



Project: J 05552
Plant Noise Assessment:
3 Sorrel Drive, Wokingham

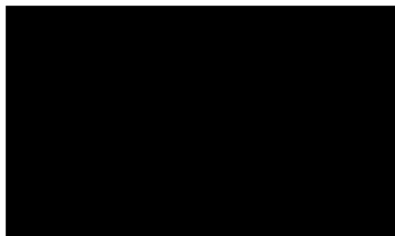
Consultants: Sound Planning Ltd
25a Vicarage Hill
Lower Bourne
Farnham
Surrey
GU10 3QS

TEL: 01252 711972

Client: Matthew Davies

Prepared by: J. Willmott

Signed:



J. Willmott MSc M.I.O.A
Senior Acoustic Consultant

Dated: Wednesday 23rd October 2024



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1. **BACKGROUND**

- 1.1. The assessment concerns the installation of a hot tub with associated heat pump in the garden of the property.

See APPENDIX 2 - Site Location/Plans.

- 1.2. Sound Planning understands that the following equipment/activities will contribute to the noise emissions from the proposed new activity areas:

- 1x Mr Silence MS70 Air Source Heat Pump
- 1x Thermals Joys Hot Tub

- 1.3. Sound Planning has been retained to evaluate potential noise impact on the nearest noise sensitive receivers using appropriate methodologies and assessment criteria, and to design a suitable noise mitigation strategy if required.

- 1.4. Jake Willmott is a Member of the Institute of Acoustics (M.I.O.A) having attained appropriate qualifications in acoustics and has six years' experience undertaking acoustic assessments including significant experience of BS4142 assessments in the context of planning applications.

Jake has attained the following qualifications within the field of acoustics:

- Institute of Acoustics (IOA) Diploma
- Masters Degree - Applied Acoustics (Solent University)

- 1.5. Site and Location

1.5.1. The site is in a residential area. The residential development is new-build so up to date satellite imagery is not available. See APPENDIX 2 - Site Location/Plans.

1.5.2. The nearest noise sensitive receivers to the proposed hot tub is the adjacent property to the north.

- 1.6. Proposed Operation Times:

- Monday – Sunday: up to 24 hours per day as required by residents



2. ASSESSMENT CRITERIA

2.1. The plant noise assessment should be carried out in accordance with relevant standards and guidelines in conjunction with National Planning Policy (from the National Planning Policy Framework and the Noise Policy Statement for England), and the requirements of Wokingham Borough Council.

2.2. National Planning Policy Framework

2.2.1. The National Planning Policy Framework (NPPF) was released in March 2012 and last updated in December 2023.

2.2.2. Paragraph 174 of the NPPF states: *'Planning policies and decisions should contribute to and enhance the natural and local environment by... preventing new and existing development from contributing to or being put at unacceptable risk from, or being adversely affected by, unacceptable levels of... noise pollution...'*

2.2.3. Paragraph 185 of the NPPF states that; *'Planning policies and decisions should also ensure that new development is appropriate for its location taking into account the likely effects (including cumulative effects) of pollution on health, living conditions and the natural environment, as well as the potential sensitivity of the site or the wider area to impacts that could arise from the development. In doing so they should:*

- *mitigate and reduce to a minimum potential adverse impacts resulting from noise from new development – and avoid noise giving rise to significant adverse impacts on health and the quality of life (see Explanatory Note to the Noise Policy Statement for England (DEFRA)).*
- *identify and protect tranquil areas which have remained relatively undisturbed by noise and are prized for their recreational and amenity value for this reason; and*
- *limit the impact of light pollution from artificial light on local amenity, intrinsically dark landscapes and nature conservation.'*

2.2.4. Paragraph 193 of the NPPF states that; *'Planning policies and decisions should ensure that new development⁴ can be integrated effectively with existing businesses and community facilities (such as places of worship, pubs, music venues and sports clubs). Existing businesses and facilities should not have unreasonable restrictions placed on them as a result of development permitted after they were established. Where operation of an existing business or community facility could have a significant adverse effect on new development*



(including changes of use) in its vicinity, the applicant (or ‘agent of change’) should be required to provide suitable mitigation before the development has been completed.’

2.2.5. Therefore, the NPPF requires that significant impacts are avoided, adverse impacts be mitigated and reduced to a minimum, and places an obligation on developers to not unduly constrain the operation of existing businesses and other noise sources in the area (the ‘agent of change’ principle).

2.3. Noise Policy Statement for England (NPSE)

2.3.1. The NPSE requires that developments:

- ‘Avoid significant adverse impacts on health and quality of life;
- Mitigate and minimise adverse impacts on health and quality of life; and
- Where possible contribute to the improvement of health and quality of life’

2.4. Wokingham Borough Council planning policy does not provide specific numerical targets for plant noise emissions therefore the criteria from BS4142: 2014 should apply to the assessment.

2.5. Noise Measurement Protocol - British Standard 7445-1: 2003¹

2.5.1. The methods and procedures described in BS 7445 are intended to be applicable to sounds from all sources, individually and in combination, which contribute to the total noise at a site.

2.5.2. The aim of the BS 7445 series is to provide authorities with material for the description of noise in community environments. Based on the principles described in this standard, acceptable limits of noise can be specified and compliance with these limits can be controlled.

