Heyford Park Phase 10
Upper Heyford
Bicester

Environmental Noise Survey and Acoustic Design Statement Report

23195/ADS1-10 (Rev 2)

8 September 2022

For:
Dorchester Living

Hann Tucker Associates
Consultants in Acoustics Noise & Vibration

Head Office: Duke House, 1-2 Duke Street, Woking, Surrey, GU21 5BA (t) +44 (0) 1483 770 595
Manchester Office: First Floor, 346 Deansgate, Manchester, M3 4LY (t) +44 (0) 161 832 7041
(w) hanntucker.co.uk (e) enquiries@hanntucker.co.uk

Hann Tucker Associates

Environmental Noise Survey and Acoustic Design Statement Report
23195/ADS1-10 (Rev 2)

Document Control

Rev	Date	Comment	Prepared by	Authorised by
2	08/09/2022	-	[redacted] Rebeca Sanchez Assistant Consultant MSc(Hons), Larch, AMIOA	John Gibbs Director MIOA MSEE CEnv
1	06/09/2022	Updated window specification	Rebeca Sanchez Assistant Consultant MSc(Hons), Larch, AMIOA	John Gibbs Director MIOA MSEE CEnv
0	18/08/2022	-	Rebeca Sanchez Assistant Consultant MSc(Hons), Larch, AMIOA	Gareth Evans Senior Associate BSc(Hons), MIOA

Hann Tucker Associates

Environmental Noise Survey and Acoustic Design Statement Report
23195/ADS1-10 (Rev 2)

Contents

Attachments

1.0 Introduction

A new phase of a residential development (Phase 10) is proposed at the Heyford Park development in Upper Heyford, Bicester.

Hann Tucker Associates have therefore been commissioned to undertake an environmental noise survey and noise impact assessment in order to assess the suitability of the site for residential use.

This report presents the methodology and findings of our noise survey and assessment in the context of national planning policies and the policy of the Local Authority.

2.0 Objectives

To establish by means of an unmanned 24-hour survey the existing L_{Amax}, L_{Aeq} and L_{A90} environmental noise levels at up to 4No. secure and accessible on-site positions, using fully computerised noise monitoring equipment.

To identify the noise emission limits from the development with reference to the requirements of the Local Authority and/or the application of BS 4142: 2014 and to minimise the possibility of noise nuisance to neighbours.

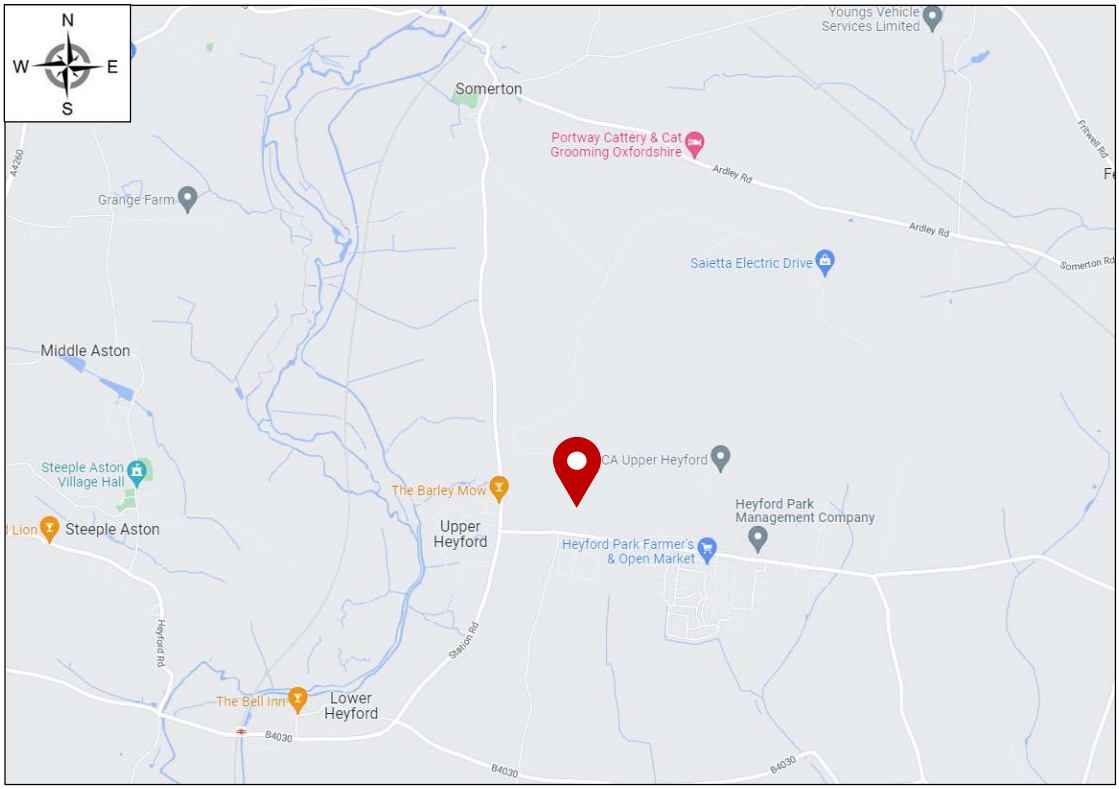
Based on the results of the survey, to undertake a noise assessment to assess the suitability of the site for residential use in accordance with the Noise Policy Statement for England (NPSE), National Planning Policy Framework (NPPF), Planning Practice Guidance (ProPG), British Standard BS8233:2014 and Local Authority requirements.

To present our methodology and findings in a detailed Environmental Noise Survey and Noise Impact Assessment Report to assist with discharge of Outline Consent condition 24.

3.0 Site Description

3.1 Location

The site is located in Upper Heyford, Bicester, to the south of the old Upper Heyford Airfield, OX25. The location is shown in the Location Map below.



Location Map (Map data © 2022 Google)

The site falls within the jurisdiction of Oxfordshire County Council and Cherwell District Council.

3.2 Description

The site is surrounded by large green areas and undeveloped lands, with residential units to the east and south of the site. The residential units have a height of ground floor plus one storey. The site is bounded to the south by Camp Road and to the north with the old Upper Heyford Airfield and Pro-Auto vehicle repair.

The site is shown in the Site Plan below.

Site Plan (Imagery © 2022 Getmapping plc, Infoterra Ltd & Bluesky, Maxar Technologies, The GeoInformation Group, Map Data © 2022 Google)

4.0 Acoustic Terminology

For an explanation of the acoustic terminology used in this report please refer to Appendix A enclosed.

5.0 Methodology

The survey was undertaken by John Gibbs MIOA MSEE CEnv.

5.1 Procedure

Fully automated environmental noise monitoring was undertaken from approximately 09:00 hours on Wednesday 10th August 2022 to 12:00 hours on Thursday 11th August 2022.

