REPORT TITLE:

Environmental Survey & Preliminary Acoustic Design for the development of Castle Sports Centre, Spalding into the South Holland Health & Wellbeing Hub

CLIENT DETAILS:

Willmott Dixon Construction

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Document Status and Revision Schedule

Issue/Revision	Description/Comments	Date	Prepared by	Approved by
First Issue	Checked & authorised	15/3/24	MJ	JCB
Revision A	Updated with AGP assessment and calculations	10/5/24	MJ	JCB
Revision B	Updated AGP Assessment	24/5/24	MJ	JCB

1. Executive Summary

An environmental noise survey to determine preliminary acoustic design parameters has been commissioned by Willmott Dixon Construction in support of the planning application for the development of the South Holland Health and Wellbeing Hub, located on the site of the Castle Sports Centre, Albion Street, Spalding.

The site borders existing residential properties to the north and a significant distance to the west. The development will take the form of a large extension as well as reworking some of the existing internal areas. A large artificial grass pitch is also proposed to the west of the site.

Criteria are given, based on pre-existing ambient and background noise levels to limit noise emission from new mechanical services plant serving the area, to avoid noise nuisance at the site. Acoustic parameters are set based on current planning guidance related to noise impact.

Findings indicate that the AGP if unprotected, would produce a noise level which is beyond the criterion of 50dBA. This is a value which is stated to protect the majority of people from even moderate annoyance in the context of residential garden amenity. A 2m acoustic barrier to the northwest boundary, has been calculated to reduce the noise to below this value by 5dB.

The scheme is at a preliminary stage; however, the scheme is to be designed to offer compliance with the proposed limits set for mechanical services plant noise and internal occupational noise breakout.

2. Introduction & Site Description

This report presents acoustic design parameters and early specifications for the proposed development of the existing Castle Sports Centre on Albion Street in Spalding.

Criteria for noise emission are provided, which will apply to new plant serving the leisure centre. Criteria are also discussed regarding building envelope sound insulation to control internal occupational noise from the proposed new swimming pool and studio areas proposed within an extension to the existing building. An artificial grass pitch is also proposed for the scheme and is to be discussed relative to Sport England research in to this area. A fully compliant design will be worked up during the next phases of the scheme.

This report assesses the existing ambient and background noise climate at the boundary of the site and provides continuously logged environmental noise data.

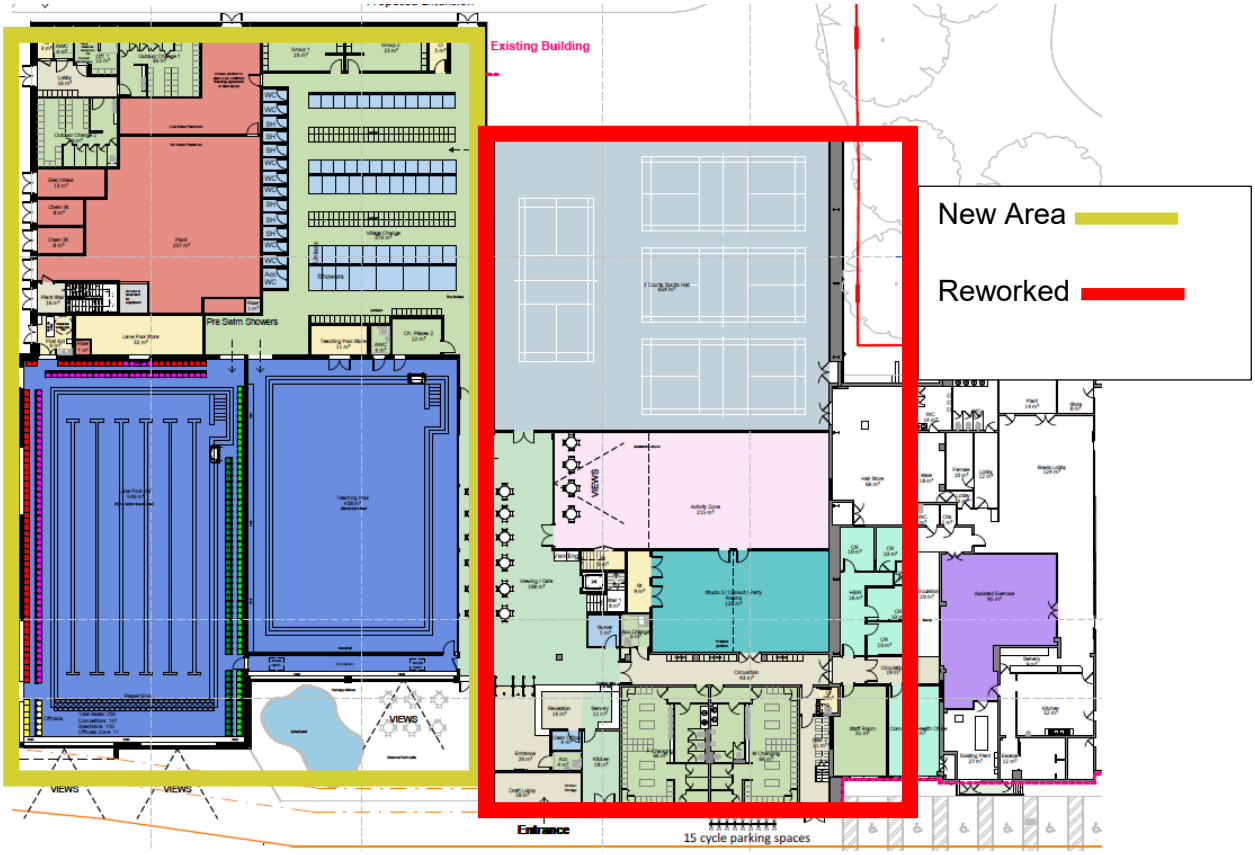


The proposed development master plan is shown overleaf.

