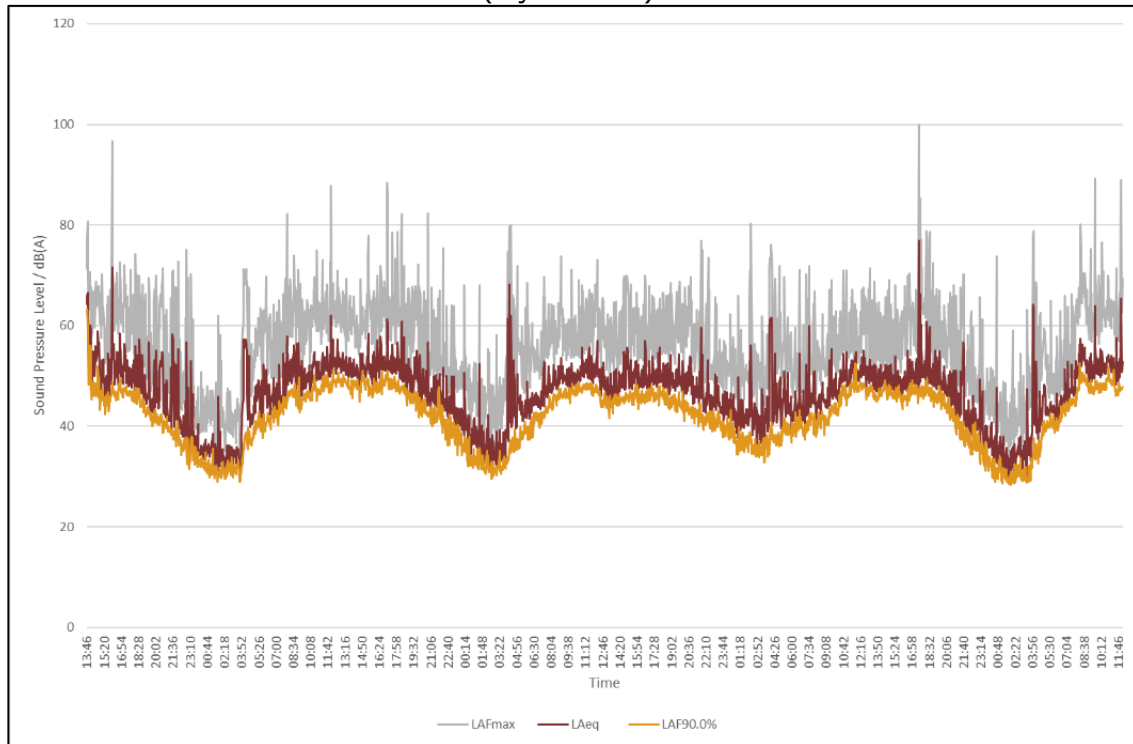
During the equipment set up, it was observed that there was a school fete/ sports day event at the nearby park to the east of the site. As with MP1, road works were being undertaken at the A465/ A470 junction to the west during the survey period; MP2 was shielded from this construction noise. Noise from the school event to the east and roadworks to the west is not expected to have had an adverse effect on the collected data.

5.4. Noise Monitoring Data

5.4.1. Monitoring Position 1

A chart detailing the measured equivalent (L_{Aeq} , 2 minutes), maximum (L_{AFmax} , 2 minutes) and background (L_{A90} , 2 minutes) noise levels over the survey period is provided below.

Chart 1: Measured levels over time at MP1 (façade levels)



The table below details the measured daytime equivalent (L_{Aeq} , 16 hour), night time equivalent (L_{Aeq} , 8 hour) and night time maximum (L_{AFmax}) noise levels over the full survey period converted into free-field noise levels. The noise levels below are considered representative of the levels at the proposed northern façades.

Table 5: Measured daytime and night time noise levels at MP1 (free field levels)

Parameter	Sound Pressure Level (dB) per Octave Band (Hz)								dBA
	63	125	250	500	1k	2k	4k	8k	
L_{Aeq} , 16 hour	52	47	47	45	45	42	36	30	49
L_{Aeq} , 8 hour	43	37	36	34	36	41	35	25	44
L_{AFmax}	58	54	54	53	56	46	67	51	68

The table below details the measured 15-minute background (L_{A90}) and equivalent (L_{Aeq}) noise levels measured at MP1.