During the periods we were on site the wind conditions were calm. The sky was generally clear. We understand that generally throughout the survey period the weather conditions were calm.

These conditions are considered suitable for obtaining representative measurement results.

Measurements were taken continuously of the A-weighted (dBA) L_{90}, L_{eq} and L_{max} sound pressure levels over 15-minute periods.

5.2 Measurement Positions

The noise level measurements were undertaken at 4 positions as described in the table below.

Position No	Description
1	The microphone was attached to the pole, facing the north-west of the site, with a height of 1.2 metres above the ground.
2	The microphone was attached to the pole, installed at the north-east corner of the site, with a height of 1.2 metres above the ground.
3	The microphone was attached to the pole, installed at the south-east corner of the site, facing Camp Road, with a height of 1.2 metres above the ground.
4	The microphone was attached to the pole, installed at the south-west corner of the site, facing Camp Road, with a height of 1.2 metres above the ground.

The positions are shown on the plan below.

Plan Showing Measurement Positions (Imagery © 2022 Getmapping plc, Infoterra Ltd & Bluesky, Maxar Technologies, The GeoInformation Group, Map Data © 2022 Google)

5.3 Instrumentation

The instrumentation used during the survey is presented in the table below:

Description	Manufacturer	Type	Serial Number	Calibration
Position 1 Type 1 Data Logging Sound Level Meter	Larson Davis	824	3155	Calibration on 05/11/2021
Position 1 Type 1 ½" Condenser Microphone	PCB	377B02	107427	Calibration on 05/11/2021
Position 1 Preamp	Larson Davis	PRM902	4154	Calibration on 05/11/2021
Position 2 Type 1 ½" Condenser Microphone	PCB	377B02	133362	Calibration on 19/07/2022

Description	Manufacturer	Type	Serial Number	Calibration
Position 2 Preamp	Larson Davis	PRM902	3318	Calibration on 19/07/2022
Position 2 Type 1 Data Logging Sound Level Meter	Larson Davis	824	3699	Calibration on 19/07/2022
Position 3 Type 1 ½" Condenser Microphone	ACO Pacific	7052E	50282	Calibration on 12/07/2022
Position 3 Preamp	Larson Davis	PRM902	4158	Calibration on 12/07/2022
Position 3 Type 1 Data Logging Sound Level Meter	Larson Davis	824	3804	Calibration on 12/07/2022
Position 4 Type 1 Data Logging Sound Level Meter	Larson Davis	824	3053	Calibration on 05/11/2021
Position 4 Preamp	Larson Davis	PRM902	4157	Calibration on 05/11/2021
Position 4 Type 1 ½" Condenser Microphone	PCB	377B07	107417	Calibration on 05/11/2021
Type 1 Calibrator	Bruel & Kjaer	4230	584692	Calibration on 05/11/2021

Each sound level meter, including the extension cable, was calibrated prior to and on completion of the surveys. No significant change was found to have occurred (no more than 0.1 dB).

Each sound level meter was located in an environmental case with the microphone connected to the sound level meter via an extension cable. Each microphone was fitted with a windshield.

6.0 Results

The results have been plotted on Time History Graphs 23195/TH1 to 23195/TH4 enclosed presenting the 15-minute A-weighted (dBA) L_{90}, L_{eq} and L_{max} levels at each measurement position throughout the duration of the survey.

In order to compare the results of our survey with the relevant guidelines it is necessary to convert the measured $L_{Aeq(15\ minute)}$ noise levels into single figure daytime $L_{Aeq(16\text{-}hour)}$ (07:00-23:00

hours) and night-time $L_{Aeq(8\text{-}hour)}$ (23:00-07:00 hours) levels.

The daytime $L_{Aeq(16\text{-}hour)}$ and night-time $L_{Aeq(8\text{-}hour)}$ noise levels for each position are presented in the tables below. In order to provide representative results, in the case of Position 3, a short period where an equipment error occurred was removed from our calculations. This period was between 5:30 hours to 07:45 on Thursday 11 August 2022.

Position	Daytime $L_{Aeq(16\text{-}hour)}$	Night-Time $L_{Aeq(8\text{-}hour)}$
1	42 dB	41 dB
2	48 dB	40 dB
3	56 dB	48 dB
4	52 dB	45 dB

7.0 Discussion of Noise Climate

During the periods we were on site the dominant noise source was noted to be road traffic noise from Camp Road, which is at the south of the site.

8.0 Relevant Planning Policies and Guidance

8.1 Noise Policy Statement for England

The Noise Policy Statement for England (NPSE) was published in March 2010 (i.e. before the NPPF). The NPSE is the overarching statement of noise policy for England and applies to all forms of noise other than occupational noise, setting out the long term vision of Government noise policy which is to:

"Promote good health and a good quality of life through the effective management of noise within the context of Government policy on sustainable development."

That vision is supported by the following NPSE noise policy aims which are reflected in three of the four aims of planning policies and decisions in paragraph 123 of the NPPF (see paragraph 8.2 (b) below):

"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."*

The Explanatory Note to the NPSE has three concepts for the assessment of noise in this country:

NOEL – No Observed Effect Level
This is the level below which no effect can be detected and below which there is no detectable effect on health and quality of life due to noise.

LOAEL – Lowest Observable Adverse Effect Level
This is the level above which adverse effects on health and quality of life can be detected.

SOAEL – Significant Observed Adverse Effect Level
This is the level above which significant adverse effects on health and quality of life occur.

None of these three levels are defined numerically and for the SOAEL the NPSE makes it clear that the noise level is likely to vary depending upon the noise source, the receptor and the time of day/day of the week, etc. The need for more research to investigate what may represent an SOAEL for noise is acknowledged in the NPSE and the NPSE asserts that not stating specific SOAEL levels provides policy flexibility in the period until there is further evidence and guidance.

The NPSE concludes by explaining in a little more detail how the LOAEL and SOAEL relate to the three NPSE noise policy aims listed above. It starts with the aim of avoiding significant adverse effects on health and quality of life, then addresses the situation where the noise impact falls between the LOAEL and the SOAEL when *"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."* The final aim envisages pro-active management of noise to improve health and quality of life, again taking into account the guiding principles of sustainable development which include the need to minimise travel distance between housing and employment uses in an area.

8.2 National Planning Policy Framework (NPPF)

The following paragraphs are from the NPPF (published July 2021):

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.

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."

Paragraph 185 also references the Noise Policy Statement for England (NPSE). This document does not refer to specific noise levels but instead sets out three aims:

- "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.
- 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.
- 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."