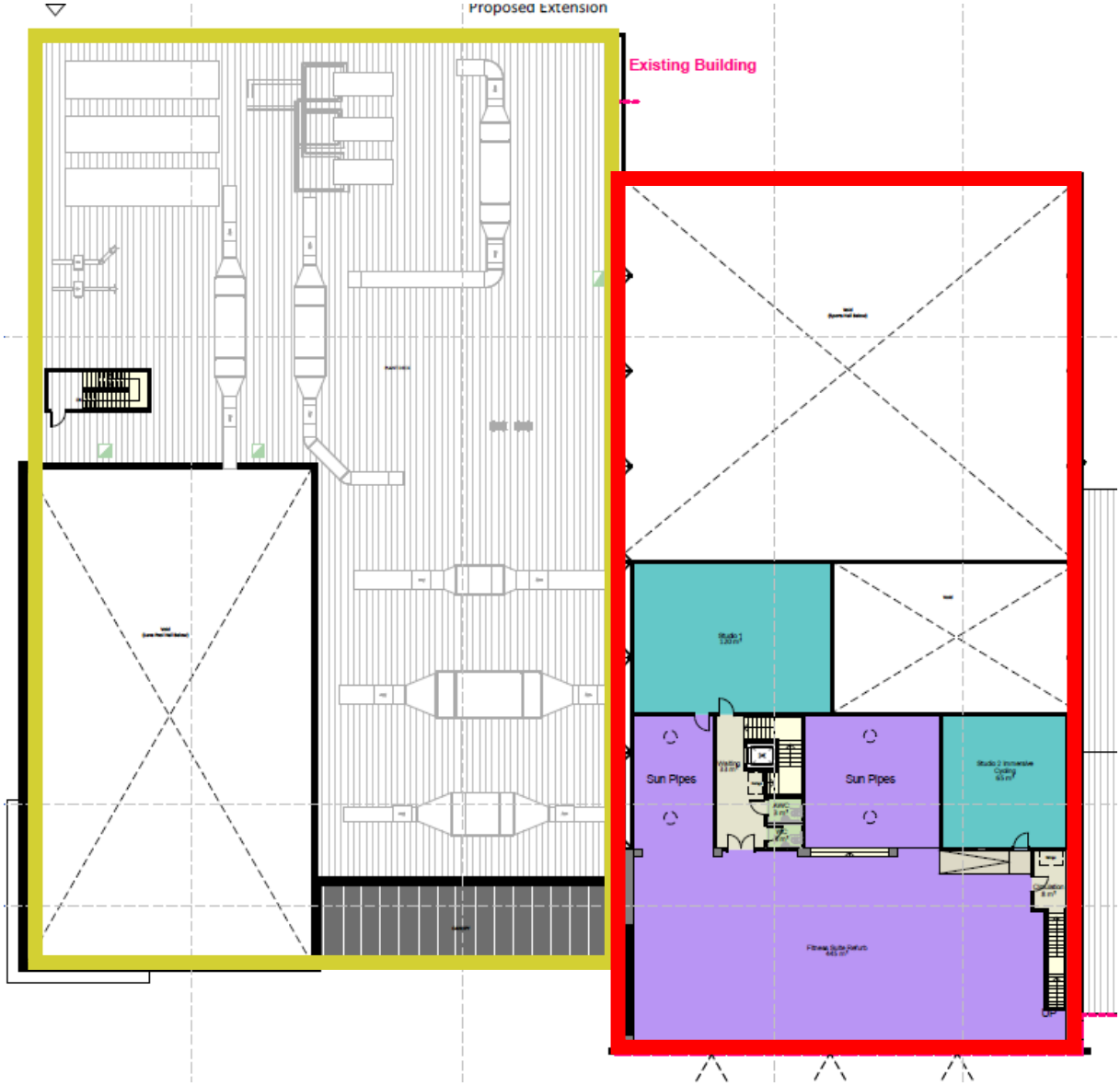
Site Development Master Plan:



Ground Floor Plan:



First Floor Plan:



3. Criteria

3.1 Policy

The National Planning Policy Framework (NPPF) 2023 sets out the general requirements for gaining planning permission. Comments regarding noise found within the document are as follows.

S15. Conserving and enhancing the natural environment

Para 174

Planning policies and decisions should contribute to and enhance the natural and local environment by:

e) preventing new and existing development from contributing to, being put at unacceptable risk from, or being adversely affected by, unacceptable levels of soil, air, water or noise pollution or land instability.

S15. Para 185

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:

a) 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;

b) Identify and protect tranquil areas which have remained relatively undisturbed by noise and are prized for their recreational and amenity value for this reason;

S15. Para 187

Planning policies and decisions should ensure that new development 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 the 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.

The NPPF directs us for further specific guidance on noise to the Noise Policy Statement for England (DEFRA March 2010) which gives three aims, which should be adhered to when considering a development:

Noise Policy Aims

Through the effective management and control of environmental, neighbour and neighbourhood noise within the context of Government policy on sustainable development:

- **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.**

Within the document the avoidance of impact on health and quality of life are discussed in the context of terminology used in toxicology as the excerpt from the document discusses below.

There are several key phrases within the NPSE aims and these are discussed below.

"Significant adverse" and "adverse"

There are two established concepts from toxicology that are currently being applied to noise impacts, for example, by the World Health Organisation. They are:

NOEL – No Observed Effect Level

This is the level below which no effect can be detected. In simple terms, below this level, there is no detectable effect on health and quality of life due to the noise.

LOAEL – Lowest Observed Adverse Effect Level

This is the level above which adverse effects on health and quality of life can be detected.

Extending these concepts for the purpose of this NPSE leads to the concept of a significant observed adverse effect level.

SOAEL – Significant Observed Adverse Effect Level

This is the level above which, significant adverse effects on health and quality of life occur.

It is not possible to have a single objective noise-based measure that defines SOAEL that is applicable to all sources of noise in all situations. Consequently, the SOAEL is likely to be different for different noise sources, for different receptors and at different times. It is acknowledged that further research is required to increase our understanding of what may constitute a significant adverse impact on health and quality of life from noise. However, not having specific SOAEL values in the NPSE provides the necessary policy flexibility until further evidence and suitable guidance is available.

The first aim of the Noise Policy Statement for England

Avoid significant adverse impacts on health and quality of life from environmental, neighbour and neighbourhood noise within the context of Government policy on sustainable development.

The first aim of the NPSE states that significant adverse effects on health and quality of life should be avoided while also taking into account the guiding principles of sustainable development

The second aim of the Noise Policy Statement for England

Mitigate and minimise adverse impacts on health and quality of life from environmental, neighbour and neighbourhood noise within the context of Government policy on sustainable development.

The second aim of the NPSE refers to the situation where the impact lies somewhere between LOAEL and SOAEL. It requires that all reasonable steps should be taken to mitigate and minimise adverse effects on health and quality of life while also taking into account the guiding principles of sustainable development. This does not mean that such adverse effects cannot occur.

The third aim of the Noise Policy Statement for England

Where possible, contribute to the improvement of health and quality of life through the effective management and control of environmental, neighbour and neighbourhood noise within the context of Government policy on sustainable development.

This aim seeks, where possible, positively to improve health and quality of life through the pro-active management of noise while also taking into account the guiding principles of sustainable

development, recognising that there will be opportunities for such measures to be taken and that they will deliver potential benefits to society. The protection of quiet places and quiet times as well as the enhancement of the acoustic environment will assist with delivering this aim.