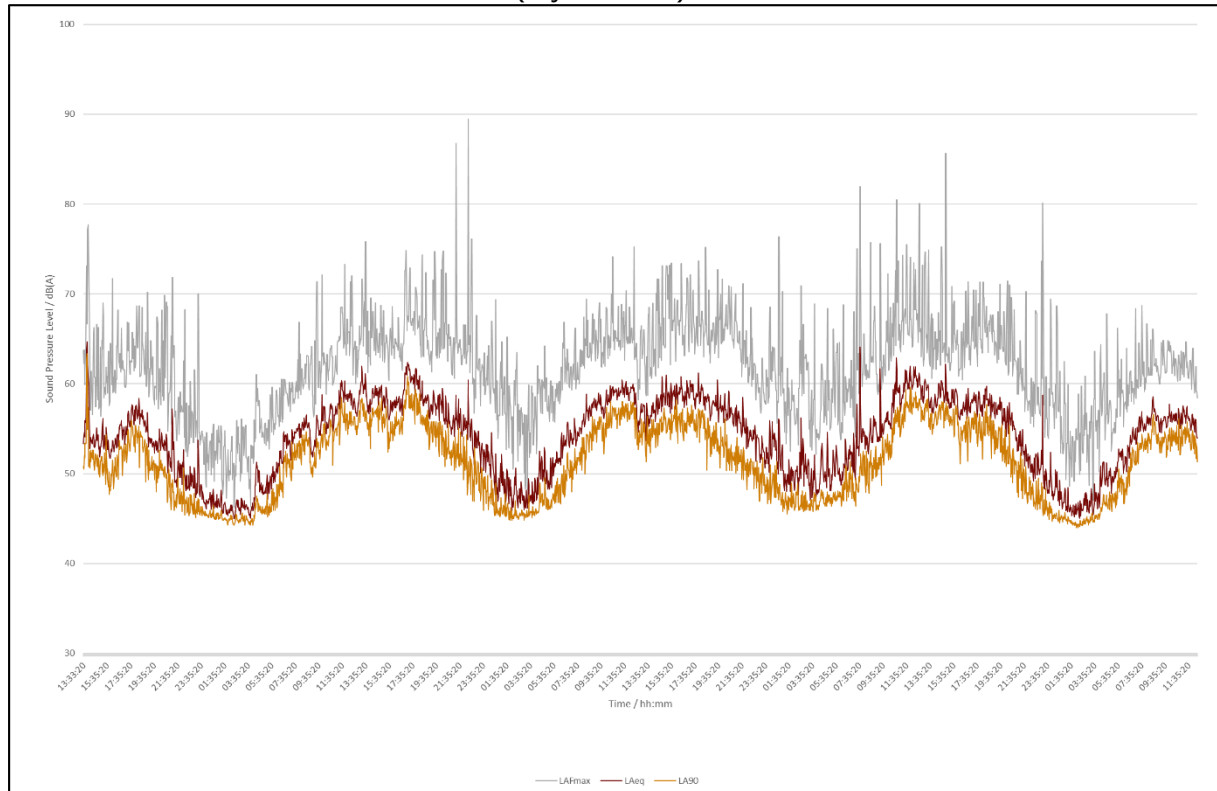
Table 6: Measured 15-minute noise levels at MP1 (facade levels)

Period	L_{A90} , 15 minutes		L_{Aeq} , 15 minutes	
	Range	Typical	Range	Typical
Daytime	36 - 50	46	40 - 69	50
Night Time	29 - 43	31	32 - 61	42

5.4.2. Monitoring Position 2

A chart detailing the measured equivalent ($L_{Aeq, 2 \text{ minutes}}$), maximum ($L_{AFmax, 2 \text{ minutes}}$) and background ($L_{A90, 2 \text{ minutes}}$) noise levels over the survey period is provided below.

Chart 2: Measured levels over time at MP2 (façade levels)



The table below details the measured daytime equivalent ($L_{Aeq, 16 \text{ hour}}$), night time equivalent ($L_{Aeq, 8 \text{ hour}}$) and night time maximum (L_{AFmax}) noise levels over the full survey period converted into free-field noise levels. The noise levels below are considered representative of the levels at the proposed southern façades.

