Noise Impact Assessment

Project No: PA353

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Land at Reddish Lane, Whaley Bridge, High Peak, SK23 7FY

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1. Summary

1.1. Proposal

It is proposed to develop a residential dwelling at land off Reddish Lane, Whaley Bridge, High Peak, SK23 7FY.

1.2. Reason for Assessment

The proposed dwelling will be in close proximity of a multi-use game area (MUGA). An assessment has been requested to determine the likely noise impact of the MUGA and for mitigation measures through façade sound insulation (glazing and ventilation) and acoustic barriers to be studied.

1.3. Planning Conditions & Criteria

Desirable noise limits for residential dwellings are set out in BS8233:2014, however these are based upon on anonymous noise sources, such as road traffic. Noise emissions from the MUGA will be from a defined source, therefore penalties are to be applied to account for acoustic characteristics that make the sound more noticeable. The desirable criteria, with penalties applied is as follows:

- 35dB $L_{Aeq,16hr}$ within living rooms (07:00 – 23:00)
- 30dB $L_{Aeq,8hr}$ within bedrooms (23:00 – 07:00)
- 45dB L_{Amax} should not be regularly exceeded within bedrooms (23:00 – 07:00)
- 50dB $L_{Aeq,16hr}$ within external residential amenity spaces

1.4. Assessment Standards & Justification

'BS8233:2014 – Guidance on sound insulation and noise reduction for buildings' is a recognised standard for assessing and mitigating environmental noise levels upon a proposed noise sensitive development. The standard gives a rigorous calculation method for determining interior noise levels based on measured environmental noise levels, however it is noted the rigorous calculation omits the usage for point noise sources, such as raised voices.

'BS EN 12354-3:2000 – Estimation of acoustic performance in buildings from the performance of elements - Airborne sound insulation against outdoor sound' allows internal noise levels to be derived from point sources situated externally from the building façade.

1.5. Measurements

To assess noise emissions, noise measurements were undertaken over a 24-hour period from 8th – 9th August 2016. Periods whereby the MUGA was in use are considered for the assessment and the associated noise levels, as measured, are tabulated below:

Table 1: Measurement Summary

Measurement	Date	Period	dB L_{Aeq}	dB L_{Amax}
M1	8th August	4hr	53.1	82.8

1.6. Noise Assessment Outcome

It is determined that by using mitigation as specified below for the building façade, the outcome summarised in the following table is achieved.

Table 2: Noise Assessment Outcome

Internal Space	Noise Parameter	Internal Noise Level	Within Desired Criteria
Living Room	Daytime $L_{Aeq, 16hr}$	9.6	**Yes**
Bedroom	Night-time $L_{Aeq, 8hr}$	14.6	**Yes**
Bedroom	Night-time L_{AFmax}	25.4	**Yes**
External Space	**Noise Parameter**	**External Noise Level**	**Within Desired Criteria**
Amenity Space	Daytime $L_{Aeq, 16hr}$	Typically, < 48	**Yes**
Roof Terrace	Daytime $L_{Aeq, 16hr}$	Typically, < 48	**Yes**

1.7. Mitigation Recommendations

1.7.1 Façade Specifications

Living Rooms – 6/12/6mm glazing and mechanical ventilation

Bedrooms – 6/12/6mm glazing and mechanical ventilation

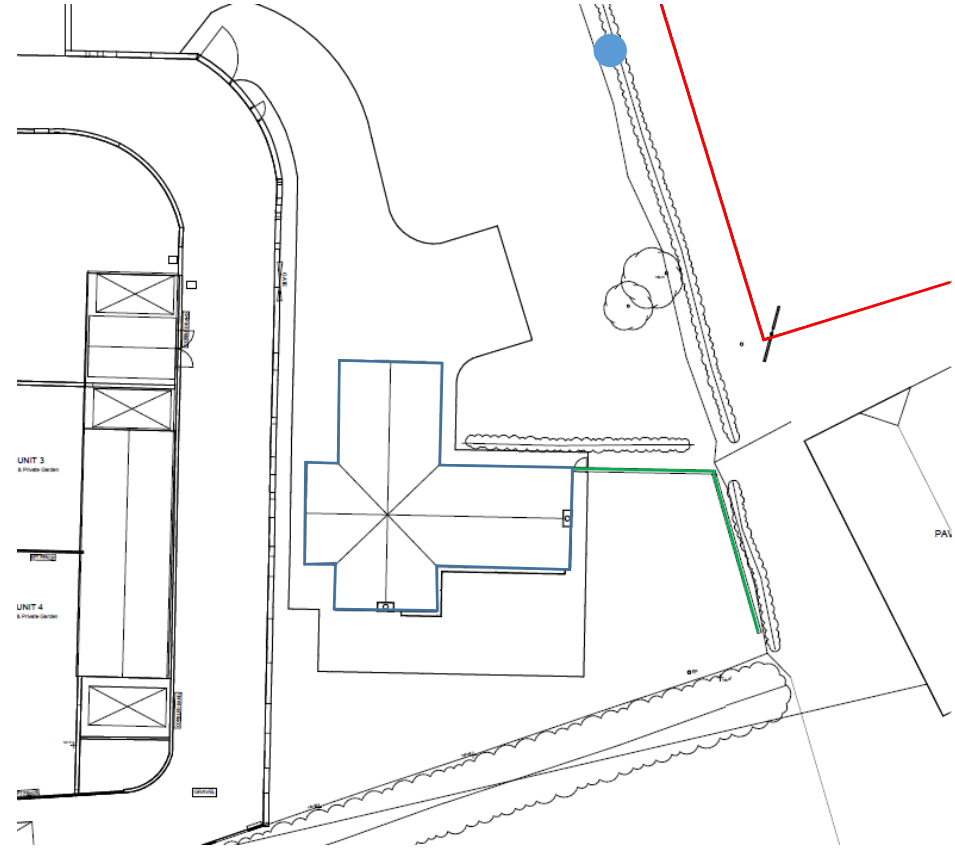
Mechanical ventilation design guidance is given in **Appendix K**.