2.5.3. BS 7445 does not specify limits for environmental noise.

¹ Description and measurement of environmental noise. Part 1 – Guide to quantities and procedures.



2.6. BS 4142: 2014+A1: 2019 – Assessment of Impacts

2.6.1. The significance of sound of an industrial and/or commercial nature depends upon both the margin by which the rating level of the specific sound source exceeds the background sound level and the context in which the sound occurs.

2.6.2. Evaluation of Adverse Impact

- 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.

2.6.3. Adverse impacts include, but are not limited to, annoyance and sleep disturbance. Not all adverse impacts will lead to complaints and not every complaint is proof of an adverse impact.

2.6.4. The specific sound source level is has character corrections applied during the assessment which account for the specific nature of the sound and whether it is more or less likely to be disruptive to the receptor. The available character corrections within the standard are:

Tonality

A correction of up to +6 dB may be applied for a sound which is likely to have discernible tonal elements at the receptor location. Tonality may be assessed via subjective (i.e. perceived on-site) or objective methods, with the subjective method given preference in the standard, where possible. The objective method may be calculated in either 1/3 octave or octave bands based, with the 1/3rd octave calculation given preference in the standard.



Impulsivity

A correction of up to +9 dB can be applied for sound that is highly impulsive, considering both the rapidity of the change in sound level and the overall change in sound level. Subjectively, this can be converted to a penalty of +3 dB for impulsivity which is just perceptible at the noise receptor, +6 dB where it is clearly perceptible, and +9 dB where it is highly perceptible. A reference method is provided in the standard if a subjective assessment is inconclusive or not possible to undertake.

Intermittency

When the specific sound has identifiable on/off conditions a penalty of +3 dB can be applied.

Other sound characteristics

Where the specific sound features characteristics that are neither tonal nor impulsive, though otherwise are readily distinctive against the residual acoustic environment, a penalty of +3 dB can be applied.

3. NOISE SURVEY METHODOLOGY

3.1. Sound Planning attended the site on Friday 18th October and Monday 21st October, to undertake a background noise survey.

3.2. Background Noise Measurements (18/10/2024 – 21/10/2024)

3.2.1. Sound Monitoring equipment was installed in the rear garden of the property in a location representative of the noise level at the rear of the adjacent property.

See APPENDIX 2 – Site Location & APPENDIX 3 – Site Photographs.

3.2.2. The background noise measurements were carried out over a weekend period to gather a representative sample of data.

3.2.3. Some rain and high winds were recorded in the local area during the survey, and data from these periods has been excluded from the assessment.

3.2.4. The sound level meter was Class 1 – details provided in 3.3. The microphone was positioned 2m above ground level and away from vertical reflective surfaces.



3.3. Sound Level Measurement Equipment

Equipment	Make	Model	Class	Serial Number	UKAS Calibration
SLM	Norsonic	NOR140	1	1406175	U42210 (11/05/23)
Field Calibrator	Norsonic	NOR1255	1	125525638	U47907 (24/5/24)

3.4. The Sound Level Meter (SLM) was field calibrated before and after the on-site noise measurements. No deviation was detected (1kHz). UKAS accredited calibration certificates are available on request.

3.5. Other Equipment

Equipment	Make	Model	Class	Serial Number	UKAS Calibration
Environmental Tripod					
Wind/Weather Shield					

3.6. The noise measurements were undertaken in accordance with BS 7445 and BS 4142.

3.7. Full background noise measurements are provided in APPENDIX 4 - Background Noise Levels.

4. NOISE LEVEL CALCULATION METHODOLOGY

4.1. The noise level at the nearest external noise sensitive receivers (NSR's) will be calculated using the formula:

$$SPL_2 = SPL_1 - 20 \log (r_2/r_1)$$

Where 'r' = radius; SPL = Sound Pressure Level.

4.2. A noise model for the site has been created using SoundPLAN Essentials 5.1 to predict sound propagation from the air conditioning units.



- 4.3. SoundPLAN Essentials implements ISO 9613-2 for sound propagation calculations. ISO 9613-2 accounts for meteorological conditions for noise propagation by calculating noise levels with the receiver always ‘downwind’ from the noise source to give a worst-case result.
- 4.4. Wall and building heights have been input into the model based on observations during setup of the noise survey.
- 4.5. No screening effect has been modelled for foliage as hedges and bushes in the vicinity of the site are not solely evergreen plants, so any noise attenuation provided will be less effective in winter months.
- 4.6. The reflection order for the model has been set to 4.
- 4.7. The heat pump and the hot tub have been modelled as point sources at 0.5m from ground level.
- 4.8. Acoustic Feature Corrections – see 2.6.4 The feature corrections to be applied to the noise sources are as follows:
 - 4.8.1. +3 dB for ‘*other sound characteristics*’ due to the low frequency bias common with noise from heat pumps
- 4.9. The resultant (combined) Rating Level (dB L_{Aeq}) will be compared to the existing background noise levels and evaluated against criteria in BS 4142: 2014+A1: 2019