Table 7: Measured daytime and night time noise levels at MP2 (free field levels)

Parameter	Sound Pressure Level (dB) per Octave Band (Hz)								dBA
	63	125	250	500	1k	2k	4k	8k	
$L_{Aeq, 16 \text{ hour}}$	54	48	50	50	53	42	34	26	54
$L_{Aeq, 8 \text{ hour}}$	42	42	43	45	40	35	27	11	45
L_{AFmax}	72	64	63	63	65	59	48	40	67

The table below details the measured 15-minute background (L_{A90}) and equivalent (L_{Aeq}) noise levels measured at MP2.

Table 8: Measured 15-minute noise levels at MP2 (façade levels)

Period	$L_{A90, 15 \text{ minutes}}$		$L_{Aeq, 15 \text{ minutes}}$	
	Range	Typical	Range	Typical
Daytime	43 - 56	51	46 - 59	55
Night Time	41 - 48	42	42 - 51	47

6. Noise Exposure Category

The free-field levels due to road traffic at the worst-case façade (south) are 54 dB $L_{Aeq, 16\text{hour}}$ during the day and 45 dB $L_{Aeq, 8\text{hour}}$ during the night. Based on the measured levels above, the NEC due to road traffic at the development would fall into category A, which states:

"Noise need not be considered as a determining factor in granting planning permission, although the noise level at the high end of the category should not be regarded as desirable."

The 10th highest max (as per WHO Guidelines on Community Noise, 1999) measured at the worst-case façade was 68 dB L_{AFmax} . This does not affect the noise exposure category for the site.

As noise levels fall into Exposure Category A, no specific noise control measures are required. This applies for both normal ventilation conditions and under over heating conditions.

In the event of overheating and noise requiring consideration, the measured noise data indicates that noise levels within bedrooms would fall within ADO criteria noted above.

7. Proposed External Plant

The information below is based on proposed plant details at the time of writing. Any alterations to plant design may require reassessment.

7.1. Air Source Heat Pump

The following comments are for guidance only. It is the responsibility of the manufacturer to ensure the ASHP cumulative noise level does not exceed 34 dB $L_{Aeq,T}$ at the façade of the most sensitive dwelling.

7.1.1. Proposed Unit & Location

The proposed ASHP unit is to be installed to the northwest of proposed block A. The proposed unit is a DAIKIN EWYT215B-XRA1+OP205.

The manufacturer's sound power level for this unit is 87 dBA. No spectral sound power data is provided by the manufacturer. In this instance, we have applied a correction to the reported octave band sound pressure levels supplied by the manufacturer. Spectral sound power levels may differ to these; and for an accurate assessment we should be supplied the octave band sound power levels.

The sound power data derived from the manufacturer's sound pressure data is provided below.

Chart 3: Derived Sound Power Data of Proposed Plant

Sound Power Level per Octave Band Frequency (dB L_w / Hz)								L _{WA}
63	125	250	500	1000	2000	4000	8000	
84	90	85	84	82	78	72	65	87

It should be noted that any changes to the plant schedule (including plant sound power level) 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. It is the responsibility of the manufacturer to ensure this information is correct.

The unit is proposed to be installed in the location marked below.

Figure 4: Proposed ASHP Location



7.1.2. Proposed Attenuator and Enclosure

The proposals indicate the unit will be housed within an aluminium louvred structure 2.25m high.

The drawings show this is to be enclosed to all sides, but open to the roof for air flow. We have previously informed the design team that the unit should be fully enclosed. There should be no gaps in the structure. This includes between the enclosure/louvers and any attenuator on top of the unit.

In addition to the enclosure noted above, fan silencers or similar attenuators will be required to be installed to the top of the unit.

Companies such as Environ, Wakefield Acoustics, and Bespoke Acoustic Solutions (BAS) can provide full acoustic enclosures with air flow requirements considered. We would strongly advise these are investigated for implementation to minimise the risk of noise complaint.

Any louvres, enclosure or attenuators in the structure should achieve the following insertion loss as a minimum.

Table 9: Proposed Insertion loss for ASHP Noise Control Elements

Insertion Loss per Octave Band Frequency (dB / Hz)							
63	125	250	500	1000	2000	4000	8000
7	8	12	21	28	30	28	27

7.2. Substation

Plans also include for a new substation to be installed to the north-west of the site boundary, adjacent to Block A, and Wern Road.

According to documents sourced via Schneider Electric, the worst-case sound power level of a substation comprising a capacity of 2000kVA is 62 dB L_{WA} .

We understand that the substation will be enclosed in a self-contained unit. We would advise that the construction of the housing be fully enclosed with brick or block work. However, if louvres are required in the design of the construction, these should achieve a minimum weighted sound reduction of 15 dB R_w .