When considering the requirements for the proposed development, the development should demonstrate that aims of the NPSE have been followed, this is through the application of the more suitable specific guidance on noise both affecting the developments and dealing with noise arising from it.

3.2 Noise Impact Assessment Overview

In terms of protecting occupants of the proposed residential development, the building envelope and ventilation mechanisms should be designed to current applicable guidance to safeguard the proposed development from excessive internal noise.

In terms of mechanical services, initial criteria are put forward in compliance with BREEAM Pol 05 which is a rating noise level of 5dB below the background noise level.

For occupational noise emission, the building envelope is to achieve compliance with the 10dB below the ambient average noise level for the quietest time of operation of the noisiest spaces, which are considered to be the new studio spaces.

For the artificial pitch proposed for the scheme, this is to be appraised against garden amenity criteria set out by the WHO and discussed below.

3.3 World Health Organisation 'Guidelines for Community Noise

WHO: 1999 '*Guidelines for Community Noise*' states that, in order to protect the majority of people from being seriously annoyed during the daytime, the sound pressure level on balconies, terraces and outdoor living areas should not exceed 55 dB L_{Aeq} for a steady, continuous noise. **To protect the majority of people from being moderately annoyed during the daytime, the outdoor sound pressure level should not exceed 50 dB L_{Aeq}.**

The following noise limits for external amenity areas should be targeted.

Location	Desirable external ambient noise levels
External Amenity Area	50-55 dB $L_{Aeq, T}$ (1)

(1) These criteria are also reflected in BS 8233: 2014 ‘Guidance on sound insulation and noise reduction for buildings’ and ProPG: Planning & Noise *Professional Practice Guidance on Planning & Noise*.

3.4 BS4142:2014 + A1: 2019 Methods for rating and assessing industrial and commercial sound

This standard sets out a methodology for the assessment of whether noise from factories, industrial premises or fixed installations and sources of an industrial/commercial nature.

The procedure contained in BS4142 for assessing the impact is to compare the measured or predicted noise level from the source in question, the ‘specific noise level’, at the assessment position with the correct background noise level for the worst-case time of operation.

Where the noise contains a ‘distinguishable, discreet, continuous note (whine, hiss, screech, hum etc.) or if there are distinct impulses in the noise (bangs, clicks or clatters), or if the noise is irregular enough to attract attention’ then a range of correction factors can be added to the specific noise level as appropriate to obtain the ‘rating level’.

As this is a prescriptive report prior to knowledge of the plant installation to serve the new dwellings, overall rating noise levels will be specified for the new installation. Compliance with the rating value will be necessary to provide evidence that significant adverse impact has been avoided as required by the NPSE.

To assess the impact, the measured background noise level is subtracted from the rating noise level. BS4142 states:

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. An effective assessment cannot be conducted without an understanding of the reason(s) for the assessment and the context in which the sound occurs/will occur. When making assessment and arriving at decisions, therefore, it is essential to place the sound in context.

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.

a) Typically, the greater the difference, 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 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.***

Where the initial estimate of the impact needs to be modified due to the context, take all pertinent factors into consideration, including the following.

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.

2) The character and level of the residual sound compared to the character and level of the specific sound. Consider whether it would be beneficial to compare the frequency spectrum and temporal variation of the specific sound with that of the ambient or residual sound, to assess the degree to which the specific sound source is likely to be distinguishable and will represent an incongruous sound by comparison to the acoustic environment that would occur in the absence of the specific sound. Any sound parameters, sampling periods and averaging time periods used to undertake character comparisons should reflect the way in which sound of an industrial and/or commercial nature is likely to be perceived and how people react to it.

3) The sensitivity of the receptor and whether dwellings or other premises used for residential purposes will already incorporate design measures that secure good internal and/or outdoor acoustic conditions, such as;

i) Façade sound insulation treatment
ii) Ventilation and/or cooling that will reduce the need to have windows open so as to provide rapid or purge ventilation; and Acoustic screening.

4. Noise Survey Details

4.1 Equipment

An environmental noise survey was undertaken from 21st and 22nd February 2024 at the site using a calibrated precision grade sound level meter (Svantek 977 Serial No.: 46409) the meter was calibrated before and after the survey and showed no drift between reference values.

4.2 Weather Conditions

Weather conditions were 6 degrees (C) daytime and 2 degrees (C) at night with light winds of approximately 6 mph during the day. No precipitation was noted.

5. Environmental Noise Survey Results

Summarised survey results are given below. Full results are included as Appendix 1 at the rear of this report. The logged results is also provided as Figure 1 also at the rear of this report.

Table 4.1: Measured daytime continuous noise levels at MP1 (dB)

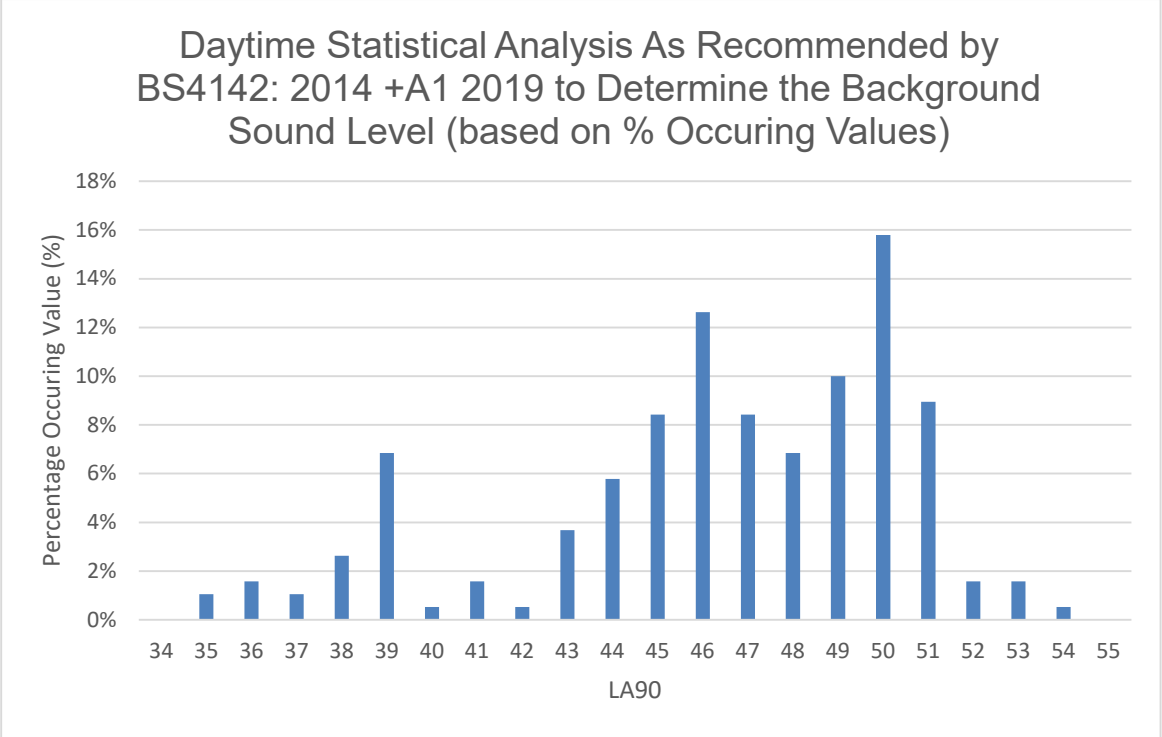
Period	**Period** $L_{Aeq, T}$ **(Log Average)**	$L_{A90, T}$ (1st quartile)
Day (07:00 – 23:00)	49	50* (44)
Evening (19:00-22:00)	44	41
Night (07:00 – 23:00)	42	31 (31)

