ACAACOUSTICS

Acoustic assessment of proposed booster pump at The Cumberland Lawn Tennis Club, Hampstead

Report Reference: 170603-R001A

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CONTENTS

0. SUMMARY

- ACA Acoustics Limited have been commissioned to assess noise emissions from a proposed new water booster pump to be installed at The Cumberland Lawn Tennis Club, Hampstead.

- The assessment is required to provide evidence that noise emissions from the equipment will not be detrimental to the amenity of nearby noise sensitive properties and complies with the requirements of London Borough of Camden Council. London Borough of Camden Council's requirement, applicable at this site, is that the rating level of sound from the equipment shall ideally not exceed 10dB below the existing background LA90 outside nearby noise-sensitive properties, when assessed in accordance with British Standard BS 4142:2014.

- Whilst on site the author identified closest non-associated noise-sensitive properties as residential dwellings to the opposite side of Alvanley Gardens. Closest property to the new pump is No. 12, approximately 25m from the proposed equipment location.

- A survey has been carried out in the vicinity to establish existing background sound levels. Representative background sound levels overnight, during the survey, were measured at LAF90 35dB. Based on results of the sound level survey and London Borough of Camden Council's requirement, the overall rating level limit for the pump to outside nearest noise-sensitive windows is set at ≤ 25dBA.

- Calculations using manufacturer's sound level data for the new pump confirm that the specific sound level to outside residential windows will be LAeq 19dB, equating to a rating level of LAr 19dB. This is at least 16dBA below the night time background sound level, and achieves London Borough of Camden Council's acoustic criteria.

- The assessment anticipates that the pump will be installed within a shed formed from solid timber laths with joints sealed or overlapped. No further noise mitigation measures would be necessary.

1. INTRODUCTION

A new water booster pump is to be installed at The Cumberland Lawn Tennis Club, Hampstead, as part of a new sprinkler and irrigation system to the tennis club and associated cricket club.

ACA Acoustics Limited has been commissioned to carry out an assessment of sound emissions from the proposed new pump and, where necessary, make recommendation to reduce sound levels to ensure that the amenity of nearby noise-sensitive properties is not compromised.

This report presents results of the sound level survey and assessment.

2. LONDON BOROUGH OF CAMDEN COUNCIL'S ACOUSTIC REQUIREMENTS

London Borough of Camden Council's policies relating to noise are set out in the new Local Plan, which the author understands are due to be adopted on 3rd July 2017 when it will replace the current Local Development Framework policies. The Inspector's report on the Local Plan was published on 15 May 2017 and concludes that the plan is 'sound' subject to modifications being made to the Plan. While the determination of planning applications should continue to be made in accordance with the existing development plan until formal adoption, substantial weight may now be attached to the relevant policies of the emerging plan as a material consideration following publication of the Inspector's report, subject to any relevant recommended modifications in the Inspector's report. It is of benefit to note that compliance with the new 'Green' criteria (discussed below), will ensure that sound emissions from new equipment are no greater than, and in most cases lower, than criteria required to comply with DP28 of the Local Development Framework, due to be replaced.

Appendix 2 of the Local Plan provides detailed noise thresholds to determine the potential acoustic impact of new development.

In Summary, London Borough of Camden requires an assessment to be carried out in accordance with British Standard 4142:2014 and the results compared against noise-related conditions set out in Table C of the Appendix, as shown in Table 1 below:

Existing Noise Sensitive Receptor	Assessment Location	Design Period	LOAEL (Green)	LOAEL to SOAEL (Amber)	SOAL (Red)
Dwellings	Garden used for main amenity (free field) and outside living or dining or bedroom window (façade)	Day	Rating level 10dB below background	Rating level between 9dB below and 5dB above background	Rating level greater than 5dB above background
Dwellings	Outside between window (façade)	Night	Rating level 10dB below background and no events exceeding 57dB LAmax	Rating level between 9dB below and 5dB above background or noise events between 57dB and 88dB LAmax	Rating level greater than 5dB above background and/or events exceeding 88dB LAmax

Table 1: London Borough of Camden Noise Limits

The scope of BS 4142:2014 advises that "*this British Standard describes methods for rating and assessing sound of an industrial and/or commercial nature … to assess the likely effects of sound on people who might be inside or outside a dwelling or premises used for residential purposes upon*

which sound is incident". BS 4142:2014 is commonly used to assess the potential for loss of amenity due to noise from mechanical services equipment and is considered appropriate for this application.