From our experience, this is achievable, subject to design requirements and installation.

With this implementation, noise emission from the substation is expected to be controlled to the existing and proposed dwellings. The supplier or manufacturer of the substation should confirm there are no significant noise characteristics such as tonality.

8. Noise Modelling

Noise modelling has been undertaken to assess the impact of the external plant proposals.

To determine noise levels across the site, noise modelling has been undertaken using computer modelling package Cadna:A by DataKustik and the noise data noted above.

8.1. Noise Model Parameters

The noise predictions have been undertaken based on the site layout provided above and the following modelling parameters.

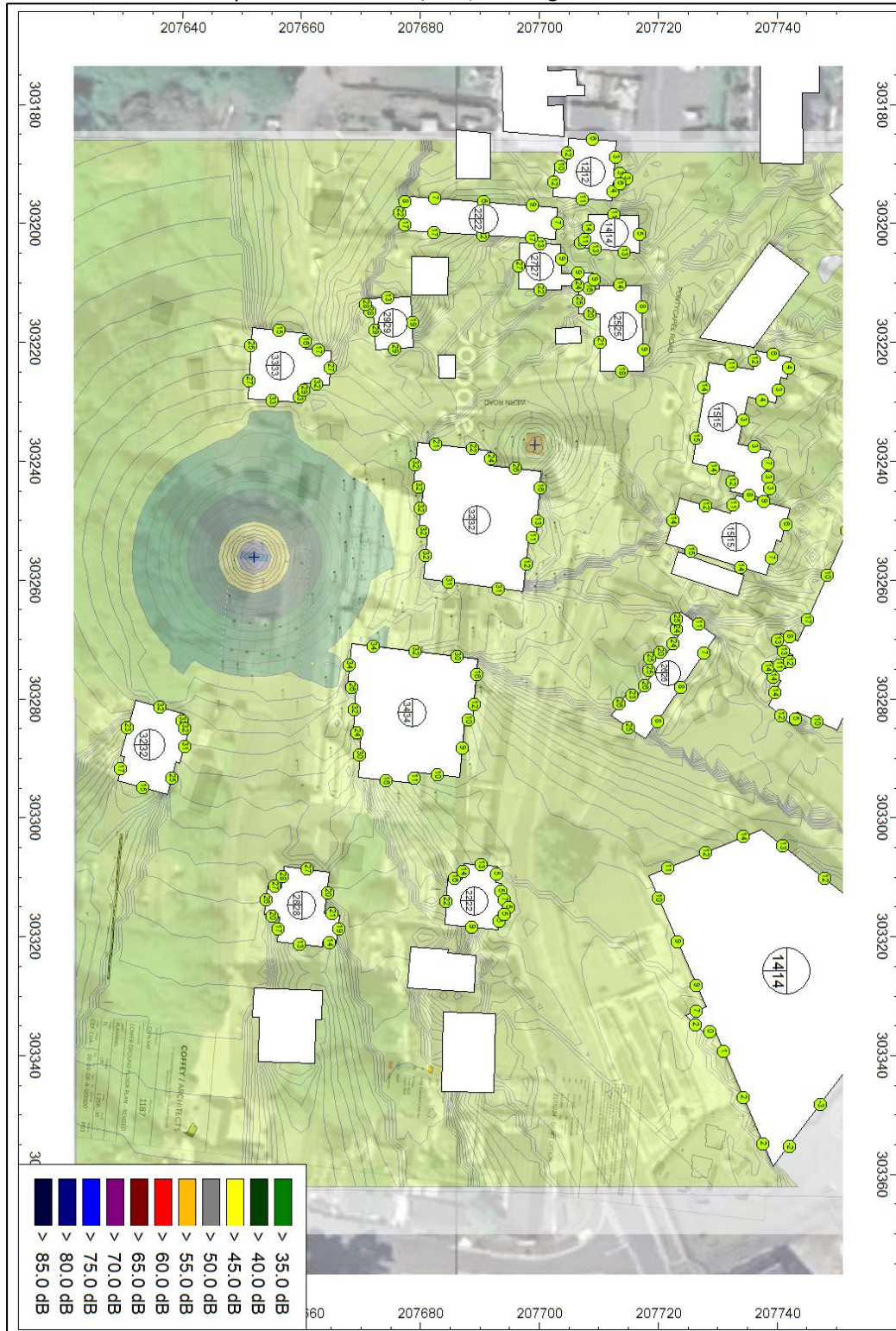
- Building heights (proposed & existing) are based on drawings, our site visit, and Google satellite imagery.
- All buildings are reflective, a third order of reflections are programmed.
- The surrounding ground is hard and reflective ($G=0$).
- The topography of the site is considered to be flat, as a worst-case scenario.
- The proposed ASHP noise data considered in the model is provided above.
- The ASHP has been included as a point source.
- The proposed enclosure has been included in the model with the sound reduction data provided above.
- We have included the substation with a worst-case scenario noise level as noted above, including the sound reduction of the proposed housing noted above.
- The building façade level is the highest level at each façade.
- We consider that the ASHP could be used during both day and night periods.