Note. Full results are provided in graphical form as Appendix B.

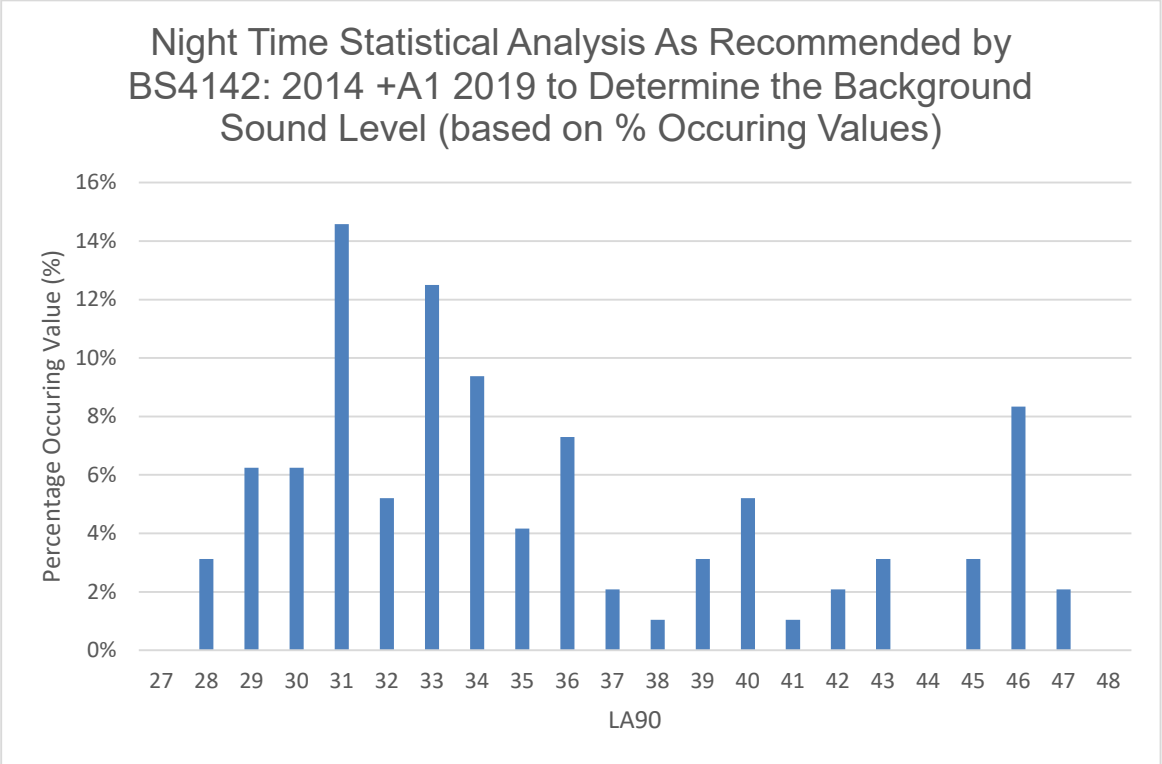
Note. * denotes the L_{A90} value used for the design of mechanical services equipment on the scheme follows the method set out by section 8 of BS 4142: 2014 (+ A1:2019 amendment) *Methods for rating and assessing industrial and commercial sound.*

This uses the statistical analysis of measured background sound values to select the typical /most occurring value to design to rather than the absolute minimum recorded.

The statistical analysis is shown below for information.



Although the most occurring value determined is L_{A90} = 50dB, there are two other notable peaks which is indicative of a time variable background noise level and as such this route to determining the background noise level for future analysis may not be the most suitable.



6. Limiting Plant Noise Criteria

The noise levels recorded on the site are to be used to set environmental noise limiting criteria for mechanical services noise, from the newly developed hub. The site relationship of the approximate location of the first floor plant deck to its closest residential receptor on Chambers Court is shown below:



The new building is approximately 70-80 metres from the closest residential dwellings. A plant deck is proposed for the scheme as well as plant room shown in board of the new extension.

It is proposed that for a robust assessment, the site is designed such that the rating noise level (noise output inclusive of acoustic feature corrections) is equal to the background noise level at the site boundaries. Limiting plant noise criteria are proposed as follows:

At Nearest Boundary (+1.5m above ground level)	Cumulative Rating Level*
Daytime	44dB
Evening	41dB
Night/24 hour operation	31dB

* Denotes this must include all applicable acoustic feature corrections as well as specific plant noise levels.

It should be noted that both day and night criteria are determined by the weekend background noise levels and are considered very low.

Noise levels generated by mechanical plant and experienced by local receptors depends upon a number of variables, the most significant of which are considered to be as follows.

- Noise generated by plant or equipment used on site, generally expressed as sound power levels (SWL)
- Distance between the noise source and the receptor
- Attenuation due to ground absorption, atmospheric and barrier effects
- Periods of operation of the plant on the site, known as its “on-time”

The selection of new plant is not expected to be made for some time, however in order to comply with the criteria determined from the environmental noise survey, low noise options and operational timers should certainly be considered from the outset.

A further analysis is to be undertaken once the scheme is moving forward and plant items can be selected.

7. Occupational Noise Emission

Noise within the new studio spaces will be modelled in the context of noise emission to neighbouring residential properties.

The principle transmission routes are the façade and roof. Performance data for each element will be obtained and where necessary, additional measures to assist in controlling noise emission will be advised to the design team.

The design of occupational noise emission is to be carried out in order that the use of the new spaces within the hub is shown to be below L_{eq} = 44dBA during the day (07:00-19:00) and L_{eq} = 39dBA for the evening period (19:00-22:00), which is 5dB below the ambient average noise level for each period, this is expected to avoid significant adverse noise impact, in accordance with the Noise Policy Statement for England.