1.7.2 Acoustic Barrier

An acoustic barrier is required to the west of the site as shown in figure 1.

1.8. Site & Measurement Location

Figure 1: Site, Measurement and Acoustic Barrier Location



Dwelling Location

Measurement Location

MUGA Location

3m Barrier Location

2. Environmental Noise Survey

2.1. Source Under Investigation

Primary noise sources identified onsite were users of the MUGA during operational hours, birdsong and dog walkers. Secondary noises sources included occasional vehicles accessing Reddish Barns. Daytime and night-time noise measurements have been carried out on 8th – 9th August 2016.

3.1. Measurement location

Noise levels were measured at a height of 1.5m from the ground at the eastern boundary of the plot.

3.2. Weather Conditions

Weather conditions were deemed acceptable for environmental noise measurements; detailed weather conditions are given in **Appendix C**.

3.3. Measurement Equipment

Measurement equipment used complies with accuracy requirements for common environmental noise measurement standards. A detailed equipment list is given in **Appendix B** with calibration information in **Appendix D**.

3.4. Measurement Results

The results from the measurement intervals are summarised section 1.5, table 1. Noise levels during use of the MUGA is considered throughout this assessment as a worst-case scenario, accounting for both daytime and possible night-time usage of the MUGA.

3. Noise Modelling

An acoustic model of the site has been developed within industry standard software SoundPLAN, allowing the propagation of the noise from the MUGA to the site to be determined in accordance with 'ISO 9613 – Attenuation of sound during propagation outdoors' considering standard corrections for distance, ground absorption, barriers, reflections etc.

3.1. MUGA Noise Levels

Equivalent

The equivalent noise source is derived from the measured equivalent noise level tabulated in table 1 of **53.1 dB $L_{Aeq,4hr}$**. The measured level in 1/1 octave bands from 63Hz – 4kHz was input into the model as an area source spanning the entire MUGA area at a height of 1.5m to account for both speech noise emissions (occurring at a typical height of 1.8m) and kicking/bouncing emissions (occurring at a lower height of <1.8m). The input levels were calibrated to return 53.1 dB L_{Aeq} at the measurement location.

Maxima

As the location of maxima noise emissions cannot be ascertained, the maxima noise source considered for the assessment is from a shout, whereby a noise level of **89 dB L_{Amax}** is given within a reputable document produced by '*United States Environmental Protection Agency*' titled '*Speech Levels in Various Environments*' - pg. 35. The noise source is modelled as a point source at a height of 1.8m to the southern corner of the MUGA, as close as possible to the development site to demonstrate a worst-case scenario. A centre frequency of 500Hz is considered as human speech typically has a spectral focus towards this frequency, as shown in **Appendix I**. Derived maxima noise levels are inclusive of equivalent noise emissions occurring in unison as it is likely that the shouting will occur during general sports activity.

3.1.1. Penalty

It has been requested by the local planning authority that the noise levels considered within the acoustic model are corrected due to distinguishable acoustic characteristics to give a Sound Rating Level.

The most distinguishable characteristic of the noise emissions from the MUGA is the impulsiveness of both shouting and of balls being kicked/bounced. To account for a worst-case scenario, a **+9dB** penalty for impulsivity, in accordance with the subjective method of '*BS4142:2014 – Methods for rating and assessing industrial and commercial sound*' is applicable. The +9dB penalty has been applied to both the equivalent and maxima noise sources within the acoustic model.

3.2. Noise Levels at the Development Façade

Six receptor locations are placed at habitable room window locations within the acoustic model. The highest incident noise levels are considered for the assessment. All highest noise levels were derived at receptor #6, as shown in **Appendix F**.