8.3 Planning Practice Guidance on Noise

Planning Practice Guidance (PPG) under the NPPF has been published by the Government as a web based resource at http://planningguidance.planningportal.gov.uk/blog/guidance/. This includes specific guidance on Noise although, like the NPPF and NPSE the PPG does not provide any quantitative advice. It seeks to illustrate a range of effect levels in terms of examples of outcomes as set out in the following table:

Perception	Examples of Outcomes	Increasing effect level	Action
Not noticeable	No effect	No Observed Effect	No specific measures required
Noticeable and not intrusive	Noise can be heard, but does not cause any change in behaviour or attitude. Can slightly affect the acoustic character of the area but not such that there is a perceived change in the quality of life.	No Observed Adverse Effect	No specific measures required
		Lowest Observed Adverse Effect Level	
Noticeable and intrusive	Noise can be heard and causes small changes in behaviour and/or attitude, e.g. turning up volume of television; speaking more loudly; where there is no alternative ventilation, having to close windows for some of the time because of the noise. Potential for some reported sleep disturbance.	Observed Adverse Effect	Mitigate and reduce to a minimum
		Significant Observed Adverse Effect Level	
Noticeable and disruptive	The noise causes a material change in behaviour and/or attitude, e.g. avoiding certain activities during periods of intrusion; where there is no alternative ventilation, having to keep windows closed most of the time because of the noise. Potential for sleep disturbance resulting in difficulty in getting to sleep, premature awakening and difficulty in getting back to sleep. Quality of life diminished due to change in acoustic character of the area.	Significant Observed Adverse Effect	Avoid
Noticeable and very disruptive	Extensive and regular changes in behaviour and/or an inability to mitigate effect of noise leading to psychological stress or physiological effects, e.g. regular sleep deprivation/awakening; loss of appetite, significant, medically definable hard, e.g. auditory and non-auditory.	Unacceptable Adverse Effect	Prevent

8.4 Local Planning Policy

The site lies within the jurisdiction of Oxfordshire County Council and Cherwell District Council. The Condition 24 of the Planning Application Recommendation states:

"For each phase or sub phase comprising of the residential development, no works shall be undertaken until such times as a detailed scheme of noise assessment and possible sound insulation measures for the residential units (including a timetable for its implementation) has first been submitted to and approved in writing by the Local Planning Authority. That scheme shall be implemented in accordance with the approved details.

Reason - To ensure the creation of a satisfactory environment free from intrusive levels of noise and to comply with saved Policies C30 and ENV1 of the Cherwell Local Plan 1996 and guidance

in the NPPF"

The Policy C30 of the Cherwell Local Plan 1996 states:

"Design control will be exercised to ensure:

(i) That new housing development is compatible with the appearance, character, layout, scale and density of existing dwellings in the vicinity;

(ii) That new proposal to extend an existing dwelling (in cases where planning permission is required) is compatible with the scale of the existing dwelling, its curtilage and the character of the street scene;

(iii) That new housing development or any proposal for the extension (in cases where planning permission is required) or conversion of an existing dwelling provides standards of amenity and privacy acceptable to the Local Planning Authority."

The Policy ENV1 of the Cherwell Local Plan 1996 states:

"Development which is likely to cause materially detrimental levels of noise, vibration, smell, smoke, fumes or other type of environmental pollution will not normally be permitted."

8.5 World Health Organisation

The current Environmental Noise Guidelines 2018 for the European Region (ENG) supersede the Guidelines for Community Noise from 1999 (CNG). Nevertheless, the ENG recommends that all CNG indoor guideline values and any values not covered by the current guidelines (such as industrial noise and shopping areas) remain valid.

A summary of the guidance from the ENG and CNG is shown in the table below.

Source	CNG guideline indoors all sources	ENG guideline outdoors noise from specific source only
Road traffic noise	35 $L_{Aeq, 16h}$	53 dB L_{den}
	30 $L_{Aeq, 8h}$	45 dB L_{night}
Railway noise	35 $L_{Aeq, 16h}$	54 dB L_{den}
	30 $L_{Aeq, 8h}$	44 dB L_{night}
Aircraft noise	35 $L_{Aeq, 16h}$	45 dB L_{den}
	30 $L_{Aeq, 8h}$	40 dB L_{night}

With regard to single-event noise indicators, Section 2.2.2 of the WHO Environmental Noise Guidelines 2018 state:

"In many situations, average noise levels like the L_{den} or L_{night} indicators may not be the best to explain a particular noise effect. Single-event noise indicators – such as the maximum sound pressure level ($L_{A,max}$) and its frequency distribution – are warranted in specific situations, such as in the context of night-time railway or aircraft noise events that can clearly elicit awakenings and other physiological reactions that are mostly determined by $L_{A,max}$. Nevertheless, the assessment of the relationship between different types of single-event noise indicators and long-term health outcomes at the population level remains tentative. The guidelines therefore make no recommendations for single-event noise indicators."

8.6 British Standard BS8233: 2014

British Standard 8233: 2014 "Guidance on sound insulation and noise reduction for buildings" provides guidance for the control of noise in and around buildings.

8.6.1 Internal Areas

BS8233:2014 Section 7.7.2 titled "Internal ambient noise levels for dwellings" states:

"In general for steady external noise sources, it is desirable that internal ambient noise levels do not exceed the following guideline values:

Activity	***Location***	***Desirable Internal Ambient Criteria***	
		07:00 – 23:00	***23:00 – 07:00***
Resting	*Living Rooms*	*35 dB $L_{Aeq,16hour}$*	*-*
Dining	*Dining Room/Area*	*40 dB $L_{Aeq,16hour}$*	*-*
Sleeping (Daytime Resting)	*Bedroom*	*35 dB $L_{Aeq,16hour}$*	*30 dB $L_{Aeq,8hour}$*

Note 1 The above table provides recommended levels for overall noise in the design of a building. These are the sum total of structure-borne and airborne noise sources. Groundborne noise is assessed separately and is not included as part of these targets, as human response to groundborne noise varies with many factors such as level, character, timing, occupant expectation and sensitivity.

Note 2 The levels shown in the above table are based on the existing guidelines issued by the WHO and assume normal diurnal fluctuations in external noise. In cases where local conditions do not follow a typical diurnal pattern, for example on a road serving a port with high levels of traffic at certain times of the night, an appropriate alternative period, e.g. 1 hour, may be used, but the level should be selected to

ensure consistency with the levels recommended in the above table.

Note 3 These levels are based on annual average data and do not have to be achieved in all circumstances. For example, it is normal to exclude occasional events, such as fireworks nigh or News Year's Eve.

Note 4 Regular individual noise events (for example, scheduled aircraft or passing trains) can cause sleep disturbance. A guideline value may be set in terms of SEL or $L_{Amax,F}$ depending on the character and number of events per night. Sporadic noise events could require separate values.

Note 5 If relying on closed windows to meet the guide values, there needs to be an appropriate alternative ventilation that does not compromise the façade insulation or the resulting noise level.

If applicable, any room should have adequate ventilation (e.g. trickle ventilators should be open) during assessment.

Note 6 Attention is drawn to the Building Regulations.