The assessment method of BS 4142:2014 corrects the specific sound level from the source under investigation to account for characteristics that could make the sound more intrusive to obtain a rating level. This rating level is compared against the prevailing background sound level outside the noise-sensitive property. Section 11 of BS 4142:2014 provides a commentary of the assessment result and advises that:

a) The greater the difference between the rating level and the background sound level, the greater the magnitude of the impact;
b) A difference of around +10dB or more is likely to be an indication of a significant adverse impact, depending on the context;
c) A difference of around +5dB is likely to be an indication of an adverse impact, depending on the context;
d) The lower the rating level is 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.

Assessment results within Appendix 2 of Camden's new Local Plan are shown to be more stringent than those set out in the British Standard and can therefore be taken to ensure a robust assessment. Compliance with the "Green" criteria or lower half of the "Amber" range will generally ensure no loss of amenity to nearby residents, albeit, the context of the development must also be considered on a project-by-project basis which can alter the initial assessment result. This is discussed in more detail in Section 4 below.

3. REVIEW OF SITE LOCATION & DEVELOPMENT PROPOSALS

A planning application is being prepared, to include the installation of a new water booster pump associated with a new sprinkler and irrigation system at The Cumberland Lawn Tennis Club, Hampstead. The proposed pump will have the potential to operate at any time over a full 24-hour period, particularly as the operator may wish to water the cricket and tennis pitches late at night or early morning during warmer summer months.

The surrounding area is a predominantly to residential dwellings. Closest noise-sensitive windows, used in this assessment, have been taken to be to the front façade of 12 Alvanley Gardens, nominally 25m from the equipment location with direct line-of-sight. Drawing showing equipment location and closest noise-sensitive properties is provided in Figure 1 below. The pump is to be installed within a new timber shed on a concrete plinth.