5. NOISE MEASUREMENT RESULTS

- 5.1. Background Noise Levels – see APPENDIX 2

Noise Sensitive Receiver	Typical Background Noise Level dB $L_{A90, hr}$
Adjacent Residential Property Garden	37



6. NOISE CALCULATION RESULTS

6.1. NSR 1 – Adjacent Residential Garden - Predicted Rating Level

Equipment / Activity	Specific	BS 4142 Penalties	Rating
	dB L _{Aeq}	(dB)	(dB)
MS70 Heat Pump	7	+3	9
Hot Tub (Jet Mode)	33	+3	36

7. BS4142:2014 ASSESSMENT

7.1. NSR 1– Predicted Rating Level

Equipment / Activity	Rating	Background Level	Excess	
	(dB)	dB L _{A90}	(dB)	
MS70 Heat Pump	9	37	-28	
Hot Tub (Jet Mode)	36	37	-1	
Combined	36	37	-1	Low Impact

8. NOISE MITIGATION MEASURES

8.1. The predicted rating level at the adjacent residential dwelling should be considered to cause 'low impact' in accordance with BS 4142: 2014+A1: 2019.

8.2. No noise mitigation strategy is required as the level of noise predicted is below the existing background noise level at the site.

9. CONCLUSIONS

9.1. Sound Planning has carried out a noise impact assessment in accordance with the requirements of BS 4142: 2014+A1: 2019 and BS 7445: 2003.



- 9.2. The predicted combined noise rating level (BS 4142) of the proposed hot tub and heat pump has been compared to existing background noise levels at the nearest noise sensitive receivers.
- 9.3. The evaluation shows that the predicted noise rating level at the noise sensitive receiver is '*low impact*' in accordance with BS 4142:2014+A1:2019.
- 9.4. The proposed installation therefore satisfies the requirements of local and national planning policy.



APPENDIX 1

Glossary of Acoustic Terms

The Decibel, dB

The unit used to describe the magnitude of sound is the decibel (dB) and the quantity measured is the sound pressure level. The decibel scale is logarithmic and it ascribes equal values to proportional changes in sound pressure, which is a characteristic of the ear. Use of a logarithmic scale has the added advantage that it compresses the very wide range of sound pressures to which the ear may typically be exposed to a more manageable range of numbers. The threshold of hearing occurs at approximately 0 dB (which corresponds to a reference sound pressure of 2×10^{-5} pascals) and the threshold of pain is around 120 dB. The sound energy radiated by a source can also be expressed in decibels. The sound power is a measure of the total sound energy radiated by a source per second, in watts. The sound power level, L_w is expressed in decibels, referenced to 10^{-12} watts.

Frequency, Hz

Frequency is analogous to musical pitch. It depends upon the rate of vibration of the air molecules that transmit the sound and is measure as the number of cycles per second or Hertz (Hz). The human ear is sensitive to sound in the range 20 Hz to 20,000 Hz (20 kHz). For acoustic engineering purposes, the frequency range is normally divided up into discrete bands. The most commonly used bands are octave bands, in which the upper limiting frequency for any band is twice the lower limiting frequency, and one-third octave bands, in which each octave band is divided into three. The bands are described by their centre frequency value and the ranges which are typically used for building acoustics purposes are 63 Hz to 4 kHz (octave bands) and 100 Hz to 3150 Hz (one-third octave bands).

Noise Rating

The Noise Rating (NR) system is a set of octave band sound pressure level curves used for specifying limiting values for building services noise. The Noise Criteria (NC) and Preferred Noise Criteria (PNC) systems are similar.

A-weighting

The sensitivity of the ear is frequency dependent. Sound level meters are fitted with a weighting network which approximates to this response and allows sound levels to be expressed as an overall single figure value, in dB(A).



Noise Descriptors

Where noise levels vary with time, it is necessary to express the results of a measurement over a period of time in statistical terms. Some commonly used descriptors follow.

- $L_{Aeq, T}$ *The most widely applicable unit is the equivalent continuous A-weighted sound pressure level ($L_{Aeq, T}$). It is an energy average and is defined as the level of a notional sound which (over a defined period of time, T) would deliver the same A-weighted sound energy as the actual fluctuating sound.*
- L_{AE} *Where the overall noise level over a given period is made up of individual noise events, the $L_{Aeq, T}$ can be predicted by measuring the noise of the individual noise events using the sound exposure level, L_{AE} (or SEL or L_{AX}). It is defined as the level that, if maintained constant for a period of one second, would deliver the same A-weighted sound energy as the actual noise event.*
- L_{A1} *The level exceeded for 1% of the time is sometimes used to represent typical noise maxima.*
- L_{A10} *The level exceeded for 10% of the time is often used to describe road traffic noise.*
- L_{A90} *The level exceeded for 90% of the time is normally used to describe background noise.*

Sound Transmission Descriptors

- D_{nT} Standardised level difference
- $D_{nT, w}$ Weighted standardised level difference
- L_1 The average sound pressure level in the source room
- L_2 The average sound pressure level in the receiving room
- T Reverberation time (receiving room)
- T_0 Reference reverberation time = 0.5s
- C_{tr} Adaption spectrum which takes account for low to medium speed road/rail/air traffic; disco music; and factory noise (medium to low frequency noise).
- C Adaptation spectrum which takes account of domestic activities including speech, music, radio and television.