Note 7 Where development is considered necessary or desirable, despite external noise levels above WHO guidelines, the internal target levels may be relaxed by up to 5 dB and reasonable internal conditions still achieved."

8.6.2 External Amenity Areas

BS8233:2014 Section 7.7.3.2 titled "Design criteria for external noise" states:

"For traditional external areas that are used for amenity space, such as gardens and patios, it is desirable that the external noise level does not exceed 50 dB $L_{Aeq,T}$[1], with an upper guideline value of 55 dB $L_{Aeq,T}$ which would be acceptable in noisier environments. However, it is also recognized that these guideline values are not achievable in all circumstances where development might be desirable. In higher noise areas, such as city centres or urban areas adjoining the strategic transport network, a compromise between elevated noise levels and other factors, such as the convenience of living in these locations or making efficient use of land resources to ensure development needs can be met, might be warranted. In such a situation, development should be designed to achieve the lowest practicable levels in these external amenity spaces, but should not be prohibited.

Other locations, such as balconies, roof gardens and terraces, are also important in residential buildings where normal external amenity space might be limited or not available, i.e. in flats, apartment blocks, etc. In these locations, specification of noise limits is not necessarily appropriate. Small balconies may be included for uses such as drying washing or growing pot plants, and noise limits should not be necessary for these uses. However, the general guidance on noise in amenity space is still appropriate for larger balconies, roof gardens, and terraces, which might be intended to be used for relaxation. In high-noise areas consideration should be given to protecting these areas by screening or building design to achieve

the lowest practicable levels. Achieving levels of 55dB $L_{Aeq,T}$ or less might not be possible at the outer edge of these areas, but should be achievable in some areas of the space."

8.7 ProPG : Planning & Noise : 2017

8.7.1 The primary goal of the ProPG is to assist the delivery of sustainable development by promoting good health and well-being through the effective management of noise. It seeks to do that through encouraging a good acoustic design process in and around proposed new residential development having regard to national policy on planning and noise. It is applicable to noise from existing transport sources (noting that good professional practice should have regard to any reasonably foreseeable changes in existing and/or new sources of noise). The recommended approach is also considered suitable where some industrial or commercial noise contributes to the acoustic environment provided that is "not dominant".

8.7.2 This ProPG advocates a systematic, proportionate, risk based, 2-stage, approach. The approach encourages early consideration of noise issues, facilitates straightforward accelerated decision making for lower risk sites, and assists proper consideration of noise issues where the acoustic environment is challenging.

8.7.3 The two sequential stages of the overall approach are:

- Stage 1 – an initial noise risk assessment of the proposed development site; and
- Stage 2 – a systematic consideration of four key elements.

8.7.4 The four key elements to be undertaken in parallel during Stage 2 of the recommended approach are:

- Element 1 – demonstrating a "Good Acoustic Design Process";
- Element 2 – observing internal "Noise Level Guidelines";
- Element 3 – undertaking an "External Amenity Area Noise Assessment"; and
- Element 4 – consideration of "Other Relevant Issues".

8.7.5 The ProPG considers suitable guidance on internal noise levels found in "BS8233:2014: Guidance on sound insulation and noise reduction for buildings". Table 4 in Section 7.7.2 of the standard suggests that "in general, for steady external noise sources, it is desirable that the internal ambient noise level does not exceed the guideline values". The standard states (Section 7.7.1) that "occupants are usually more tolerant of noise without a specific character" and only noise without such character is considered in Table 4 of the standard.

Activity	Location	07:00 – 23:00 Hours	23:00 – 07:00 Hours
Resting	Living Room	35dB $L_{Aeq,16hr}$	-
Dining	Dining Room / Area	40dB $L_{Aeq,16hr}$	-
Sleeping (daytime resting)	Bedroom	35dB $L_{Aeq,16hr}$	30dB $L_{Aeq,16hr}$ 45dB $L_{Amax,F}$

NOTE 1 the Table provides recommended internal L_{Aeq} target levels for overall noise in the design of a building. These are the sum total of structure-borne and airborne noise sources. Ground-borne noise is assessed separately and is not included as part of these targets, as human response to ground-borne noise varies with many factors such as level, character, timing, occupant expectation and sensitivity.

NOTE 2 The internal L_{Aeq} target levels shown in the Table are based on the existing guidelines issued by the WHO and assume normal diurnal fluctuations in external noise. In cases where local conditions do not follow a typical diurnal pattern, for example on a road serving a port with high levels of traffic at certain times of the night, an appropriate alternative period, e.g. 1 hour, may be used, but the level should be selected to ensure consistency with the L_{Aeq} target levels recommended in the Table.

NOTE 3 These internal L_{Aeq} target levels are based on annual average data and do not have to be achieved in all circumstances. For example, it is normal to exclude occasional events, such as fireworks night or New Year's Eve.

NOTE 4 Regular individual noise events (for example, scheduled aircraft or passing trains) can cause sleep disturbance. A guideline value may be set in terms of SEL or $L_{Amax,F}$, depending on the character and number of events per night. Sporadic noise events could require separate values. In most circumstances in noise-sensitive rooms at night (e.g. bedrooms) good acoustic design can be used so that individual noise events do not normally exceed 45dB $L_{Amax,F}$ more than 10 times a night. However, where it is not reasonably practicable to achieve this guideline then the judgement of acceptability will depend not only on the maximum noise levels but also on factors such as the source, number, distribution, predictability and regularity of noise events (see Appendix A).

NOTE 5 Designing the site layout and the dwellings so that the internal target levels can be achieved with open windows in as many properties as possible demonstrates good acoustic design. Where it is not possible to meet internal target levels with windows open, internal noise levels can be assessed with windows closed, however any façade openings used to provide

whole dwelling ventilation (e.g. trickle ventilators) should be assessed in the "open" position and, in this scenario, the internal L_{Aeq} target levels should not normally be exceeded, subject to the further advice in Note 7.

NOTE 6 Attention is drawn to the requirements of the Building Regulations.