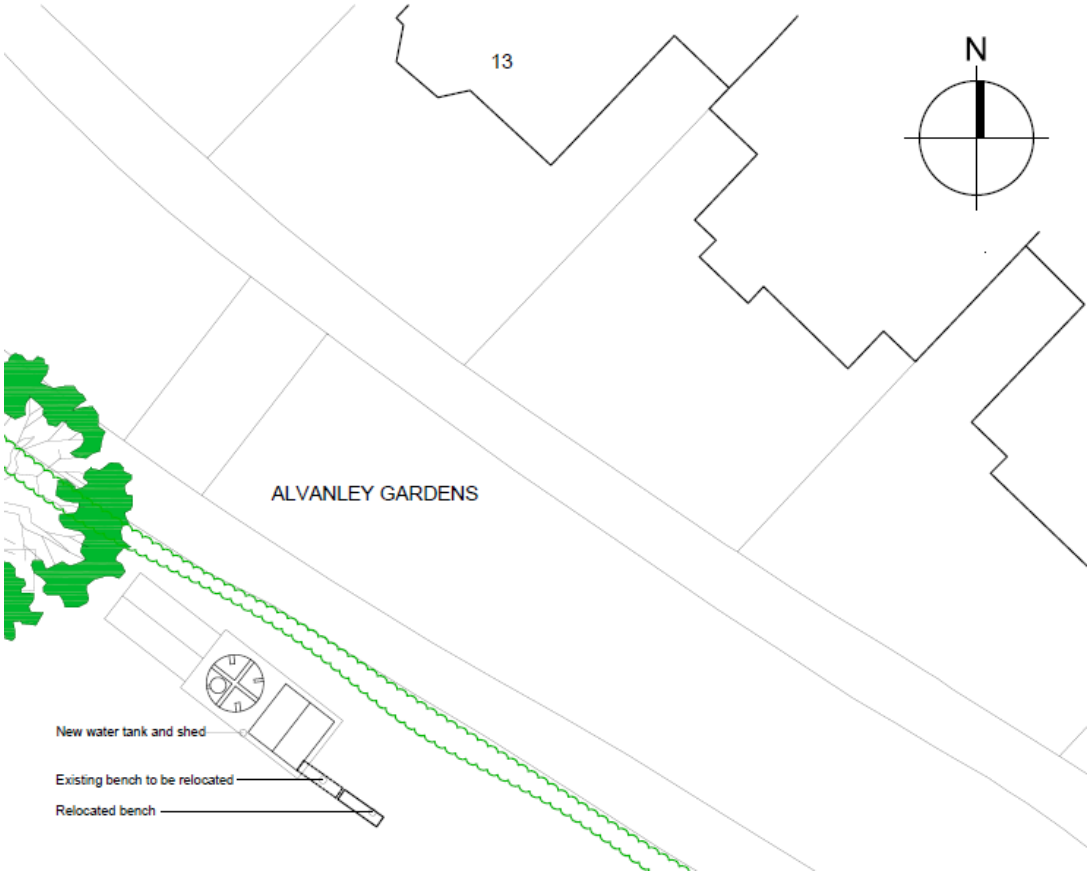

Figure 1: Proposed pump location and closest noise-sensitive properties

4. SOUND LEVEL SURVEY

To assess sound levels from the mechanical services equipment it is necessary to establish sound levels in the vicinity. Details of the sound level survey carried out by ACA Acoustics Limited are provided below.

The sound level survey measurement position was selected to be equivalent to the nearest residential windows, adjacent to the boundary of the cricket pitch facing No. 12 to the opposite side of Alvanley Gardens. The site was considered secure and therefore an unattended survey was carried out over a nominally a 4-day period between 16th June and 19th June 2017, to include a weekend; the likely quietest time of potential operation. During the survey the weather included dry and calm periods.

The following equipment was used during the survey; the sound level meter was calibrated before and checked after the survey measurements with no change noted:

Equipment	Serial Number	Calibration Certificate
Rion sound level meter type NL-31 Class 1 complete with weatherproof and lockable outdoor environmental kit	00431030	1512668
NTi Audio calibrator type CAL200 94/114dB. Compliant to IEC 60942-1:2003 (Calibrated to a reference traceable to NIST)	11441	160915

Table 2: Equipment used

Results of the survey are provided in graphical form in Figure 2.