Frequency Analysis

Octave Band	<i>A band of frequencies the upper limit of which is twice the lower limit. They are known by their centre frequency, e.g., 63, 125, 250, 500, 1000, 2000 Hz...</i>
One Third Octave	<i>The logarithmic frequency interval between a lower frequency f_2, when f_2/f_1 equals $2^{1/3}$ apart. Frequencies include: 100, 125, 160, 200, 250, 315, 400, 500, 630, 800, 1000Hz.</i>

Sound Transmission in the Open Air

Most sources of sound can be characterised as a single point in space. The sound energy radiated is proportional to the surface area of a sphere centred on the point. The area of a sphere is proportional to the square of the radius, so the sound energy is inversely proportional to the square of the radius. This is the inverse square law.

In decibel terms, every time the distance from a point source is doubled, the sound pressure level is reduced by 6 dB. Road traffic noise is a notable exception to this rule, as it approximates to a line source, which is represented by the line of the road. The sound energy radiated is inversely proportional to the area of a cylinder centred on the line. In decibel terms, every time the distance from a line source is doubled, the sound pressure level is reduced by 3 dB.

Factors Affecting Sound Transmission in the Open Air

Reflection

When sound waves encounter a hard surface, such as concrete, brickwork, glass, timber or plasterboard, it is reflected from it. As a result, the sound pressure level measured immediately in front of a building façade is approximately 3 dB higher than it would be in the absence of the façade.

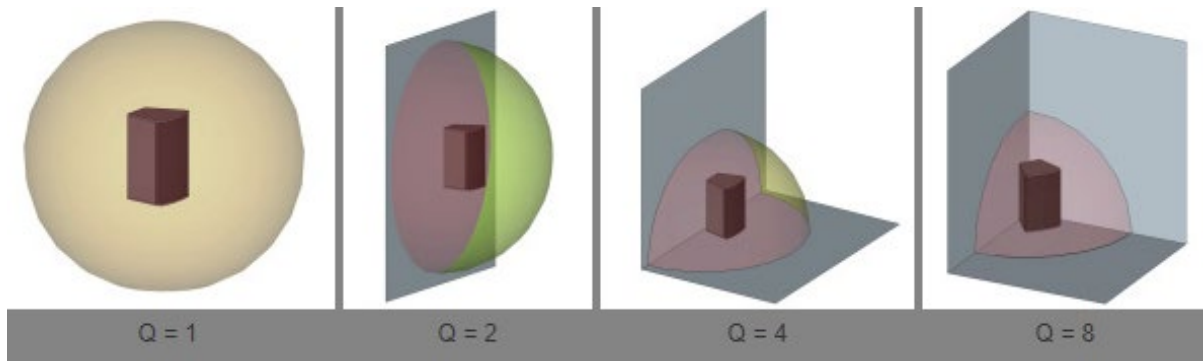
Screening and Diffraction

If a solid screen is introduced between a source and receiver, interrupting the sound path, a reduction in sound level is experienced. This reduction is limited, however, by diffraction of the sound energy at the edges of the screen. Screens can provide valuable noise attenuation however. For example, a timber boarded fence built next to a motorway can reduce noise levels on the land beyond, typically by around 10 dB(A). The best results are obtained when a screen is situated close to the source or close to the receiver.