The noise modelling results are provided below.

8.2. Noise Modelling Results

The following noise map provides the predicted noise emission due to plant operating continuously over day and night assessment periods (1-hour and 15-minutes respectively).

Figure 5: Noise Prediction Map of External Plant, $L_{Aeq,T}$ - 4m grid



8.3. Noise Modelling Summary

From the noise modelling undertaken, the worst-case cumulative noise level at the façade of the NSRs is 34 dB $L_{Aeq,T}$ at a location representative of monitoring position 2, baseline data provided in Section 5.4.2.

9. Plant Noise Assessment

A noise impact assessment at the sensitive receivers around the site is provided in accordance with BS4142:2014+A1:2019.

9.1. Initial Estimate

9.1.1. Background Sound Levels

From our measured survey data provided above we have determined the following existing background sound levels at the site.

- 51 dB $L_{A90,60\text{minutes}}$ during the day
- 42 dB $L_{A90,15\text{minutes}}$ during the night

These levels are based on the most sensitive dwellings to the proposed units, which are represented by monitoring position 2 from the survey. Dwellings to position 1 are fully shielded by the proposed and existing buildings.

9.1.2. Specific Sound Level

The specific sound level due to operating plant is 34 dB $L_{Aeq,60\text{minutes}}$ during the day, and 34 dB $L_{Aeq,15\text{minutes}}$ during the night.

This is the level determined at the NSRs without any character corrections applied.

9.1.3. Character Corrections

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

Tonality – The ASHP data provided by the manufacturer does not display any tonal noise character. The manufacturer should confirm this. The transformer operation does not include any distinguishable tonality based on provided manufacturers information and based on predicted noise levels at the receiver which is below existing background noise levels. No character correction applied.

Impulsivity – The plant noise is not expected to have any clear impulsivity at the dwellings based on the background and residual noise climate measured, along with the modelling results above. No character correction applied.

Intermittency – The plant noise is not expected to have any clear intermittency at the dwellings based on the background and residual noise climate measured, along with the modelling results above. No character correction applied.

Other Sound Characteristics – A character correction is necessary for other sound characteristics and a +3dB correction was applied.

The manufacturer should confirm that there are no significantly distinguishable noise characteristics emitted from the plant unit when operational.

9.1.4. Initial Estimate Assessment

Therefore, the British Standard 4142:2014 initial estimate of the noise impact at the most sensitive location for the two noise models created above, are as follows:

Table 10: British Standard 4142:2014 Initial Estimate at worst case receiver to the west

Parameters	Assessment Period	
	Daytime 07:00 to 23:00	Night-time 23:00 to 07:00
Background Sound Level, $L_{A90}(T)$ dB	51	42
Specific Sound Level, $L_{Aeq}(T)$ dB	34	34
Acoustic Character Correction, dB	+3	+3
Rating Sound Level $L_{Ar}(T)$ dB	37	37
Difference between rating and background, dB	-14	-5

Where T is 1-hour for daytime assessments, and 15-minute for night-time assessments.

This means the rating noise level will result in a British Standard 4142:2014 assessment difference of -14 dB during the day, and -5dB during the night at the most sensitive receivers.

This means the rating level is low, however context should be considered.

9.2. Context

9.2.1. Absolute Levels

"1) The absolute level of sound. For a given difference between the rating level and the background sound level, the magnitude of the overall impact might be greater for an acoustic environment where the residual sound level is high than for an acoustic environment where the residual sound level is low. Where background sound levels and rating levels are low, absolute levels might be as, or more, relevant than the margin by which the rating level exceeds the background. This is especially true at night. Where residual sound levels are very high, the residual sound might itself result in adverse impacts or significant adverse impacts, and the margin by which the rating level exceeds the background might simply be an indication of the extent to which the specific sound source is likely to make those impacts worse.