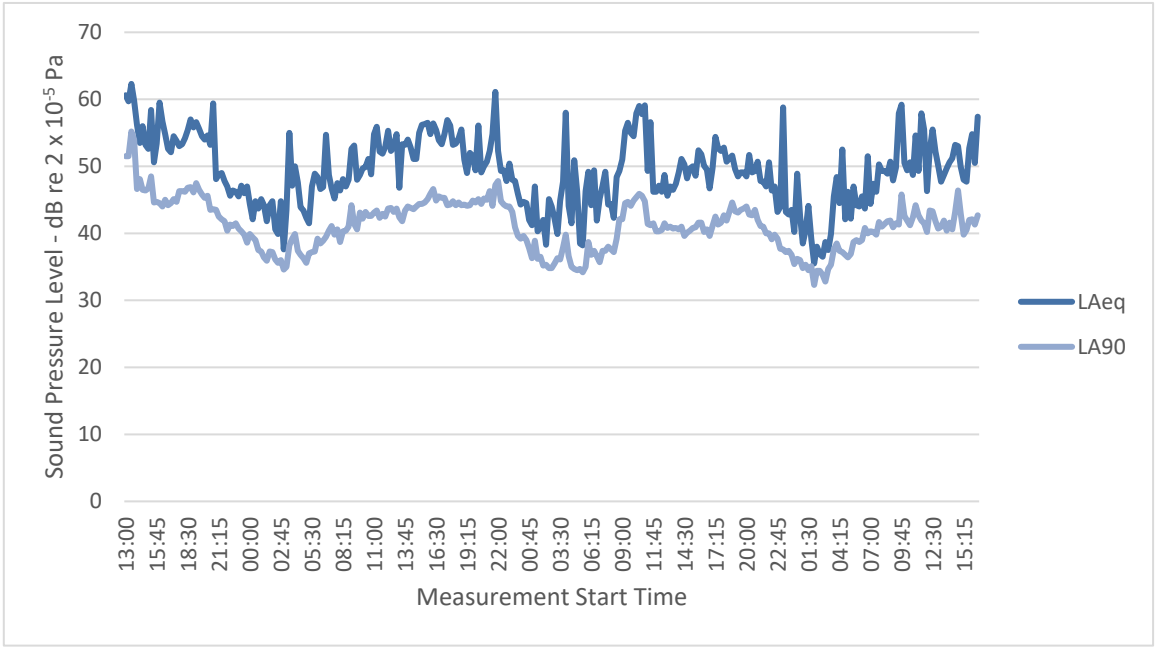

Figure 2: Sound level survey results

In accordance with BS 4142:2014, the prevailing background sound level is not necessarily taken to be the lowest recorded values, but rather the level that best represents the typical background sound level in the area over a defined period. Commentary to Section 8 of the Standard discusses this further, noting that "*the middle of the night can be distinctly different (and potentially of lesser importance) compared to the start or end of the night-time period for sleep purposes*". This acknowledges that continuous sound levels are likely to be of less significance, compared with short-term, transient events, which may result in greater levels of awakening and sleep disturbance. In this instance the source sound level is mechanical equipment which would not result in short-term high-noise events, but rather a continuous low 'hum' during operation. Therefore, in accordance with the Standard, levels to the start and end of the night time period are likely to be the most significant.

A statistical analysis of the measured sound levels has been carried out, generally following suggested guidance contained in Section 8 of the Standard. Distribution of the measured LA90 sound levels over the night time-period during each of the three nights of the survey are shown in Figures 3, 4 and 5 below.