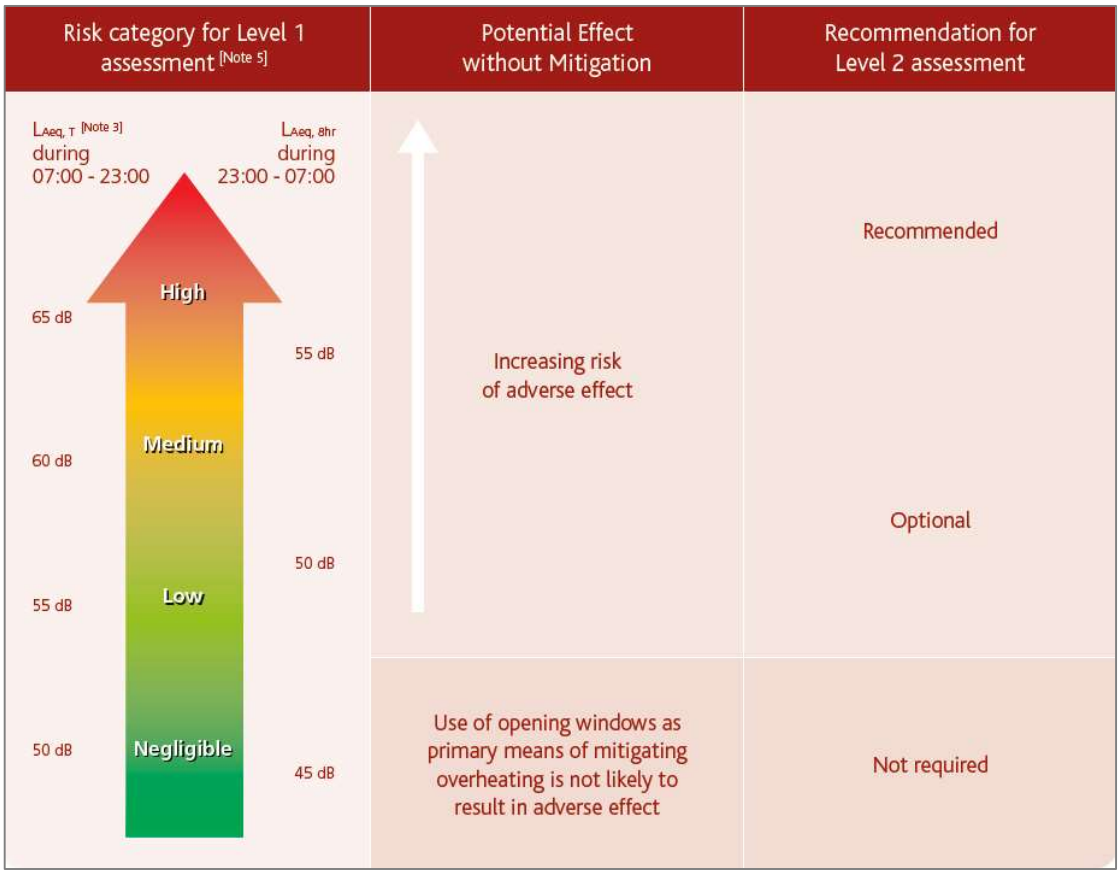
NOTE 7 Where development is considered necessary or desirable, despite external noise levels above WHO guidelines, the internal L_{Aeq} target levels may be relaxed by up to 5dB and reasonable internal conditions still achieved. The more often internal L_{Aeq} levels start to exceed the internal L_{Aeq} target levels by more than 5dB, the more that most people are likely to regard them as "unreasonable". Where such exceedances are predicted, applicants should be required to show how the relevant number of rooms affected has been kept to a minimum. Once internal L_{Aeq} levels exceed the target levels by more than 10dB, they are likely to be regarded as "unacceptable" by most people, particularly if such levels occur more than occasionally. Every effort should be made to avoid relevant rooms experiencing "unacceptable" noise levels at all and where such levels are likely to occur frequently, the development should be prevented in its proposed form (See Section 3.D).

Figure 2. ProPG Internal Noise Level Guidelines (additions to BS8233:2014 shown in blue).

8.8 Acoustics Ventilation and Overheating – Residential Design Guide (AVO)

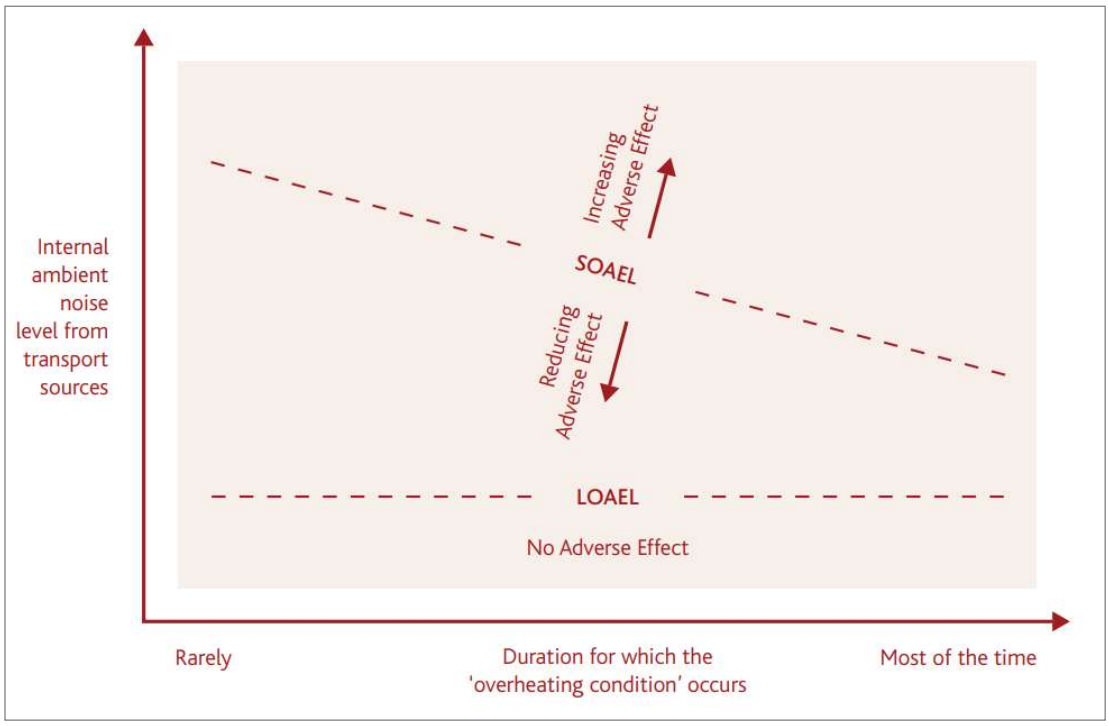
The Association of Noise Consultants (ANC) and the Institute of Acoustics (IOA) published the Acoustics Ventilation and Overheating – Residential Design Guide (AVO) in January 2020). This provides guidance on the interdependence between acoustics, ventilation and overheating.

The guidance recommends a two-level assessment to estimate the potential impact on occupants in the case of windows being open to mitigate overheating. The Level 1 assessment relates to the levels of incident environmental noise across a proposed site. The site can be put into "risk categories" depending on the levels of external noise as set out below:



Where a Level 2 assessment is recommended the AVO guide states that the Significant Observed Adverse Effect Level (SOAEL), which is the noise level above which significant adverse effects on health and quality of life occur, is dependent on how frequently and for what duration the overheating condition occurs (i.e. how often the windows need to be open to mitigate overheating). However, the document refers to the overheating condition being “rare” or “most of the time” rather than providing specific durations; therefore this is open to interpretation.

The graph presented below demonstrates how the SOAEL changes depending on how often the windows are required to be open to mitigate overheating.