Table 3: Incident Noise Levels

Receptor #	Floor	dB $L_{Aeq,4hr}$	dB L_{Amax}
6 (Living Room)	GF	33.9	-
6 (Bedroom)	FF	42.0	61.4

3.3. Noise Levels Within External Amenity Spaces

A noise maps demonstrating equivalent noise levels within the residential garden (1.5m from GF level) are shown in **Appendix G**.

4. BS8233:2014 Assessment

As the MUGA noise originates from point sources and not line sources, the rigorous calculation as given in BS8233:2014 is not applicable, therefore calculations are conducted in accordance with '*BS EN 12354-3:2000 – Estimation of acoustic performance in buildings from the performance of elements - Airborne sound insulation against outdoor sound*'

4.1. Façade Specification

A standard double-glazed window system (6 / 12 / 6mm) has been modelled as shown in **Appendix J**. It is noted that the facades have a large proportion of glazing, which is the acoustic weak point of the building, therefore only noise break-in through the glazing is considered as a worst-case scenario.

4.2. Habitable Rooms

Glazed areas and room volumes have been taken from plans of the site. Noise break-in to the largest living area (kitchen / dining) and bedroom (master bedroom) has been considered to represent a worst-case scenario due to the larger glazed areas.

4.3. Internal Noise Levels

Internal noise levels have been calculated in accordance with *BS EN 12354-3:2000* within sound insulation modelling software Insul™ (Marshall Day Acoustics), as shown in **Appendix H**.

Table 4: Internal Noise Levels

Internal Space	Noise Parameter	Internal Noise Level	Difference from Criteria
Living Room	Daytime $L_{Aeq,\ 16hr}$	9.6	-25.4
Bedroom	Night-time $L_{Aeq,\ 8hr}$	14.6	-15.4
Bedroom	Night-time L_{AFmax}	25.4	-19.6

4.3.1. Outcome

The internal noise levels are well within (>10dB) the desired criteria and will therefore not give rise to loss of amenity.

4.4. External Noise Levels

External noise levels within residential amenity spaces are shown in **Appendix G**.

4.4.1. Outcome

As shown in **Appendix G** (low resolution), areas shaded in green are compliant and areas shaded in red are not compliant with the assessment criterion. The assessment criterion is met throughout the residential amenity space.

The relocation of the dwelling and the inclusion of a 3m acoustic barrier has demonstrated good acoustic design allowing the assessment criteria to be met.

4.4.2. Context

- The garden area demonstrates that large areas to the south west of the site are well within compliance (<10dB below the criterion).
- The assessment considers that the MUGA is permanently in use to demonstrate a worst-case scenario. The following statement is applicable as documented within '*ProPG: Planning & Noise:2017*':

  > *"In addition, it may not be necessary for the whole of an external amenity area to be relatively quiet, nor for it to be relatively quiet all of the time." - ProPG pg.18*

  As the MUGA is not in regular use, the noise impact can be considered as lower than derived within this report.

- A +9dB penalty has been included to account for the impulsiveness of the noise emissions. This accounts for an 8x increase in sound pressure and can be deemed an adequate 'safety-buffer' for increased noise impact due to the subjective opinion of the dwelling occupant.

5. Barrier Specification

The 3m acoustic barrier should meet the following to ensure the required sound attenuation is achieved:

- Have no gaps/cracks/fissures.
- Be continuous throughout the areas marked within figure 1 and the submitted site plan.
- Achieve a minimum surface density of 15kgm^{-2} as to ensure that sound passing through the barrier is significantly quieter than sound passing over/around the barrier.

Suitable materials to meet the above specification include masonry and reflective acoustic fencing.

6. Discussion

The orientation of the site ensures that residential room windows do not overlook the MUGA and this provides a large degree of noise attenuation. Noise levels at the north façade are noted as being 54 – 58 dB L_{Aeq} whereas noise levels at the south façade are 40 – 42 dB L_{Aeq}, resulting in an approximate 12 dB reduction in noise. This attenuation has allowed the assessment criteria to be met with an increased margin of 10 dB, therefore ensuring there will be no loss of amenity whilst the MUGA is in use.

The assessment of maxima noise emissions has considered a shout occurring within the MUGA as close as possible to the development site, therefore all other maxima occurring deeper into the site would result in a lower noise impact.