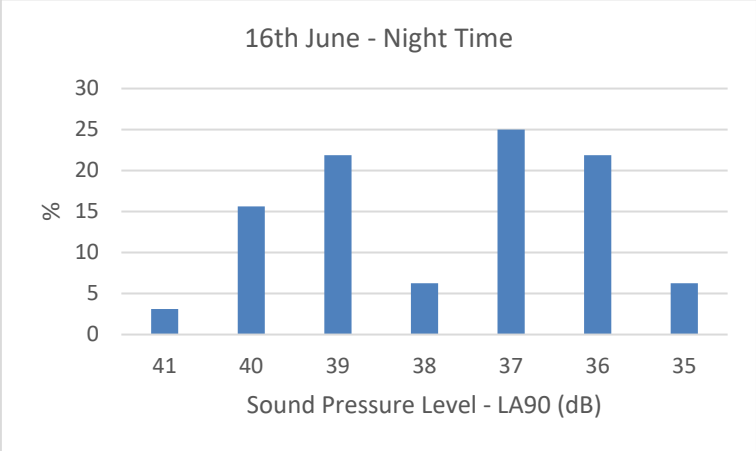

Figure 3: Statistical analysis of measured LA90 values on 16th - 17th June

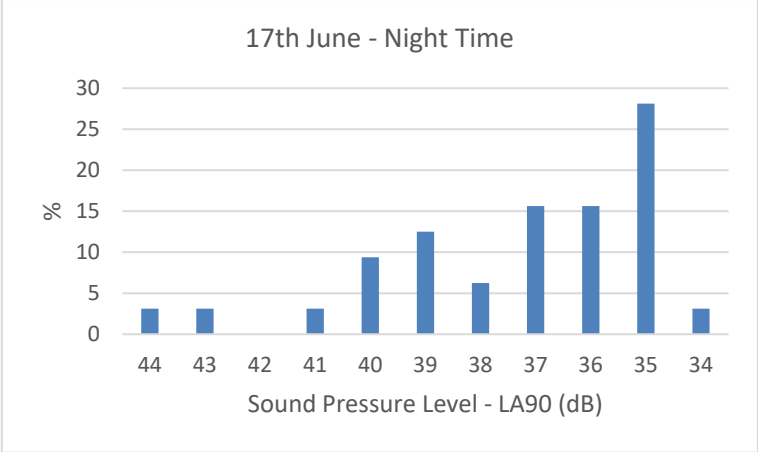

Figure 4: Statistical analysis of measured LA90 values on 17th - 18th June

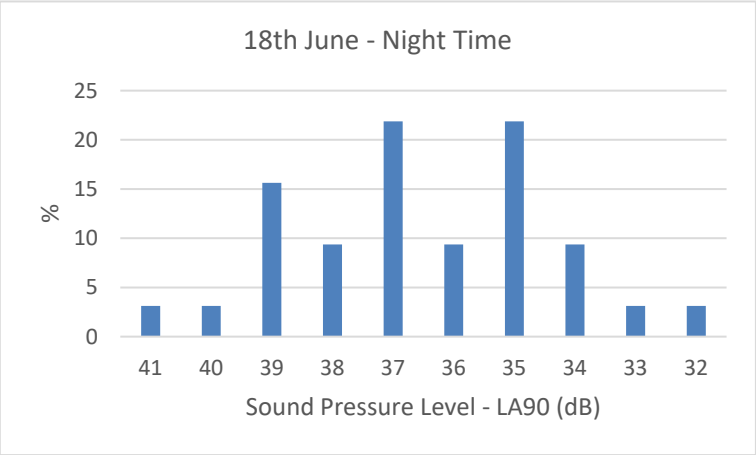

Figure 5: Statistical analysis of measured LA90 values on 18th - 19th June

From Figure 3 it can be seen that the representative background sound level during the first night is LA90 36dB, being the level equalled or exceeded for the vast majority of the period. Over the second and third nights, shown in Figures 4 and 5, the representative background sound level is LA90 35dB, being exceeded up until 01:30 hours and after 03:30 hours on the Sunday night; the more important "*start or end of the night*", as discussed in BS 4142:2014.

The values recorded by ACA Acoustics Limited are used as basis for acoustic design such that rating level of the proposed new equipment is ≤25dBA outside the closest noise sensitive windows; this is at least 10dBA below the representative night time background sound level and at least 7dBA below the lowest measured background sound level in the middle of the Sunday night.

Confirmation of the background sound level used in the assessment is shown in Table 3 below.

Survey Date	Existing Measured Background LA90, 15 min
16th to 19th June 2017	35dB

Table 3: Summary background sound level survey results

5. ACOUSTIC ASSESSMENT

The development includes the installation of a new water booster pump. Confirmation of the equipment model used in the assessment is provided in Table 4 below.

Description	Equipment Model
Booster Pump	Lowara GHV20eSV – 63dBA at 1m

Table 4: Proposed new mechanical equipment

Sound emissions from the mechanical equipment can be determined from manufacturer's published data. For the pump the manufacturer provides sound pressure levels as single-figure dBA values only; typical octave band spectra have been used in the assessment, based on similar units to achieve the published single-figure value. Note that alterations in equipment selections may be possible, so long as sound power levels for the new item does not exceed levels used in the calculation model as shown in Appendix A.

A computer model has been used to calculate the noise contribution from the proposed plant to outside nearest noise-sensitive windows. The calculation model calculates the internal sound level within the pump shed, allowing for timber walls and ceiling and a concrete slab floor. Sound emissions through the timber shed are then calculated, in accordance with BS EN 12354-4:2000, and environmental corrections taken from ISO 9613-2:1996.

The assessment anticipates the pump will be installed within a timber shed, formed from solid laths of minimum 15mm thickness, overlapped or sealed at joints.

The calculated specific sound level from the equipment to outside the closest noise sensitive windows is shown in Table 5. Summary print-outs from the calculation models are included in Appendix A.

Receptor Location	Calculated Equipment Sound Levels
Closest noise-sensitive windows	19dBA

Table 5: Calculated cumulative equipment sound levels at 1m outside noise-sensitive windows

Assessment of the calculated specific sound levels in accordance with BS 4142:2014 is provided in Table 6 below.