Based on the above, the SOAEL in a Level 2 assessment will change depending on how often the overheating condition occurs.

8.9 Building Regulations Approved Document O

Building Regulations Approved Document O relates to setting standards for overheating in new residential buildings. It aims to protect the health and welfare of occupants of the building by reducing the occurrence of high indoor temperatures.

Requirement O1 of Approved Document O is met by designing and constructing the building to achieve both of the following:

a. Limiting unwanted solar gains in summer.

b. Providing an adequate means of removing excess heat from the indoor environment.

Sections 3.2 to 3.4 of this document relate to noise and state the following:

"In locations where external noise may be an issue (for example, where the local planning authority considered external noise to be an issue at the planning stage), the overheating mitigation strategy should take account of the likelihood that windows will be closed during sleeping hours (11pm to 7am).

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

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

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

Where in-situ noise measurements are used as evidence that these limits are not exceeded, measurements should be taken in accordance with the Association of Noise Consultants' Measurement of Sound Levels in Buildings with the overheating mitigation strategy in use.

***NOTE:** Guidance on reducing the passage of external noise into buildings can be found in the National Model Design Code: Part 2 – Guidance Notes (MHCLG, 2021) and the Association of Noise Consultants' Acoustics, Ventilation and Overheating: Residential Design Guide (2020).*

9.0 Proposed Design Target Internal Noise Levels

On the basis of BS8233:2014 we propose the following internal noise levels be adopted as design targets in the proposed habitable rooms:

Activity	Location	Desirable Internal Ambient Criteria	
		07:00 – 23:00	23:00 to 07:00
Resting	Living Rooms	35 dB $L_{Aeq,16hour}$	-
Dining	Dining Room/Area	40 dB $L_{Aeq,16hour}$	-
Sleeping (Daytime Resting)	Bedroom	35 dB $L_{Aeq,16hour}$	30 dB $L_{Aeq,8hour}$

Note: For this site the $L_{Aeq,T}$ noise parameter alone is considered to be sufficient given the character of the noise climate we have measured. This is consistent with Section 2.2.2 of The World Health Organisation Environmental Noise Guidelines for the European Region and Note 4 of Section 7.7.2 of BS8233:2014).

Where development is considered necessary or desirable, despite external noise levels above WHO guidelines, the internal target noise levels may be relaxed (subject to the requirements of any planning conditions) by up to 5 dB and reasonable internal conditions still achieved.

10.0 Achievable Internal Noise Levels

We have predicted the levels that would be achievable in the worst-case dwellings with windows partially opened and also with windows closed.

10.1 Windows Partially Open

It is generally accepted that the typical noise reduction achieved with partially opened windows is around 15dBA (ref. BS 8233:2014 Annex G.1). This value is the difference between dBA levels measured outside and inside typical dwellings, therefore 3dBA should be added to free field noise levels to determine outside levels.

A simple assessment thus indicates the following noise levels may be expected within the proposed worst case habitable rooms with partially opened windows.

Description	Predicted Worst Case Internal Noise Levels with Windows Partially Opened			
	Position 1		Position 2	
	Daytime $L_{Aeq(16\text{-hour})}$	Night-time $L_{Aeq(8\text{-hour})}$	Daytime $L_{Aeq(16\text{-hour})}$	Night-time $L_{Aeq(8\text{-hour})}$
External free field level	42 dBA	41 dBA	48 dBA	40 dBA
Façade correction	+ 3 dBA	+ 3 dBA	+ 3 dBA	+ 3 dBA
Façade noise level	45 dBA	44 dBA	51 dBA	43 dBA
Noise reduction for conventional thermal double glazing	-15 dBA	-15 dBA	-15 dBA	-15 dBA
Predicted internal noise levels	30 dBA	29 dBA	36 dBA	28 dBA

Description	Predicted Worst Case Internal Noise Levels with Windows Partially Opened			
	Position 3		Position 4	
	Daytime $L_{Aeq(16\text{-hour})}$	Night-time $L_{Aeq(8\text{-hour})}$	Daytime $L_{Aeq(16\text{-hour})}$	Night-time $L_{Aeq(8\text{-hour})}$
External free field level	56 dBA	48 dBA	52 dBA	45 dBA
Façade correction	+ 3 dBA	+ 3 dBA	+ 3 dBA	+ 3 dBA
Façade noise level	59 dBA	51 dBA	55 dBA	48 dBA
Noise reduction for conventional thermal double glazing	-15 dBA	-15 dBA	-15 dBA	-15 dBA
Predicted internal noise levels	44 dBA	36 dBA	40 dBA	33 dBA

The predicted internal noise levels with windows partially opened at Position 1 (daytime and night-time hours) and Position 2 (night-time hours) achieves BS8233 design targets.

As shown above, predicted internal noise levels with windows partially opened exceed the BS8233 design targets as follows:

- At Position 2: by 1 dB during daytime hours
- At Position 3: by 9 dB during daytime hours and 6 dB during night-time hours

- At Position 4: by 5 dB during daytime hours and 3 dB during night-time hours.

10.2 Windows Closed

As we understand it, the glazing selected for this project is 4/20/4 (32dB R_w) and 6.8/16/4 (36 dB R_w) double glazing. Also, trickle vents that achieve 32 dB $D_{n,e,w}$ will be used. The spectral sound reduction data was not provided.

We have carried out preliminary calculations to determine the likely façade sound insulation performance requirements for the worst affected facades. Our calculation methods follow those outlined in BS 8233:2014. Our calculations are based on the following assumptions, which include double glazing and trickle vent R_w values similar to the proposed ones:

- Conventional brick/block cavity external wall or equivalent
- 80m^3 approximate room volume
- 4m^2 approximate window area
- Typical furnishings including beds, sofas, chairs etc.
- Double glazing comprising 4/16/4 or equivalent having an R_w of 32dB
- Hit-and-miss ventilator having an $D_{n,e,w}$ of 32dB

The following table summarises our assessment of achievable noise levels within the proposed worst case habitable rooms with closed windows.

Description	Predicted Worst Case Internal Noise Levels with Windows Closed			
	Position 1		Position 2	
	Daytime $L_{Aeq(16\text{-hour})}$	Night-time $L_{Aeq(8\text{-hour})}$	Daytime $L_{Aeq(16\text{-hour})}$	Night-time $L_{Aeq(8\text{-hour})}$
External free field level	42 dBA	41 dBA	48 dBA	40 dBA
Noise reduction for closed windows[1]	-30 dBA	-30 dBA	-30 dBA	-30 dBA
Predicted internal noise levels	12 dBA	11 dBA	18 dBA	10 dBA
Description	Predicted Worst Case Internal Noise Levels with Windows Closed			
	Position 3		Position 4	
	Daytime $L_{Aeq(16\text{-hour})}$	Night-time $L_{Aeq(8\text{-hour})}$	Daytime $L_{Aeq(16\text{-hour})}$	Night-time $L_{Aeq(8\text{-hour})}$
External free field level	56 dBA	48 dBA	52 dBA	45 dBA
Noise reduction for closed windows[1]	-30 dBA	-30 dBA	-30 dBA	-30 dBA
Predicted internal noise levels	26 dBA	18 dBA	22 dBA	15 dBA

As shown above, predicted internal noise levels with windows closed achieves BS8233 design targets.