APPENDIX A - Measurement Details

Measurement	Kit	Start Date	Start Time	End Date	End Time
M1	A2	08/08/16	13:52	09/08/16	12:30

APPENDIX B - Equipment Details

Kit	Equipment	Make	Model	Class	Serial Number
A2	Sound Meter	Svantek	971	1	40305
A2	Pre-Amp	Svantek	SV18	1	41651
A2	Calibrator	Svantek	SV31	1	32507

APPENDIX C - Meteorology Details

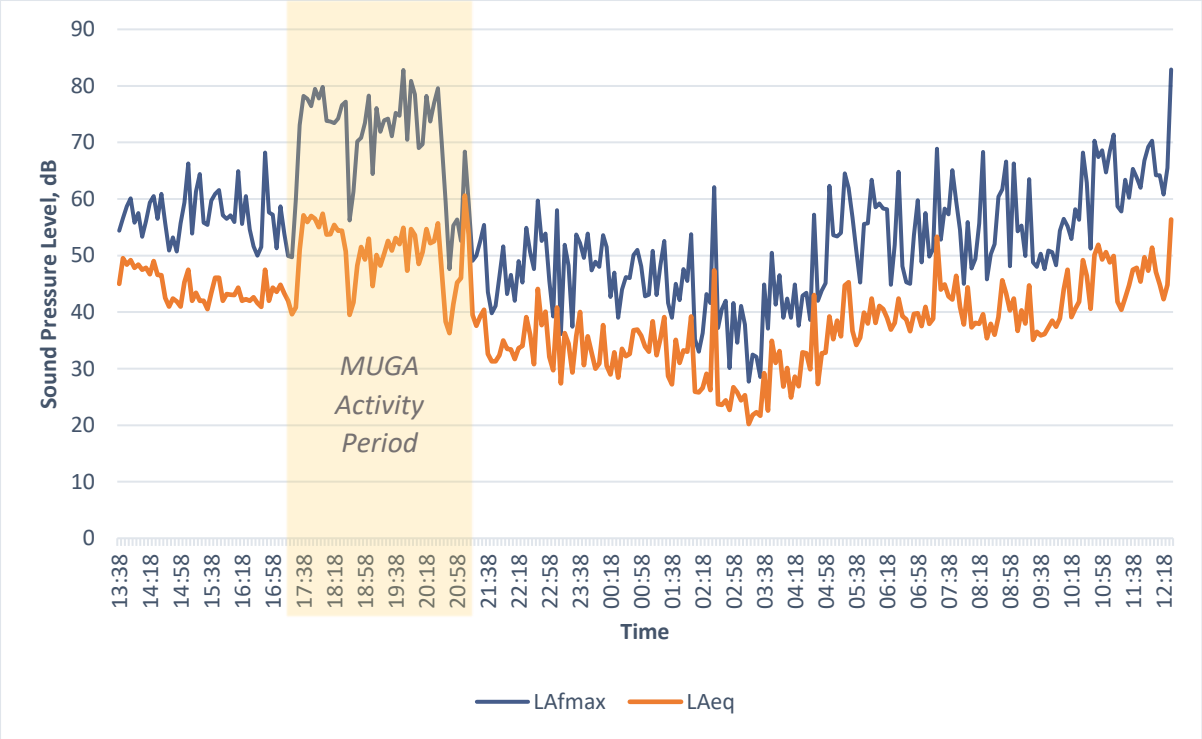
Measurement	Temp C	Wind Speed m/s	Wind Direction	Humidity %	Precipitation mm	Cloud Cover (Oktas)
M1	15	3.3	SW	66	1.8	6/8