Meteorological Effects

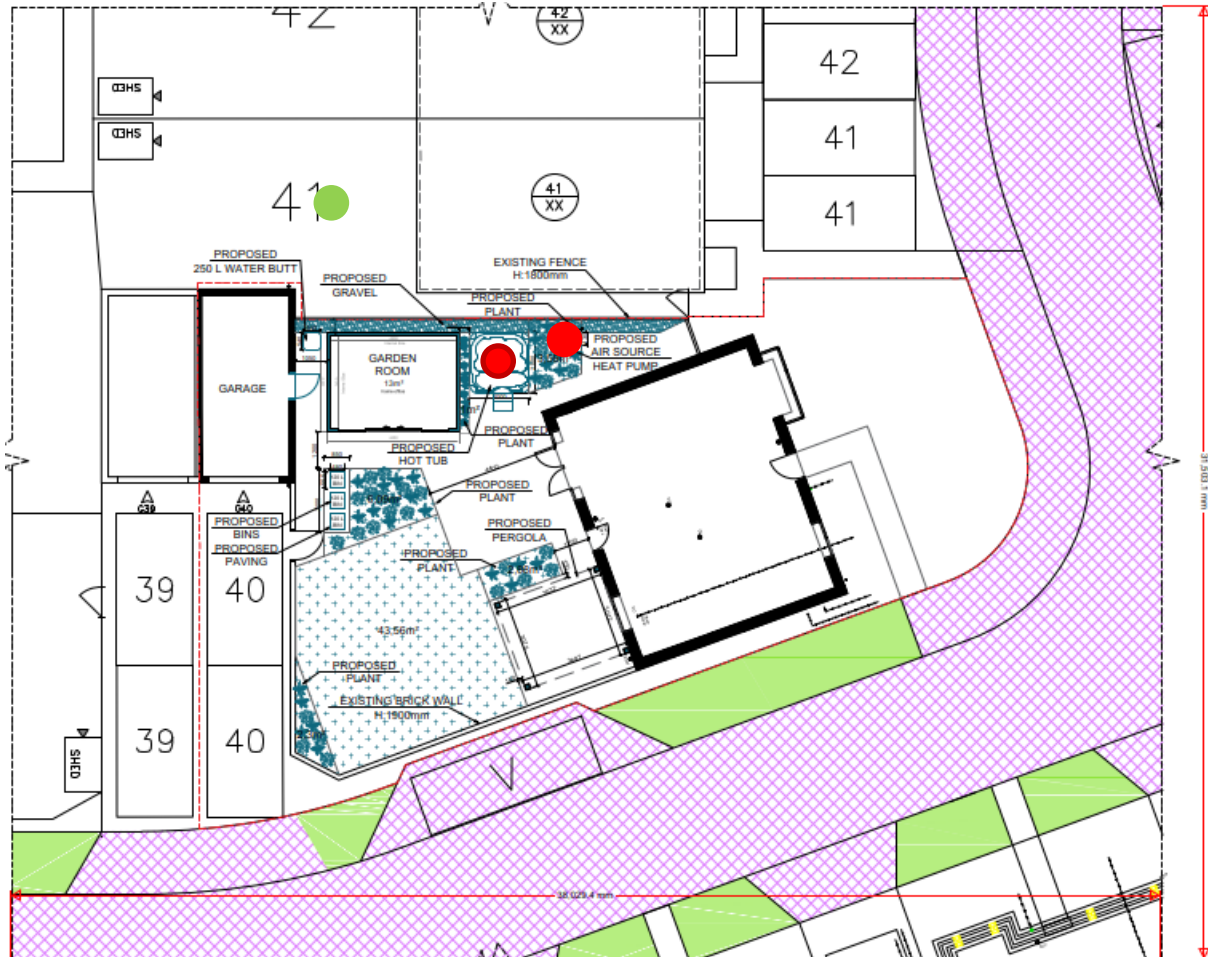
Temperature and wind gradients affect noise transmission, especially over large distances. The wind effects range from increasing the level by typically 2 dB downwind, to reducing it by typically 10 dB upwind – or even more in extreme conditions. Temperature and wind gradient are variable and difficult to predict.

Directivity Index



APPENDIX 2

Site Location/Plans



Key:

- NSR
- Hot Tub
- Heat Pump

APPENDIX 3
Site Photographs



Background Noise Measurement Position



APPENDIX 4

Noise Measurement Data

Background Noise Levels – MPI

Red text indicates measurement data excluded from assessment due to influence from construction noise or poor weather conditions.

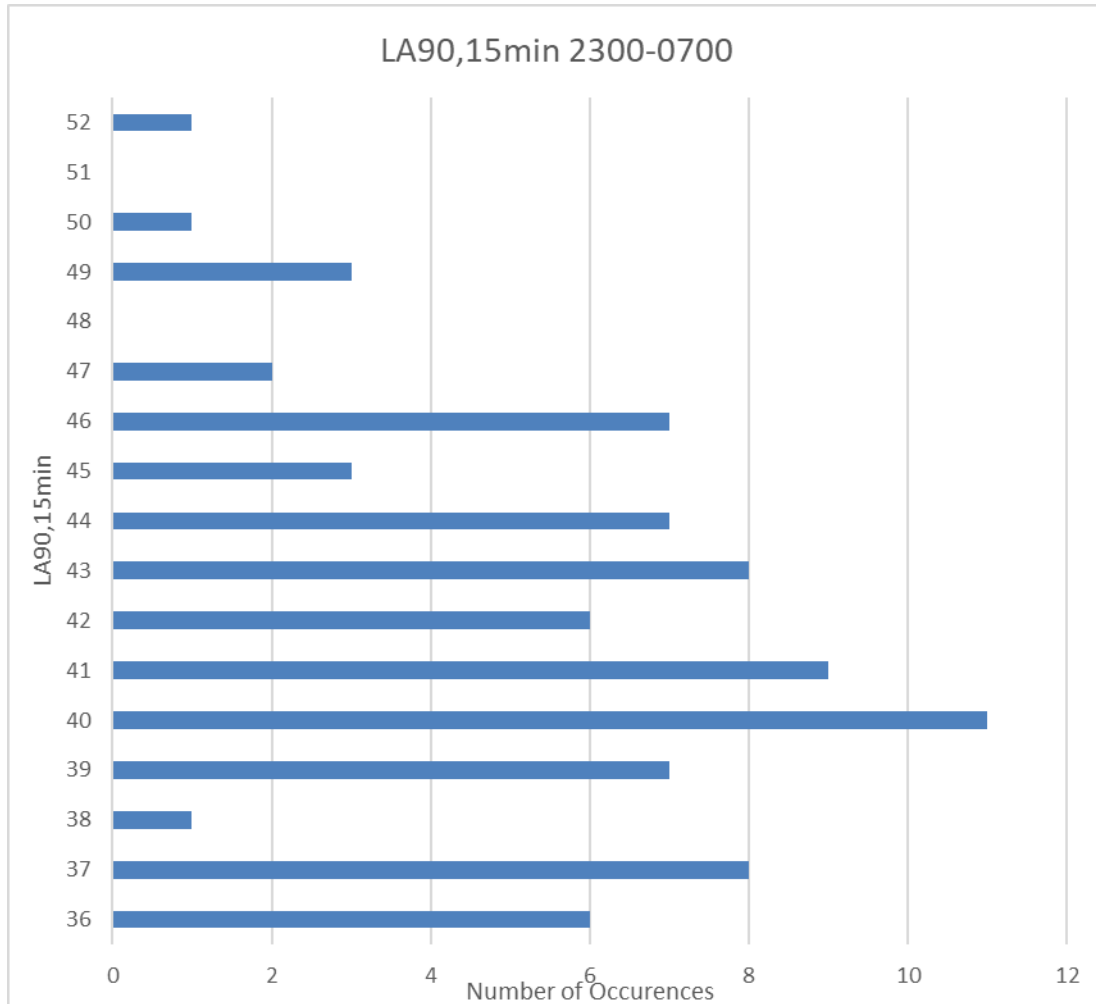
Date	Time	L _{Aeq}	L _{AFmax}	L _{AF10}	L _{AF90}
(d/m/y)	(hrs:mins)	(dB)	(dB)	(dB)	(dB)
18/10/2024	14:00	63.2	82.4	57.4	54.9
18/10/2024	15:00	56.7	75.5	55.8	54.3
18/10/2024	16:00	51.9	75.6	48.7	45.2
18/10/2024	17:00	50.3	75.2	47.5	45.2
18/10/2024	18:00	49.5	66.1	49.1	46.0
18/10/2024	19:00	50.0	76.5	50.9	47.1
18/10/2024	20:00	52.7	79.3	50.7	46.0
18/10/2024	21:00	50.3	74.9	49.9	45.8
18/10/2024	22:00	47.8	60.6	49.3	44.5
18/10/2024	23:00	47.2	63.6	49.2	41.5
19/10/2024	00:00	47.7	63.4	48.0	41.1
19/10/2024	01:00	48.8	75.4	48.6	40.7
19/10/2024	02:00	45.8	65.0	47.6	39.3
19/10/2024	03:00	45.2	66.8	45.2	39.5
19/10/2024	04:00	45.9	60.4	45.8	39.8
19/10/2024	05:00	48.5	61.2	47.2	41.7
19/10/2024	06:00	52.0	66.6	53.8	43.8
19/10/2024	07:00	53.0	70.2	54.5	49.3