10.3 Ventilation & Overheating Assessment

The preceding sections of this report present solutions to satisfy the proposed internal ambient noise limits within dwellings during normal ventilation conditions where windows are closed but ventilators or MVHR systems (to meet Part F minimum ventilation requirements) are operational.

The aforementioned Acoustics Ventilation and Overheating – Residential Design Guide provides guidance regarding noise and overheating. Our interpretation of the information contained within the AVO guidance is as follows:

Daytime $L_{Aeq,\ 16\ Hour}$	**Night-time $L_{Aeq,\ 8\ Hour}$**	**Night-time L_{AFmax}**	**Level 1 Noise & Overheating Risk Outcome**	**Suggested Action**
≤48 dB	≤43 dB	Does not normally exceed L_{AFmax} more than 10 times per night	Negligible	Noise can be heard but does not cause any change in behaviour. Openable windows should be suitable
>48 dB to ≤53 dB	>43 dB to ≤48 dB	-	Low	Limited behavioural change is expected, and reasonable internal noise levels should be achieved. Openable windows likely to be suitable.
>53 dB to ≤63 dB	>48 dB to ≤55 dB	-	Medium	Increasing likelihood of impact on reliable speech communication. Carry out Level 2 risk assessment. Windows may be able to be opened for limited amounts of time to mitigate overheating.
>63 dB	>55 dB	Typically exceeds 78 dB L_{AFmax}	High	Windows are unlikely to be able to be opened for any amount of time to mitigate overheating. Carry out Level 2 risk assessment.

We have undertaken a Level 1 assessment based on the AVO, to highlight the potential areas in which opening windows to mitigate overheating should be assessed in more detail. Based on the results of the environmental noise survey, the results of the Level 1 assessment indicate that the south façade can be categorised as medium risk, the north-east façade can be categorised as low risk and the north-west façade can be categorised as negligible risk.

The AVO guide advises that a Level 2 Assessment should be undertaken where facades fall within the high and medium risk categories (red and yellow). This assessment should include an estimate of how frequently and for what duration the overheating condition occurs, without reliance on openable windows.

Where façades fall within the high and medium risk categories (red and yellow), habitable rooms should be designed so as to avoid the reliance on openable windows to satisfy overheating targets. This may be achieved by use of solar rated glazing, black out blinds, or through fenestration design. In addition, the AVO guide (Table B-5) suggests mitigation measures in the form of attenuated or plenum windows, attenuated louvres or vents for overheating and sound attenuating balconies. This can be assisted with mechanical ventilation too, such as MVHR with a manual summer boost function. Air conditioning can also be considered, however, the introduction of mechanical solutions should be considered carefully; not only with regard to cost and maintenance, but sustainability and the environment, which are likely to be more prominent drivers for any new development with the LPA's jurisdiction.

With regard to Building Regulations Approved Document O, the predicted internal noise levels with partially open windows (as presented in Section 10.1) on all the façades are 4 to 12 dBA below the limits for which Approved Document O states windows are likely to be closed during sleeping hours (2300 – 0700 hours). It is presumed that windows can therefore remain partially open during the night-time.

11.0 Mitigation Measures

At this stage of the design scheme the precise details of the glazing to be used are not known, nor are the precise details of the ventilation.

11.1 Glazing

The external envelope of the proposed residences will incorporate suitably specified glazing so as to achieve the proposed design target internal noise levels presented above.

The predicted worst case internal noise levels with windows closed meet the proposed criteria.

11.2 Background Ventilation

The predicted worst case internal noise levels with windows closed meet the proposed criteria. It is thus demonstrated that acceptable internal noise levels are achievable with typical double glazing.

The predicted worst case internal noise levels with windows partially opened exceed the proposed target levels in most of the façades (as is often the case). The minimum mitigation available to future occupants would be to close their window. Ventilation (incorporating suitable acoustic attenuation) will be provided to comply with the requirements of the Building Regulations Approved Document F whole dwelling ventilation and Building Regulations Approved Document O. The occupants will thus have the option of keeping windows closed for most of the time and opening windows for purge ventilation.

This form of mitigation is supported within the Pro:PG which advises the following:

2.34 Where the LPA accepts that there is a justification that the internal target noise levels can only be practically achieved with windows closed, which may be the case in urban areas and at sites adjacent to transportation noise sources, special care must be taken to design the accommodation so that it provides good standards of acoustics, ventilation and thermal comfort without unduly compromising other aspects of the living environment. In such circumstances, internal noise levels can be assessed with windows closed but with façade openings used to provide *"whole dwelling ventilation"* in accordance with Building Regulations Approved Document F (e.g. trickle ventilators) in the open position (see Supplementary Document 2). Furthermore, in this scenario the internal L_{Aeq} target noise levels should not generally be exceeded.

2.35 It should also be noted that the internal noise level guidelines are generally not applicable under *"purge ventilation"* conditions as defined by Building Regulations Approved Document F, as this should only occur occasionally (e.g. to remove odour from painting and decorating or from burnt food).

At this stage of the design scheme the precise details of window to be used are not known, nor are the precise details of the ventilation.

The external envelope of the proposed residences will incorporate suitably specified glazing so as to achieve the proposed design target internal noise levels presented above.

Where ventilation is provided through the façade it shall be suitably acoustically attenuated to ensure the achievement of the proposed target internal noise levels is not compromised.

11.3 Purge Ventilation/Overheating

With reference to the aforementioned AVO guidance, habitable rooms should be designed so as to avoid the reliance on openable windows to satisfy overheating targets. This can be

achieved by use of solar rated glazing, black out blinds, or through fenestration design. In addition, the AVO guide (Table B-5) suggests mitigation measures in the form of attenuated or plenum windows, attenuated louvres or vents for overheating and sound attenuating balconies. This can be assisted with mechanical ventilation too, such as MVHR with a manual summer boost function. Air conditioning can also be considered. However, the introduction of mechanical solutions should be considered carefully; not only with regard to cost and maintenance, but sustainability and the environment.

12.0 External Amenity Area

Noise levels in external amenity areas should ideally not be above the range of 50-55dB $L_{Aeq,16hr}$, as stated in BS8233:2014. The design has achieved the lowest practicable noise levels. It is acknowledged that noise levels in some gardens at the south of the development may be above this noise level. However, in addition to these gardens, all dwellings will have access to gardens and balconies on the north and west of the development, where noise levels will be below the range of 50-55dB $L_{Aeq,16hr}$ as stated in BS8233:2014.