APPENDIX D - Calibration Details

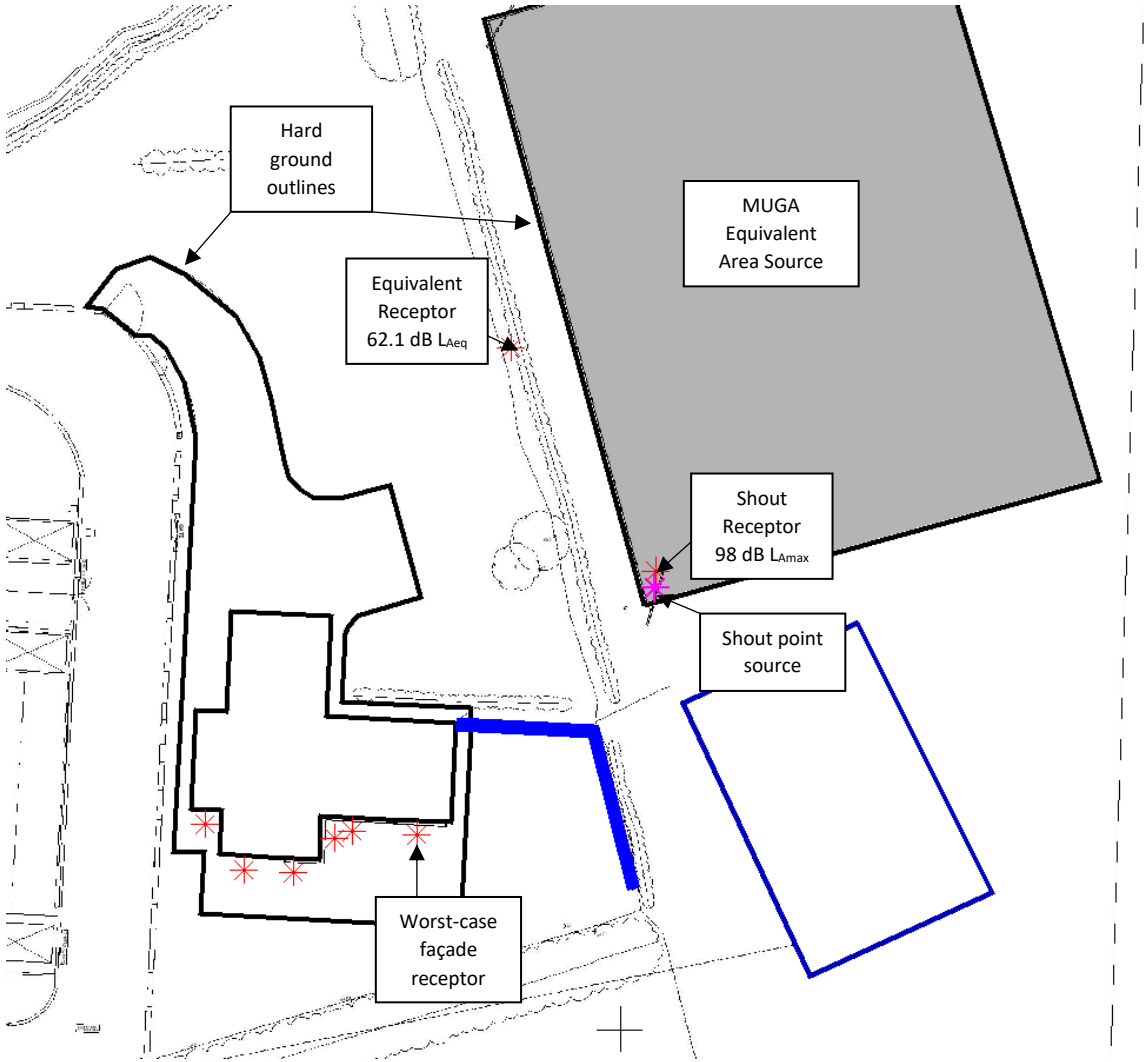
Measurement	Calibrator Ref Level (dB)	Level Before (dB)	Deviation Before (dB)	Level After (dB)	Deviation After (dB)
M1	113.0	112.51	0.49	112.41	0.59

APPENDIX E – Noise Survey Results

Environmental Noise Measurements, 8th – 9th August 2016, Measurement M1



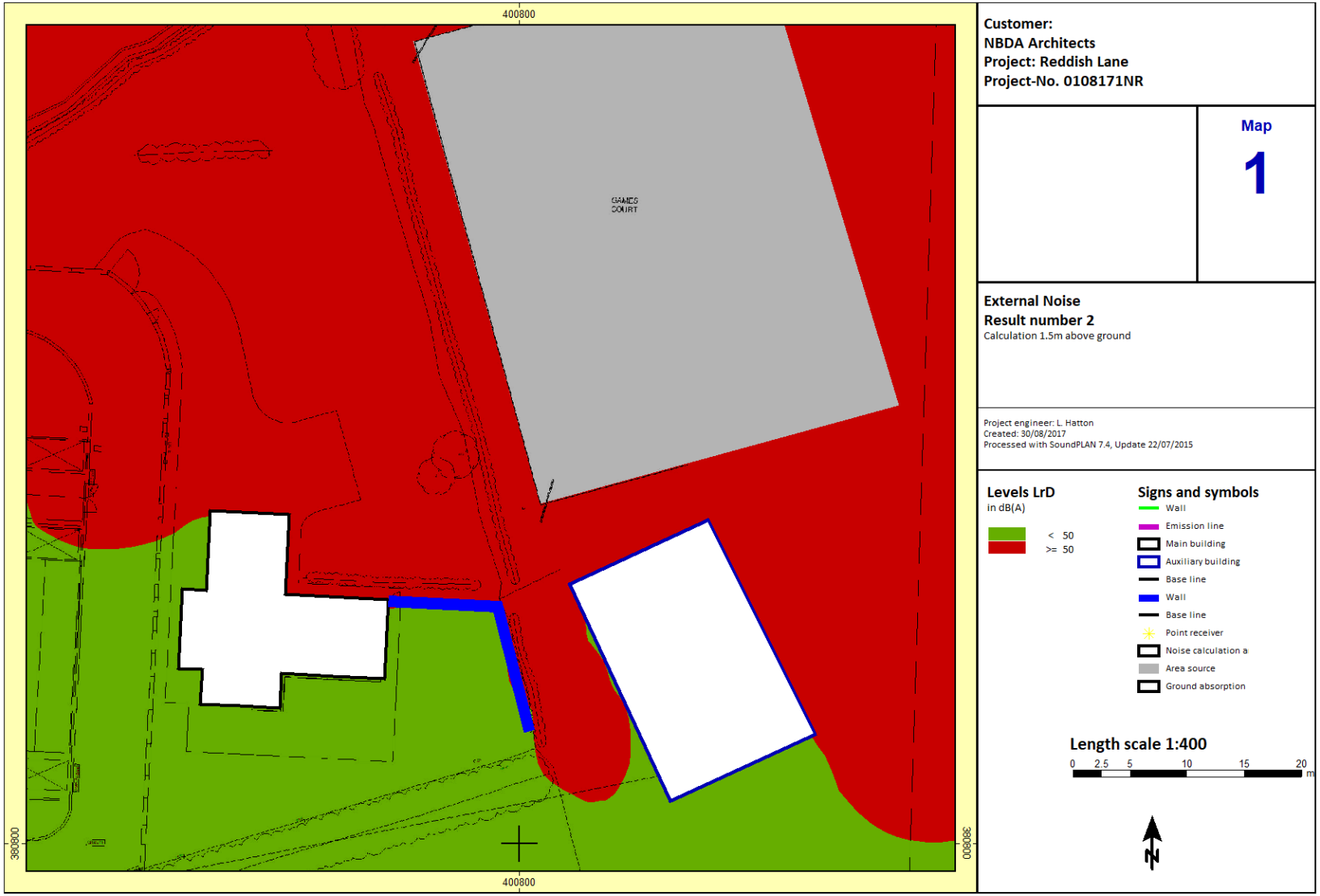
APPENDIX F – Acoustic Model Object Locations