Description		Relevant Clause	Commentary
Calculated specific sound level to closest noise-sensitive windows	LAeq 19dB	7.1 7.3.6	Refer calculation sheets in Appendix A.
Background sound level	LA90 35dB	8.1.3 8.3	Representative night time background sound level.
Acoustic feature correction	0dB	9.2	The calculated specific sound level is 16dBA below the representative background sound level overnight, 13dBA below the lowest measured LA90 overnight and 11dBA below the lowest measured LAfmin sound level. Sound emissions from the new pump are likely to be inaudible to outside nearby noise-sensitive properties and therefore, as discussed in Example 6 of BS 4142:2014 Appendix A, where it is not possible to clearly define the specific sound source above the prevailing background sound level then no penalty for acoustic features is required.
Rating level	LAr 19dB		
Excess of rating level over background sound level	**-16dBA**	**11**	**Assessment indicates negligible likelihood of adverse impact**

Table 6: BS 4142:2014 Assessment for all plant operating simultaneously

Table 6 shows that the overall rating level of the proposed new pump will be at least 16dBA below the background LA90 sound level to outside the closest noise-sensitive properties. During other nights and the earlier evening or daytime period the background sound level is higher than the level used in the assessment and thus calculated levels would be even further below the prevailing background level at these times.

BS 4142:2014 requires an assessment to consider the context of the development, rather than simply adhering to numerical figures. The specific sound level of the new plant has been calculated to be at least 16dBA below the representative background sound level and 13dBA below the lowest measured background sound level to outside these closest noise-sensitive properties. At these levels noise from the new equipment should be inaudible to nearby occupants.

Considering the specific numerical value, allowing for a reduction of 15dBA through partially open windows, as described in BS 8233:2014, this equates to a level inside closest residential properties from the new pump of 4dBA; significantly below the guideline sound level to bedrooms of LAeq 30dB set out in BS 8233:2014 and at a level that would be significantly below internal ambient sound levels from sources within the property itself.

The author considers that the context of the assessment does not alter the initial estimate of the impact, and that sound levels from the new mechanical equipment should not be detrimental to the amenity of any residential occupiers in the vicinity and no further noise mitigation measures will be required.

6. CONCLUSION

A new booster pump associated with a sprinkler and irrigation system is to be installed at The Cumberland Lawn Tennis Club, Hampstead.

ACA Acoustics have undertaken a background sound level survey in the vicinity and calculated sound emissions from the proposed new equipment using manufacturer's published data.

The calculated rating level from the pump is at least 16dBA below the prevailing background sound level to outside the closest noise-sensitive properties. At this level, the new equipment fully complies with London Borough of Camden's requirements and will not be detrimental to the amenity of nearby residents. No further mitigation measures would be required.

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APPENDIX A

Acoustic Calculations

Calculation Sheet

Pump Shed to 12 Alvanley Gardens

		Octave Band Centre Frequency (Hz)								
		63	125	250	500	1k	2k	4k	8k	
Internal Receiver Noise										
Internal Receiver Noise - Pump Shed										
Total Sound Pressure Level (dB)		**63.0**	**65.0**	**66.1**	**68.9**	**68.8**	**69.8**	**64.6**	**59.6**	
Diffusivity - Cd										
Levels after Correction		**57.0**	**59.0**	**60.1**	**62.9**	**62.8**	**63.8**	**58.6**	**53.6**	**Row A**
Composite R' of structural elements										
Facade Wall - Timber										
Element Area (m2)	6.8									
Facade Area	13.6									
Roof/Ceiling - Timber										
Area of Roof (m2)	6.8									
Radiating Lw		**-**	**38.0**	**43.1**	**40.9**	**38.8**	**33.8**	**22.6**	**-**	
10 log (S)										
		-	*8.3*	*8.3*	*8.3*	*8.3*	*8.3*	*8.3*	-	
Directivity Correction - Dc										
		-	*1.0*	*1.0*	*1.0*	*1.0*	*1.0*	*1.0*	-	
ISO 9613 Calculation										
Horiz. Distance (m)	25.0									
Source Height (m)	1.5									
Receiver Height (m)	1.5									
Barrier - No Barrier										
Distance to Barrier (m)	-									
Barrier Height (m)	-									
Screening at (m)	-									
Q Factor - Plane										
		-	*-33.0*	*-33.0*	*-33.0*	*-33.1*	*-33.2*	*-33.8*	-	
External Receiver										
External Receiver - 12 Alvanley Gardens										
Sound Pressure, Lp		**-**	**14.3**	**19.4**	**17.1**	**15.0**	**9.9**	**-1.9**	**-**	