Date	Time	L _{Aeq}	L _A F _{max}	L _A F ₁₀	L _A F ₉₀
19/10/2024	08:00	54.0	75.7	53.7	48.4
19/10/2024	09:00	55.0	76.8	55.6	47.6
19/10/2024	10:00	53.6	70.9	54.7	47.8
19/10/2024	11:00	53.0	73.2	54.1	47.9
19/10/2024	12:00	53.6	74.3	54.3	48.3
19/10/2024	13:00	52.4	76.9	54.9	48.6
19/10/2024	14:00	54.5	80.4	54.8	47.3
19/10/2024	15:00	52.3	74.8	50.7	45.0
19/10/2024	16:00	53.6	77.0	52.3	45.5
19/10/2024	17:00	50.8	78.7	52.2	45.7
19/10/2024	18:00	49.6	68.5	48.7	43.9
19/10/2024	19:00	48.5	64.5	49.7	43.9
19/10/2024	20:00	49.2	71.2	49.5	42.8
19/10/2024	21:00	49.1	70.2	49.0	41.9
19/10/2024	22:00	44.7	60.1	47.7	38.2
19/10/2024	23:00	44.5	68.6	47.0	37.1
20/10/2024	00:00	44.2	65.7	46.2	37.1
20/10/2024	01:00	42.5	59.6	42.9	36.5
20/10/2024	02:00	40.2	55.3	40.4	35.7
20/10/2024	03:00	48.3	69.5	46.9	37.9
20/10/2024	04:00	48.7	74.3	47.3	39.3
20/10/2024	05:00	49.9	71.3	46.5	41.3
20/10/2024	06:00	48.3	69.1	48.8	42.5
20/10/2024	07:00	50.2	75.3	50.1	43.7
20/10/2024	08:00	51.1	71.7	50.3	46.2



Date	Time	L _{Aeq}	L _{AFmax}	L _{AF10}	L _{AF90}
20/10/2024	09:00	51.9	77.5	54.0	47.2
20/10/2024	10:00	54.6	75.6	53.0	47.3
20/10/2024	11:00	53.5	78.3	53.5	47.7
20/10/2024	12:00	53.5	72.7	55.2	47.1
20/10/2024	13:00	53.5	68.8	54.1	47.0
20/10/2024	14:00	53.4	71.9	53.6	46.6
20/10/2024	15:00	51.8	74.8	52.1	44.8
20/10/2024	16:00	50.6	72.3	51.4	45.4
20/10/2024	17:00	48.9	65.7	50.9	45.6
20/10/2024	18:00	49.8	68.7	50.6	45.0
20/10/2024	19:00	52.0	66.7	52.9	45.5
20/10/2024	20:00	50.1	67.7	51.5	46.2
20/10/2024	21:00	50.7	64.6	50.1	45.4
20/10/2024	22:00	46.3	65.2	48.0	41.2
20/10/2024	23:00	47.9	68.8	49.6	41.0
21/10/2024	00:00	47.5	61.0	49.0	41.8
21/10/2024	01:00	49.3	64.0	53.7	41.8
21/10/2024	02:00	49.7	63.1	49.4	43.9
21/10/2024	03:00	53.2	66.4	52.5	48.2
21/10/2024	04:00	50.3	69.0	50.7	46.3
21/10/2024	05:00	50.1	66.6	51.8	45.5
21/10/2024	06:00	52.6	78.2	54.0	47.6
21/10/2024	07:00	51.9	71.8	52.8	46.8
21/10/2024	08:00	49.3	69.8	54.9	46.9