With regard to 'absolute levels', the most relevant guidance is British Standard 8233:2014 and WHO 1999. Internally to a dwelling during the day should not exceed 35 dB $L_{Aeq,16hour}$ and 30 dB $L_{Aeq,8hour}$ during the night.

The internal level is approximately 15 dB(A) quieter than the external free-field level (as stated by the WHO) allowing for the attenuation of a partially open window. Therefore, based on the above, the worst-case absolute level assessment is follows.

Table 11: Absolute level assessment

Time Period	Predicted External Level	Open Window Correction dB(A)	Predicted Internal Level $L_{Ar,T}$ dB	Within Criteria
Day	37 $L_{Ar,60minute}$ dB	-15	22	YES
Night	37 $L_{Ar,15minute}$ dB	-15	22	YES

As can be seen from the table above, the rating sound level of the installed plant is comfortably within the BS8233:2014 criteria for acceptable levels during the day and night.

9.2.2. Residual Levels

The lowest measured residual noise levels at a location representative of the most sensitive NSR are 46 dB $L_{Aeq,1hour}$ during the day and 42 dB $L_{Aeq,15minutes}$ during the night. The rating sound level, L_r , at the façade of the NSR is 37 dB $L_{Ar,T}$.

The L_r falls below the measured residual noise climate during both the day and night, by 9 dB and 5 dB respectively.

9.3. Noise Assessment Summary

A noise impact assessment has been undertaken based on measured existing baseline noise levels along with predicted plant noise levels at the NSRs. The assessment indicates that plant noise levels will fall below existing background sound levels during both day and night periods.

With context also considered, absolute levels within a dwelling fall far below the indoor ambient noise level criteria in terms of relevant BS8233 criteria. When compared to the existing residual sound levels at the site, the predicted plant noise levels fall below both day and night-time residual sound levels at the NSRs.

It is important to note that the above is based on derived sound power data from sound pressure data reported from the manufacturer. The sound power data could differ from that noted above (increase or decrease).

The noise control measures presented above are best available solutions with the information we have been provided with or been able to source. Due to this, it is not guaranteed that the noise emission from the proposed unit will be as derived and modelled within this report, and further noise control may be required once the unit is fully installed and operational.

10. Summary and Conclusions

Merthyr Valley Homes appointed Acoustic Consultants Limited to carry out an environmental noise assessment for the proposed residential development in Merthyr Tydfil.

A noise survey was carried out to determine environmental noise levels at the site, representative of the proposed facades of the residential development.

Measured noise levels fall into the NEC 'A' of TAN11 and therefore, no specific noise control measures are required.

As such, the proposals at the site and detailed in this report achieve the aims of the Planning Policy Wales (PPW) to "*minimise the adverse impact of noise without placing unreasonable restrictions on development or adding unduly to the costs and administrative burdens of business*" via good acoustic design.

Proposed external plant has been assessed through derived sound power data, along with proposed enclosure sound reduction requirements. The noise modelling undertaken indicates that the rating noise level of plant falls below the existing noise climate at the site in all parameters and can achieve the aims of PPW.

Noise control is required to the plant in the form of louvred enclosure, and fan attenuators/silencers. This is fully detailed within the main text of the report.

It is important to note that the above is based on derived sound power data from sound pressure data reported from the manufacturer. The sound power data could differ from that noted above to a minor tolerance (increase or decrease).

The noise control measures presented above are best available solutions with the information we have been provided with or been able to source. Due to this, it is not guaranteed that the noise emission from the proposed unit will be as derived and modelled within this report, and further noise control may be required once the unit is fully installed and operational.

Noise measurements on site may be required once the unit is fully installed to assess the performance of noise control implementation.

11. Appendix 1 – Glossary of Acoustic Terminology

A-weighted sound pressure p_A – 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 μ Pa)

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, $T = t_2 - t_1$, has the same mean-squared sound pressure as a sound that varies with time, and is given by the following equation:

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

where:

p_0 is the reference sound pressure (20 μ Pa); 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).



ACOUSTIC
CONSULTANTS LTD

Head Office: 194 West Street, Bedminster, Bristol, BS3 3NB
T: 0117 986 2956

www.acoustic-ltd.co.uk

Registered Office: 194 West St, Bristol, BS3 3NB Registered No: 8544901