In addition to this the frequency content is essential to control as the studios could be expected to contain potentially high levels of low frequency bass content from dance music tracks often utilised in high energy classes. Therefore the design ambient spectra for the day and evening periods are provided below in order to provide a comprehensive design criterion, against which the building envelope is to be designed.

Building Envelope Noise Break-Out Design Criterion – New Studios & Pool Hall

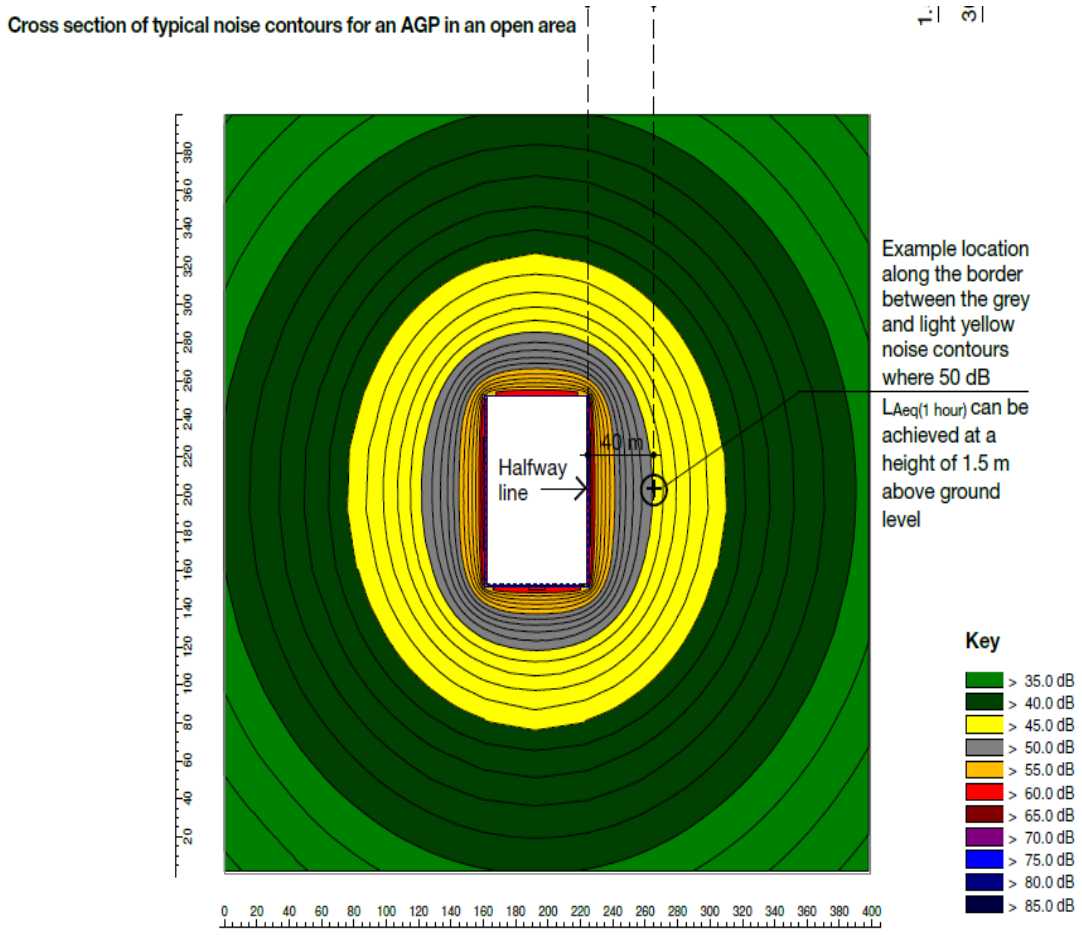
Freq. (Hz)	63	125	250	500	1k	2k	4k	8k	dBA
Daytime Design Criterion (-5dB)	52	46	43	42	40	35	28	24	44
Evening Design Criterion (-5dB)	45	39	36	35	37	29	19	16	39

The building envelope is to be reviewed when design information on the construction form is known against the above design spectra.

8. Noise from External Sports Pitches

Currently, an artificial grass pitch is proposed for the western open area of the site. It is proposed that this is to be assessed in accordance with the guidance of Sport England document Artificial Grass Pitch (AGP) Acoustics - Planning Implications.

Within this document it is stated the importance of considering the potential for disturbance to neighbours at an early stage. The key element of the noise arising from AGPs is a research based noise contour plan, showing the noise emission from the pitch against distance from it. This is shown below for information.



Plan of typical noise contours for an AGP in an open area measured at a height of 1.5 m above ground level

As can be seen above, the critical dimension is the boundary between the grey colour band and the yellow one. This is the point at which noise from the AGP is expected to drop below 50dBA, which as discussed by WHO: 1999 '*Guidelines for Community Noise*' avoids 'moderate annoyance' during the daytime and evening. This value is also picked up by BS8233:2014 *'Guidance on sound insulation and noise reduction for buildings'*.

The document states:

Based on a 15 decibel sound reduction of a partially open window, the noise level outside

a residential property during the daytime about 1 metre from façades of living spaces should not exceed 50 dB LAeq. The WHO document also provides guidance for outdoor living areas. It states that to avoid 'moderate annoyance' during the daytime and evening the noise level should not exceed 50 dB LAeq(T).

World Health Organisation guidelines for residential development are typically calculated over a 16 hour daytime period. For an artificial grass pitch, a 16 hour assessment period may not truly reflect the noise impact as it takes into account times of use and non-use. It is suggested an appropriate assessment time period is for one hour, LAeq(1 hour) as this is typically the time period for a community sports session on an AGP.