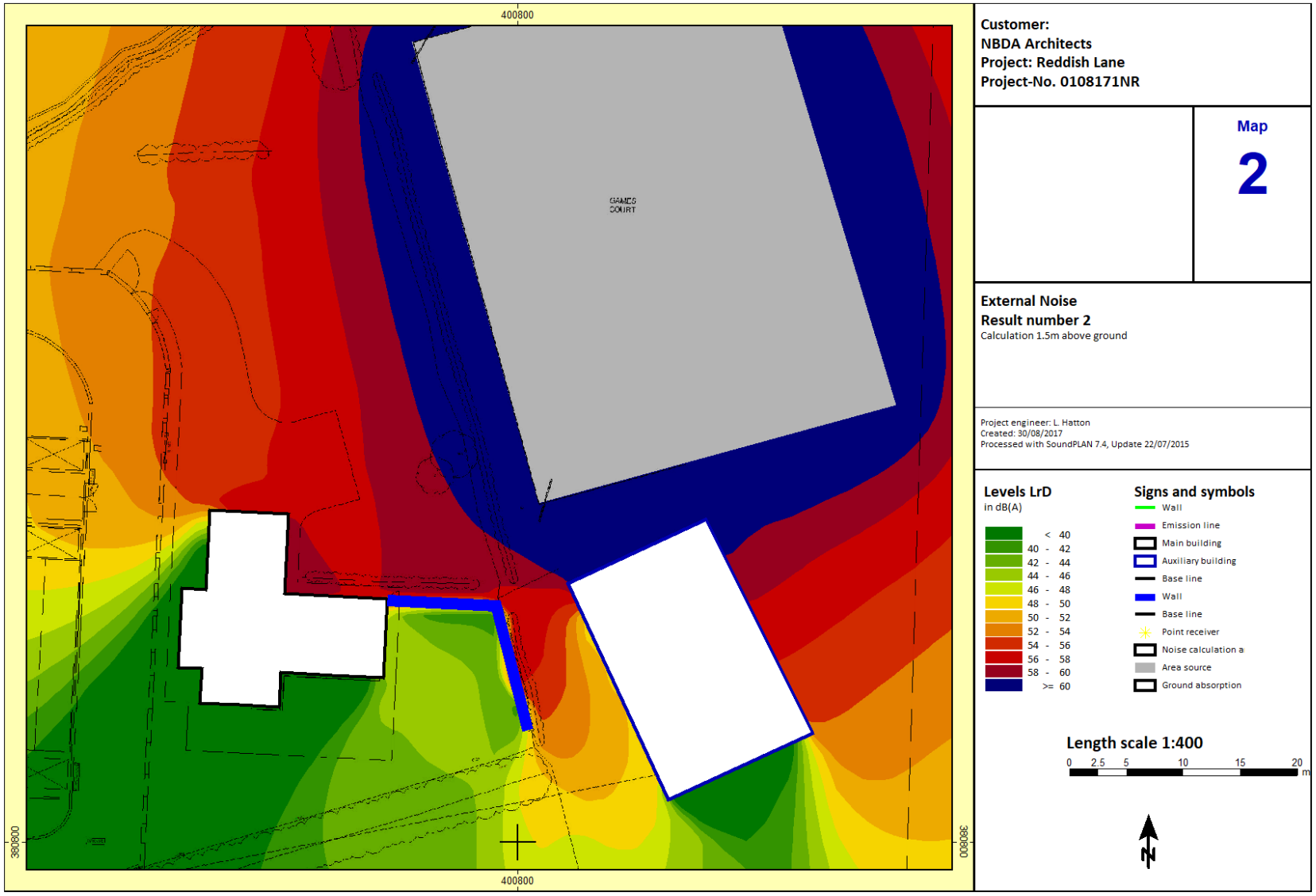
Note: Noise levels are inclusive of +9dB impulsivity penalty