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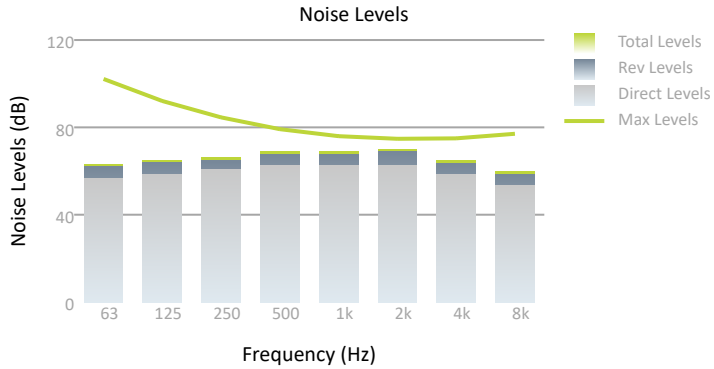
The Cumberland Lawn Tennis Club

Reference	Pump Shed
Description	Timber shed
Room Type	Exposure Action Value
Maximum Noise Level	85dB(A)
Calculated Noise Level	75dB(A)
Calculated Tmf T60 (s)	0.43
Volume (m3)	17.6



Direct Sources

Reference	Quantity	Noise Levels (dB)							
		63	125	250	500	1k	2k	4k	8k
Pump	1	57	59	61	63	63	63	59	54

Reverberant Sources

Reference	Quantity	Noise Levels (dB)							
		63	125	250	500	1k	2k	4k	8k
Pump	1	62	64	65	68	68	69	63	58

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Calculation Sheet

Direct Pump Lp in Shed

		Octave Band Centre Frequency (Hz)							
		63	125	250	500	1k	2k	4k	8k
Noise Source									
Noise Source - Pump									
Sound Pressure Levels @ 1m		**52.0**	**54.0**	**56.0**	**58.0**	**58.0**	**58.0**	**54.0**	**49.0**
Lp to Lw									
Distance (m)	1.0								
Type - Semi-anechoic									
		13.0	*13.0*	*13.0*	*13.0*	*13.0*	*13.0*	*13.0*	*13.0*
Direct Field Corrections									
Q Factor - Junction									
Distance to Listener (m)	1.5								
		-8.5	*-8.5*	*-8.5*	*-8.5*	*-8.5*	*-8.5*	*-8.5*	*-8.5*
Internal Receiver Noise									
Internal Receiver Noise - Pump Shed									
Direct Field, LPdirect		**56.5**	**58.5**	**60.5**	**62.5**	**62.5**	**62.5**	**58.5**	**53.5**

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Calculation Sheet

Reverberant Pump Lp in Shed

		Octave Band Centre Frequency (Hz)							
		63	125	250	500	1k	2k	4k	8k
Noise Source									
Noise Source - Pump									
Sound Pressure Levels @ 1m		**52.0**	**54.0**	**56.0**	**58.0**	**58.0**	**58.0**	**54.0**	**49.0**
Lp to Lw									
Distance (m)	1.0								
Type - Semi-anechoic									
		13.0	*13.0*	*13.0*	*13.0*	*13.0*	*13.0*	*13.0*	*13.0*
Reverberant Field Correction									
Internal Receiver RA - Pump Shed									
		-3.1	*-3.1*	*-4.3*	*-3.3*	*-3.4*	*-2.1*	*-3.6*	*-3.6*
Internal Receiver Noise									
Internal Receiver Noise - Pump Shed									
Reverberant Field, LPrev		**61.9**	**63.9**	**64.6**	**67.7**	**67.6**	**68.9**	**63.4**	**58.4**

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