This WHO criteria was reviewed in a report by the National Physical Laboratory (reference CMAM16) which states:

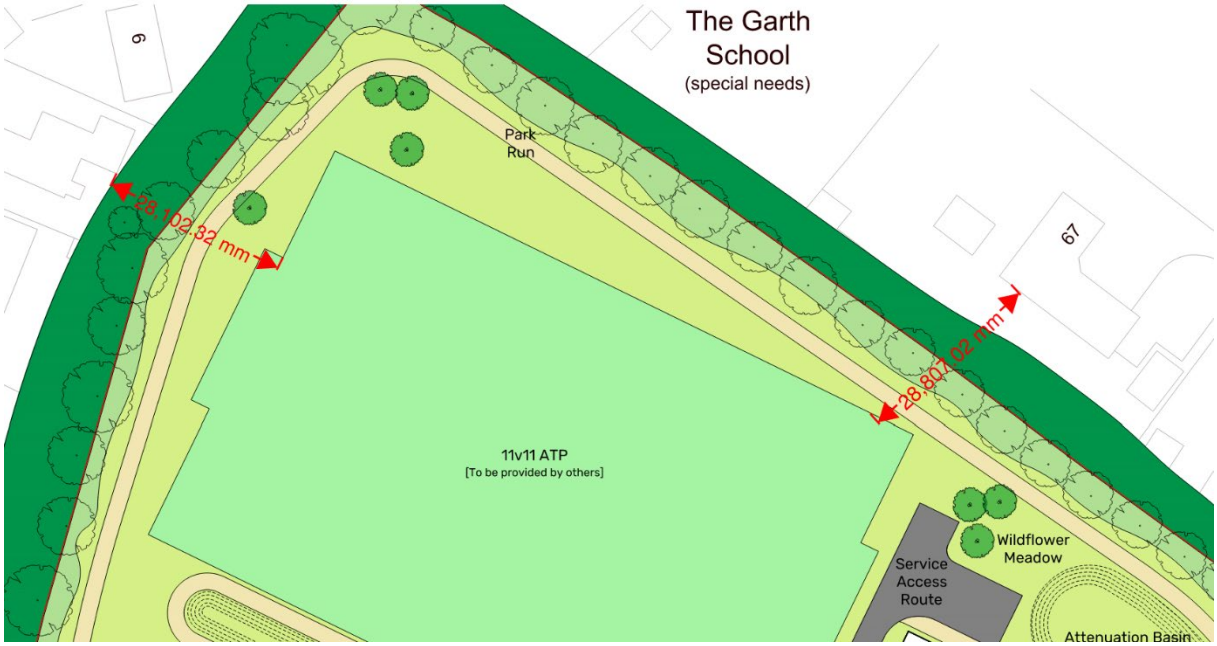
"Exceedance of the WHO guideline values does not necessarily imply significant noise impact and indeed, it may be that significant impacts do not occur until much higher levels of noise exposure are reached"

As can be seen on the image above, dropping below the 50dB contour occurs at a distance of 40metres from the pitch. This is considered a minimum distance which should be observed to avoid specific noise control measures around the pitch or at the site boundary of the Castle Sports Centre.

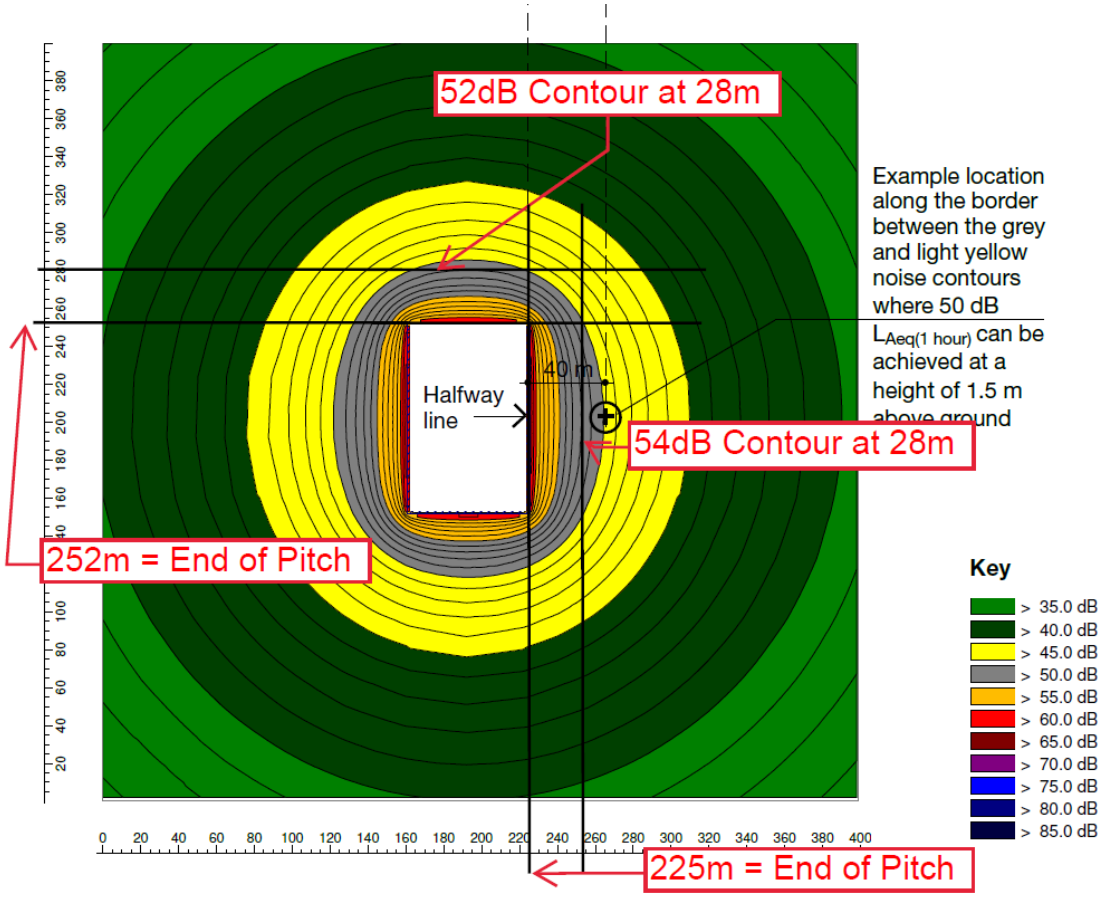
The latest site plan has been issued, illustrating the position of the AGP. This is shown overleaf with scaled distances also indicated.

Should the location of the perimeter of the AGP be closer to the dwellings including gardens than this 40 metre point, the installation of perimeter acoustic barriers may be required.