APPENDIX G – Noise Map (Equivalent Noise Levels)

Low Resolution

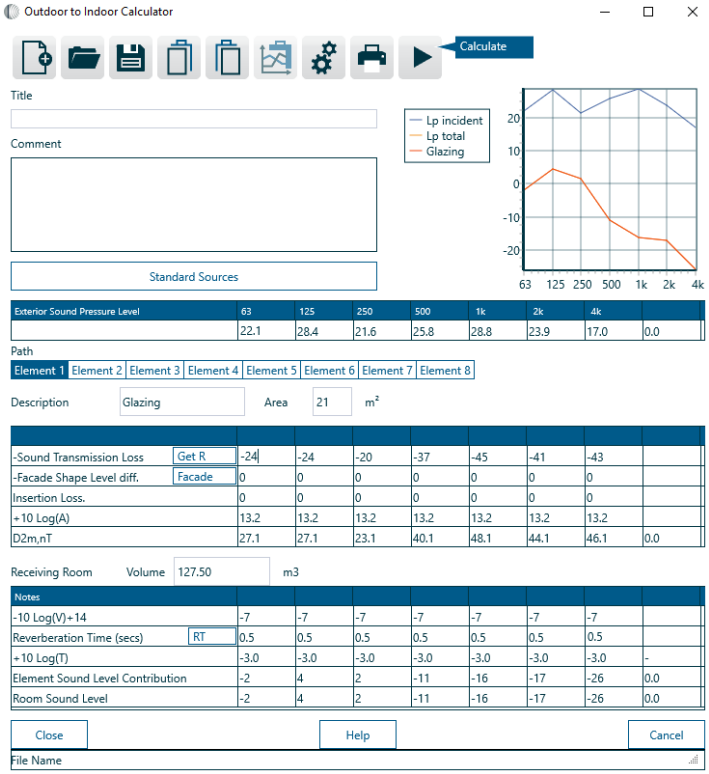


High Resolution



APPENDIX H – Internal Noise Calculations

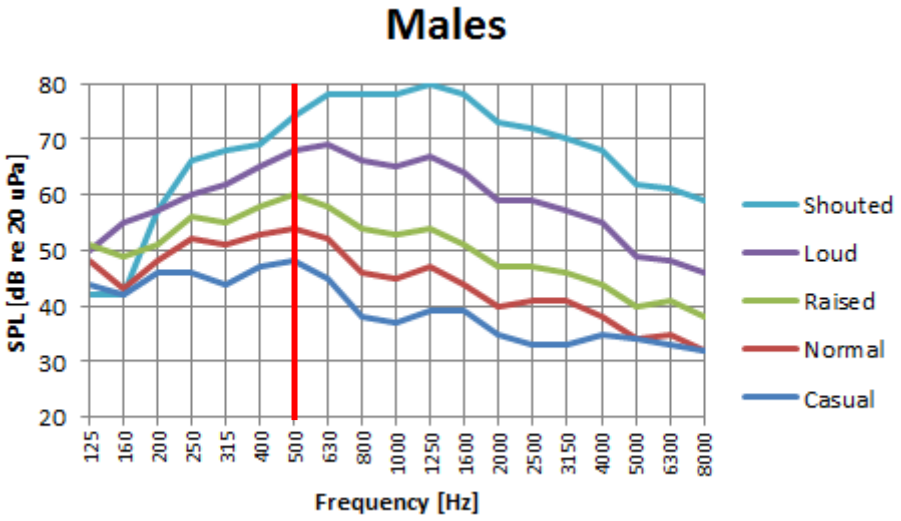
Daytime

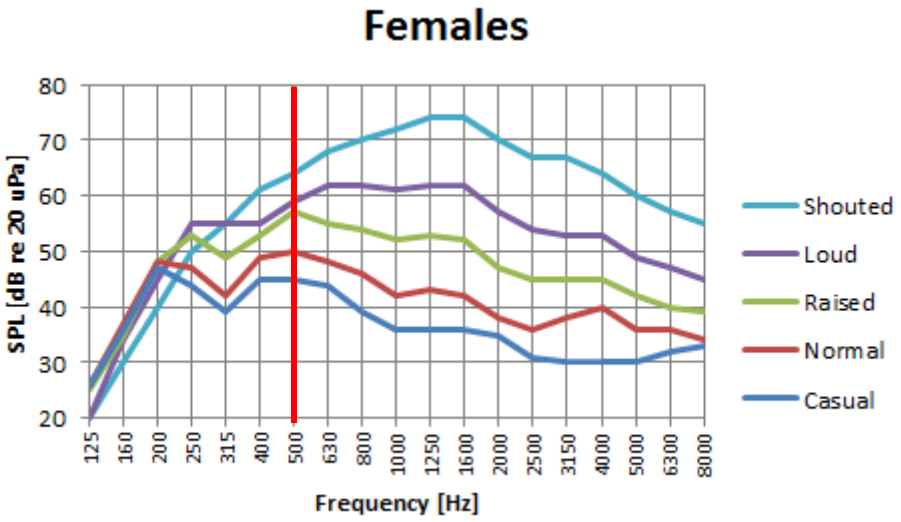


Night-time, Equivalent

Night-time, Maxima

APPENDIX I – Speech Spectrum





Source: http://www.dpamicrophones.com/mic-university/facts-about-speech-intelligibility

APPENDIX J – Glazing Sound Insulation Model

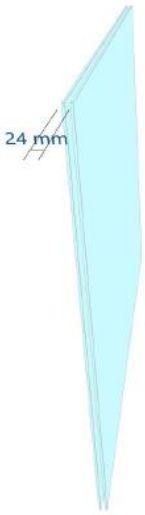
Sound Insulation Prediction (v9.0.5)

INSUL

Program copyright Marshall Day Acoustics 2017

- Key No. 5524
Job Name:
Job No.:
Initials:lukeh
Date:30/08/2017
File Name:6-12-6mm.ixl

Notes:



Rw 37 dB
C -3 dB
Ctr -7 dB

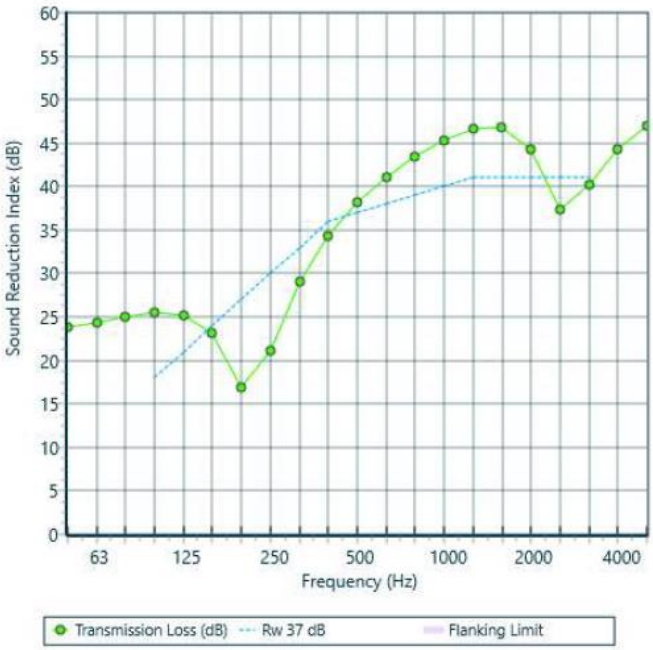
air-mass resonant frequency = =200 Hz
Size = 2.0 m x 1.5 m
on surface mass = 29.8 kg/m²

System description

Pane 1 + 1 x 6.0 mm Glass

air: 12 mm
Pane 2 + 1 x 6.0 mm Glass

freq.(Hz)	IL(dB)	IL(dB)
50	24	
63	24	24
80	25	
100	25	
125	25	24
160	23	
200	17	
250	21	20
315	29	
400	34	
500	38	37
630	41	
800	43	
1000	45	45
1250	47	
1600	47	
2000	44	41
2500	37	
3150	40	
4000	44	43
5000	47	



APPENDIX K – Mechanical Ventilation Design Guidance

The following should be considered in the design process of the mechanical ventilation system to ensure the assessment criterion is maintained:

- Ductwork inlets and outlets should be routed to non-habitable rooms, such as bathrooms, build in cupboards, kitchens or ideally; the dedicated plant room. Inlets/outlets introduce a weakness to the façade whereby noise ingress can occur and the introduction of these weaknesses to habitable façade locations should be avoided.

- The system should be designed to not exceed the following noise levels within habitable rooms when operating at the required ventilation capacity:

    - 30 dB $L_{Aeq,5min}$ within bedrooms
    - 35 dB $L_{Aeq,5min}$ within living rooms.

    The design may need to include ductwork silencers, resilient fan and ductwork mountings and insulated ductwork to meet the required design guidelines. Calculations should be conducted at the design stage to determine whether compliance will be met and where required, additional mitigation should be implemented.

- Any external plant equipment installed as part of the mechanical ventilation system should be assessed in accordance with 'BS4142:2014 – Methods for rating and assessing industrial and commercial sound. Where required, mitigation measures should be implemented to maintain a Low Impact in accordance with the standard.