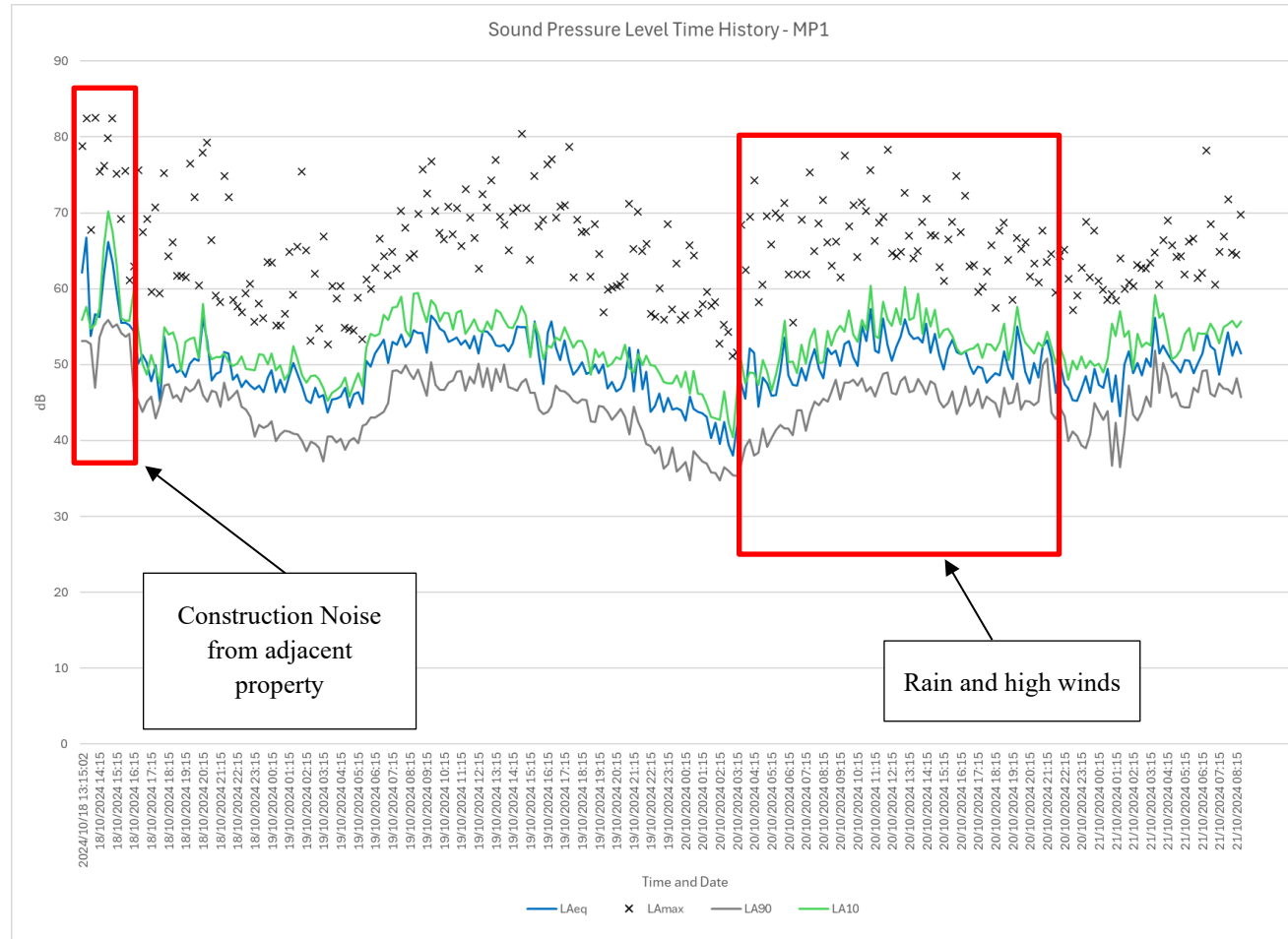
Statistical Analysis of Background Noise Levels