Sports Pitch Location Plan:



Using the distance of 28m, the following assessment is made based on the AGP noise contours:

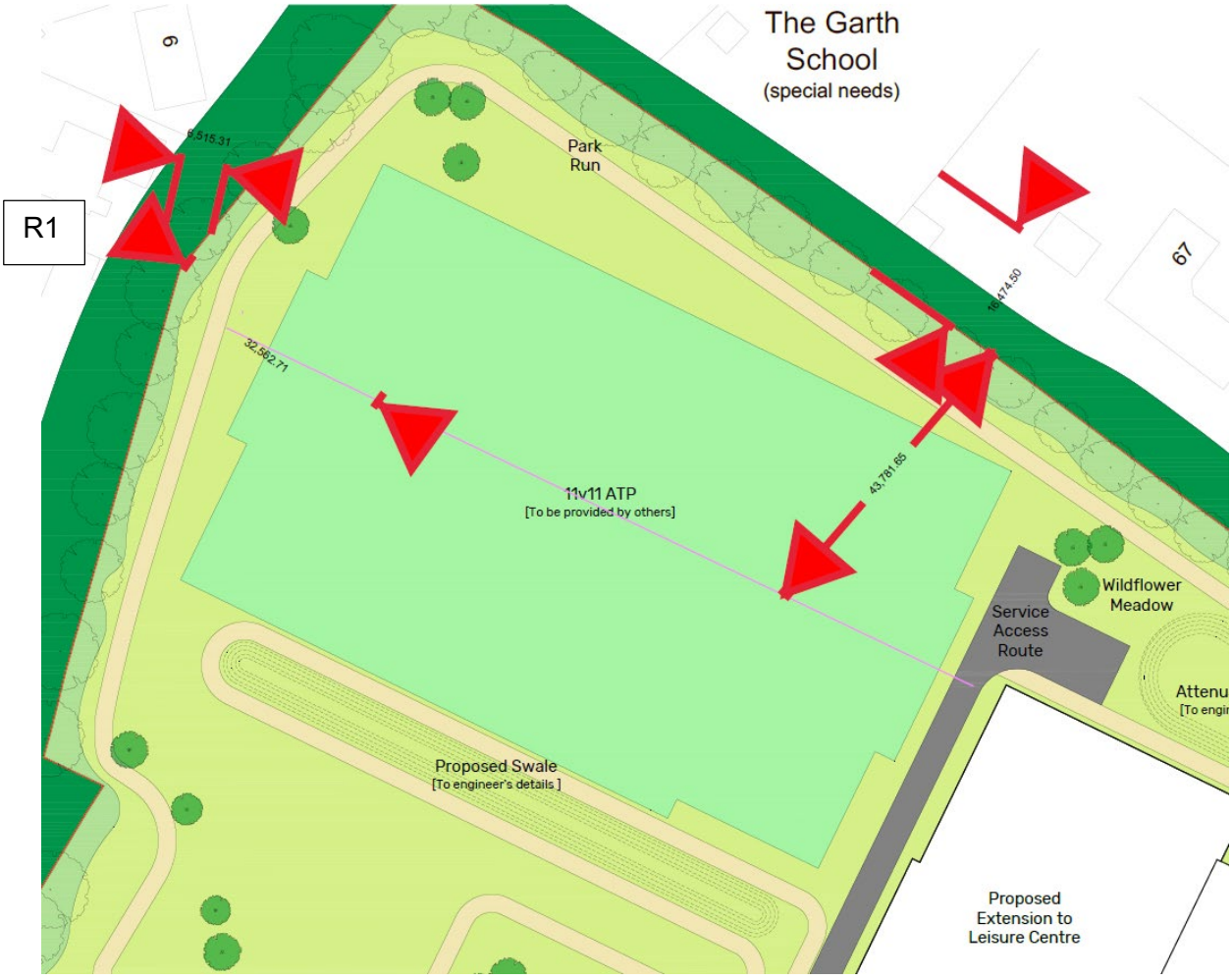


of typical noise contours for an AGP in an open area measured at a height of 1.5 m above ground level

As can be seen above there is a disparity of 2dB to the Northwest corner of the site which aligns with the end of the pitch.

Based on the width of the pitch of 58m (scaled from the AGP model), the requirement for a boundary noise barrier is calculated from the centre line of the pitch to the site's red line boundary and then to a position within the gardens of the two closest dwellings shown as R1. This is to establish a worst case scenario in terms of the calculation of noise barrier attenuation. This is due to the appraising the noise source at distance from the barrier, as opposed to the source being directly adjacent to it.

The distance applied are shown below for the calculations.



R1 Source to Barrier = 32.5m. Barrier to Receptor (Garden) = 6.5m. It is noted that the uses to the north of the AGP are not residential and as such are not included in this assessment.

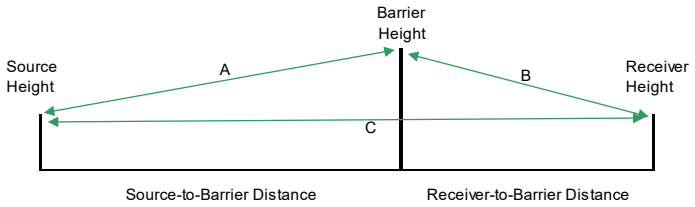
Barrier Calculations:

R1:

BASIC BARRIER ATTENUATION

Date:	10/05/2024
Project:	**South Holland HWB Hub**
Project No:	**PC-23-0226**

User input these cells



Source-to-Barrier Distance	32.5 m
Receiver-to-Barrier Distance	6.5 m

Source Height	1.5 m
Receiver Height	1.5 m
Barrier Height	2.0 m

Path difference = 0.023 m
(a + b) - c

Frequency - Hz	63	125	250	500	1K	2K	4K	8K	CRTN
Attenuation - dB	**5**	**5**	**6**	**6**	**8**	**9**	**11**	**14**	**7.3 dBA**

It can be seen that the addition of a 2m high acoustic barrier is expected to offer the necessary level of attenuation required to reduce pitch noise levels to below L_{Aeq} = 50dB, which protects the majority of people from moderate annoyance. In terms of the selection of a noise barrier, the following comments are made.

Acoustic Performance:

The Manual for Contract documents for Highways Works (Series NG 2500 Special Structures) states within paragraph 14:

"*The overall insulation performance of a barrier should be at least 10 dBA higher than the calculated screening attenuation. Care should be taken to prevent loss of performance through leakage at gaps and joints. It should be noted that the mass law may over predict the insulation performance of barriers constructed from timber planks. Consideration should be given as to whether evidence of acoustic tests should be required to demonstrate achievement of specified requirements.*"

BS EN 1793-2 recommends a classification of barrier products covering ranges of performance measured as DL_R as follows:

Barrier Classification	Acoustic Performance DL_R
B0	Not Tested
B1	<15dB
B2	15-24dB
B3	>24dB

As 7dB is calculated as the effective insertion loss of adding the boundary barrier, the selected barrier may be either B2 (if its performance is greater than DL_R = 17dB) or classification B3. Products offered must carry classification measured in terms of BS EN 1793-2.

9. Conclusion

This report has assessed the current levels of ambient and background noise in the area immediately surrounding the development of the South Holland Health & Wellbeing Hub, located on the site of the Castle Sports Centre, Albion Street, Spalding.

The scheme is to involve reworking of some of the existing spaces within the building and the addition of a large extension which is to house new swimming pools as well as provision of a large artificial grass pitch which has been assessed in line with the guidance of Sport England.

Findings indicate that the AGP if unprotected, would produce a noise level which is beyond the criterion of 50dBA. This is a value which is stated to protect the majority of people from even moderate annoyance in the context of residential garden amenity. A 2m acoustic barrier to the northwest boundary, has been calculated to reduce the noise to below this value by 5dB.

Criteria are discussed and proposed for noise emission from proposed plant and occupational noise, aimed at avoiding noise nuisance and aligning with the aims of the Noise Policy Statement for England and current guidance.

Aspects of further works are required during detailed design, when details of the building form and new plant items are confirmed.

10. Glossary of Terms

Sound Pressure Level and the decibel (dB)

The ear can detect a wide range of pressure variations and in order simplify this, a logarithmic scale is used to convert the values into manageable numbers. The dB (decibel) is the logarithmic unit used to describe sound levels. The typical range of sound pressure levels is 0 dB (threshold of hearing) to 120 dB (threshold of pain). Subjective variations in noise levels range from 3dB which is considered the minimum perceptible change in steady state noise to an increase/decrease in noise level of 10 dB(A) corresponds to a perceived doubling/halving.

Frequency and hertz (Hz)

Frequency is a measure of the rate of fluctuation of a sound wave. The unit used is cycles per second given in Hz or kHz, where 1 kHz = 1000 Hz.

A-weighting

The ear is not equally sensitive to sound at all frequencies. It is less sensitive to sound at low and very high frequencies. To reflect this, linear values are subject to a filter called the 'A' weighting, this is typically built into sound level meters. Noise levels measured using the 'A' weighting are denoted dB(A) or L_A.

Noise Indices

Environmental noise typically changes over time therefore it is not possible to represent the noise climate with a simple dB(A) value. A number of indices including statistical parameters, are normally used along with a sampling time (fast – *f*, slow – *s* or instantaneous – *i*) to assess environmental noise. The indices used in this report are described below.

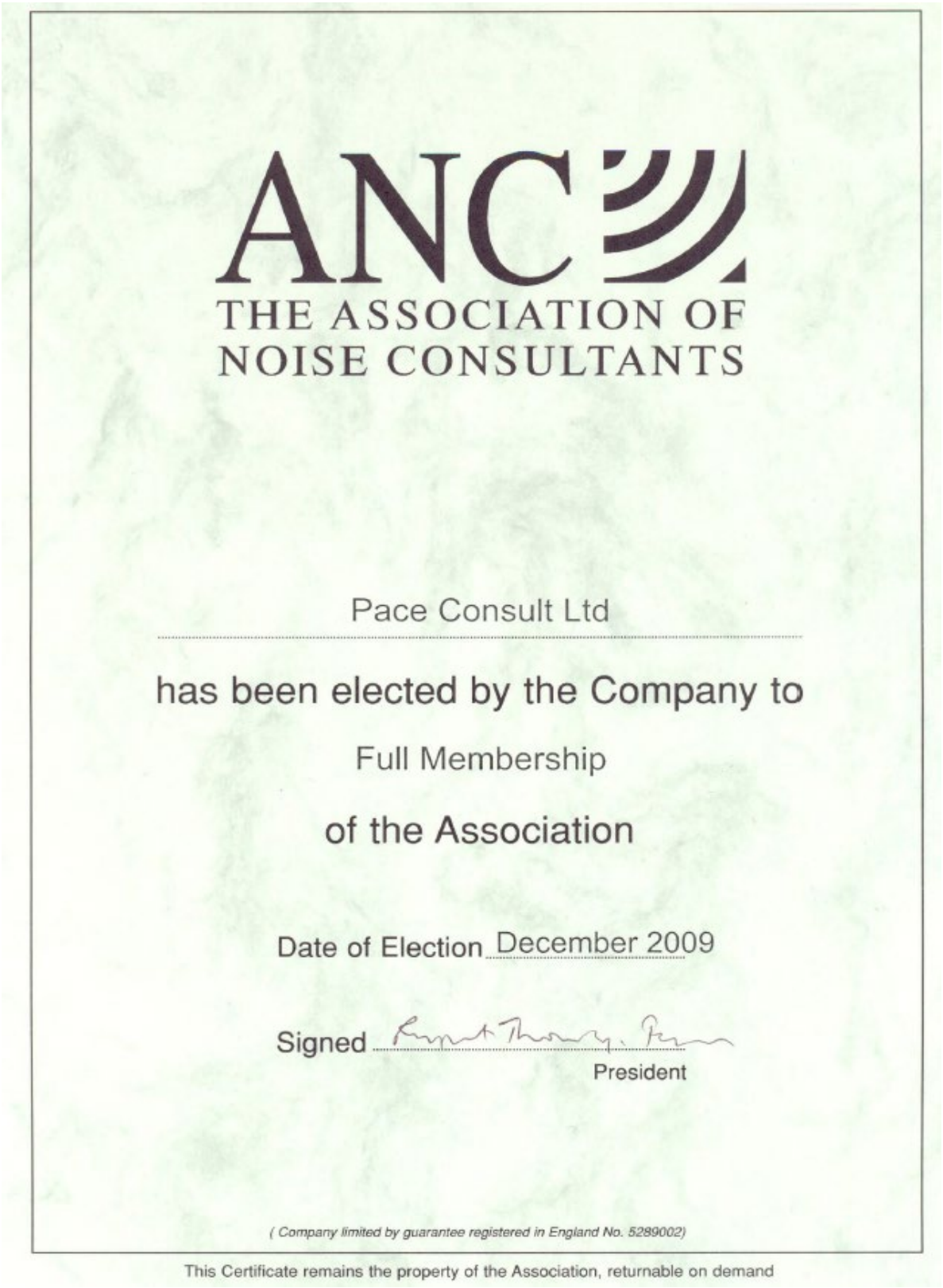
$L_{Aeq,T}$ This is the A–weighted 'equivalent continuous noise level' which is a logarithmic average of the total sound energy measured over a specified time period. In other words, L_{Aeq} is the level of a continuous noise which has the same total energy as the real fluctuating noise over a specific time period (given as T)

L_{Amax} This is the maximum A–weighted noise level recorded during the monitoring period.

L_{A10} This is the A–weighted noise level exceeded for 10% of the time period. L_{A10} is usually used as a measure of traffic noise.

L_{A90} This is the A–weighted noise level exceeded for 90% of the time period. L_{A90} is typically used as a measure of background noise.

Appendix A – ANC Membership



ANC

THE ASSOCIATION OF NOISE CONSULTANTS

Pace Consult Ltd

has been elected by the Company to

Full Membership

of the Association

Date of Election December 2009

Signed

President

(Company limited by guarantee registered in England No. 5289002)

This Certificate remains the property of the Association, returnable on demand

Appendix B – Graph of Survey Data