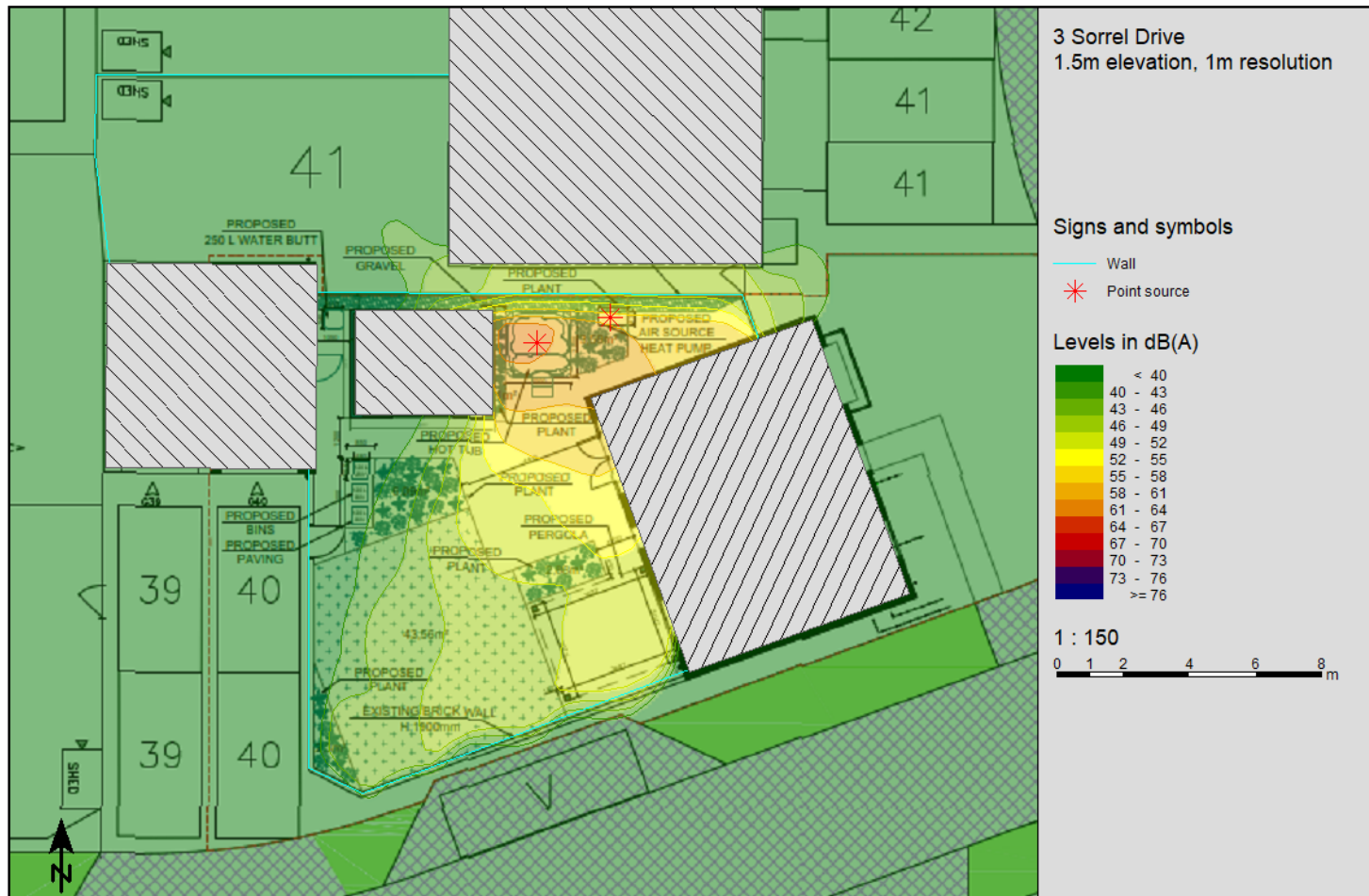
37 dB has been selected as the typical background noise level as the background noise level exceeded for 90% of the measurement periods.



Measurement Time History



Noise Map





APPENDIX 5

Levels of Uncertainty

Category	Notes
Complexity of Sound Source	1 ASHP unit and Hot Tub installed externally
Complexity of Acoustic Environment (Residual)	Residual environment is shielded from nearby noise sources and controlled by distant traffic noise
Level of Residual Sound (including Specific)	n/a – units not installed yet
Measurement Location	Representative of closest receptor
Distance Between Sound Source & Measurement Position	n/a
Number of Measurements Taken	Weekend period
Measurement Time Intervals	15-minute measurements
Range of Times	Includes quietest likely times of proposed operation
Range of Suitable Weather Conditions	1 measurement period – Periods of poor weather excluded from data used in assessment
Measurement Method/Practitioners	1 measurement period (Jake Willmott) measurements taken in line with BS7445
Level of Rounding	Rounded to nearest DP; 0.5 rounded up
Instrumentation	Class 1 SLM (suitable)



APPENDIX 6

Data Sheets

ASHP:

SILENCE

InverPad® is the most silent and saving inverter technology in the pool industry. It combines Aquark's unique airflow design that eliminates every possible noise to ensure the most silent performance for customer. The average sound level is 40dB(A) at 1 meter.

36.5 dB(A)
Silence Mode

40 dB(A)
Average

46 dB(A)
Boost Mode

Data for hot tub provided by manufacturer via email:

“The dB when jet pump is on – 64dB

The dB when the circulation is on – 47dB”

Based on the above information the assessment has been undertaken assuming that the quoted decibel figures are sound pressure level measurements taken at 1m from the Hot Tub