It should be noted that BS8233:2014 states: *"In higher noise areas, such as city centres or urban areas adjoining the strategic transport network, a compromise between elevated noise levels and other factors, such as the convenience of living in these locations or making efficient use of land resources to ensure development needs can be met, might be warranted. In such a situation, development should be designed to achieve the lowest practicable levels in these external amenity spaces, but should not be prohibited."*

13.0 Conclusions

A detailed environmental noise survey has been undertaken in order to establish the currently prevailing environmental noise climate around the site.

The environmental noise impact upon the proposed dwellings has been assessed in the context of national and local planning policies.

Appropriate target internal noise levels have been proposed. These are achievable using conventional mitigation measures.

Mitigation measures, including the use of suitably specified glazing have been recommended to reduce to a minimum the adverse impact on health and quality life arising from environmental noise.

The assessment shows the site, subject to appropriate mitigation measures, is suitable for residential development in terms of noise.

Appendix A

The acoustic terms used in this report are defined as follows:

dB — Decibel - Used as a measurement of sound level. Decibels are not an absolute unit of measurement but an expression of ratio between two quantities expressed in logarithmic form. The relationships between Decibel levels do not work in the same way that non-logarithmic (linear) numbers work (e.g. 30dB + 30dB = 33dB, not 60dB).

dBA — The human ear is more susceptible to mid-frequency noise than the high and low frequencies. The 'A'-weighting scale approximates this response and allows sound levels to be expressed as an overall single figure value in dBA. The $_A$ subscript is applied to an acoustical parameter to indicate the stated noise level is A-weighted

It should be noted that levels in dBA do not have a linear relationship to each other; for similar noises, a change in noise level of 10dBA represents a doubling or halving of subjective loudness. A change of 3dBA is just perceptible.

$L_{90,T}$ — L_{90} is the noise level exceeded for 90% of the period *T* (i.e. the quietest 10% of the measurement) and is often used to describe the background noise level.

$L_{eq,T}$ — $L_{eq,T}$ is the equivalent continuous sound pressure level. It is an average of the total sound energy measured over a specified time period, *T*.

L_{max} — L_{max} is the maximum sound pressure level recorded over the period stated. L_{max} is sometimes used in assessing environmental noise where occasional loud noises occur, which may have little effect on the L_{eq} noise level.

L_p — Sound Pressure Level (SPL) is the sound pressure relative to a standard reference pressure of 2×10^{-5} Pa. This level varies for a given source according to a number of factors (including but not limited to: distance from the source; positioning; screening and meteorological effects).

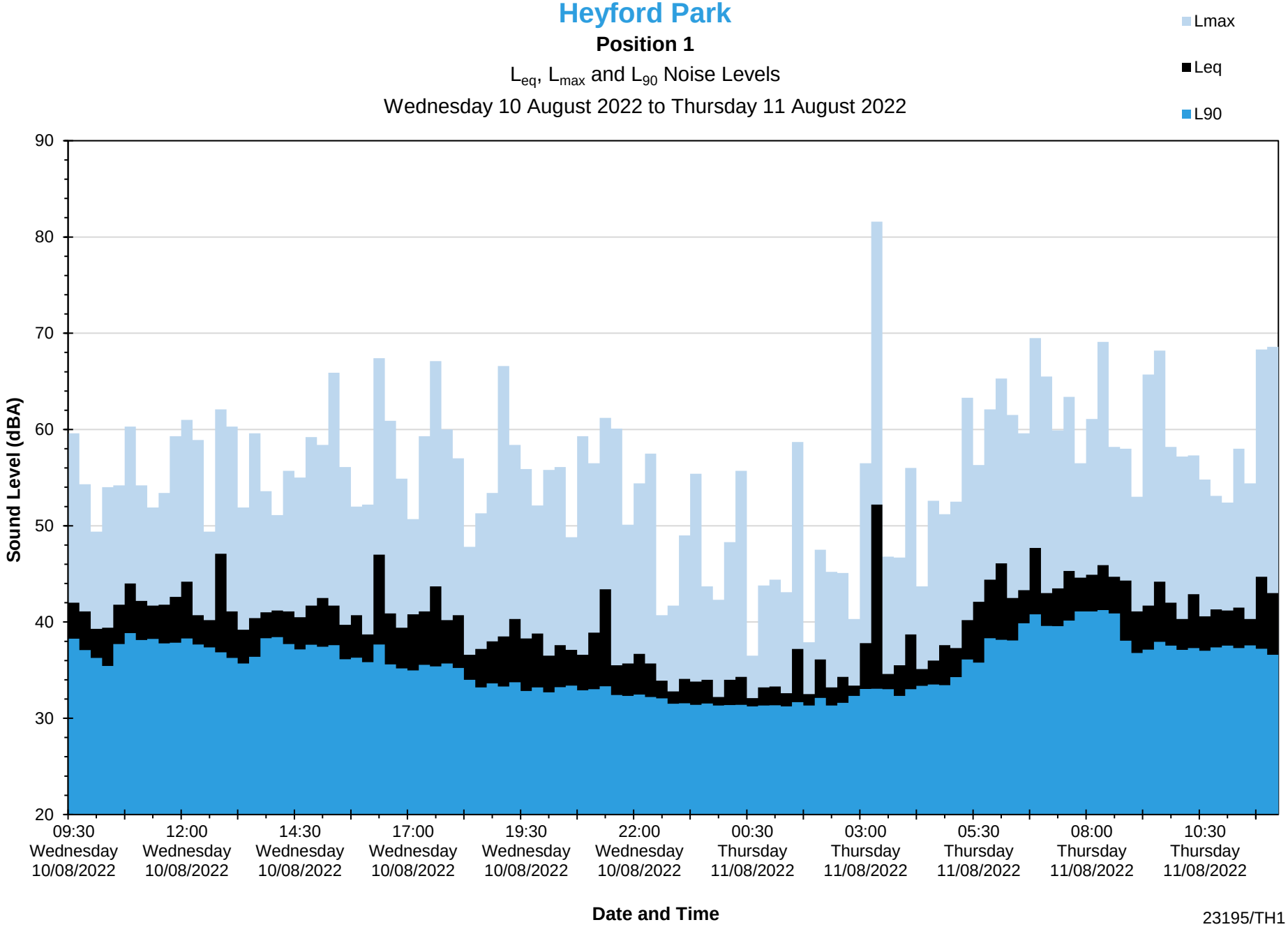
L_w — Sound Power Level (SWL) is the total amount of sound energy inherent in a particular sound source, independent of its environment. It is a logarithmic measure of the sound power in comparison to a specified reference level (usually 10^{-12} W).

Heyford Park

Position 1

L_{eq}, L_{max} and L_{90} Noise Levels

Wednesday 10 August 2022 to Thursday 11 August 2022



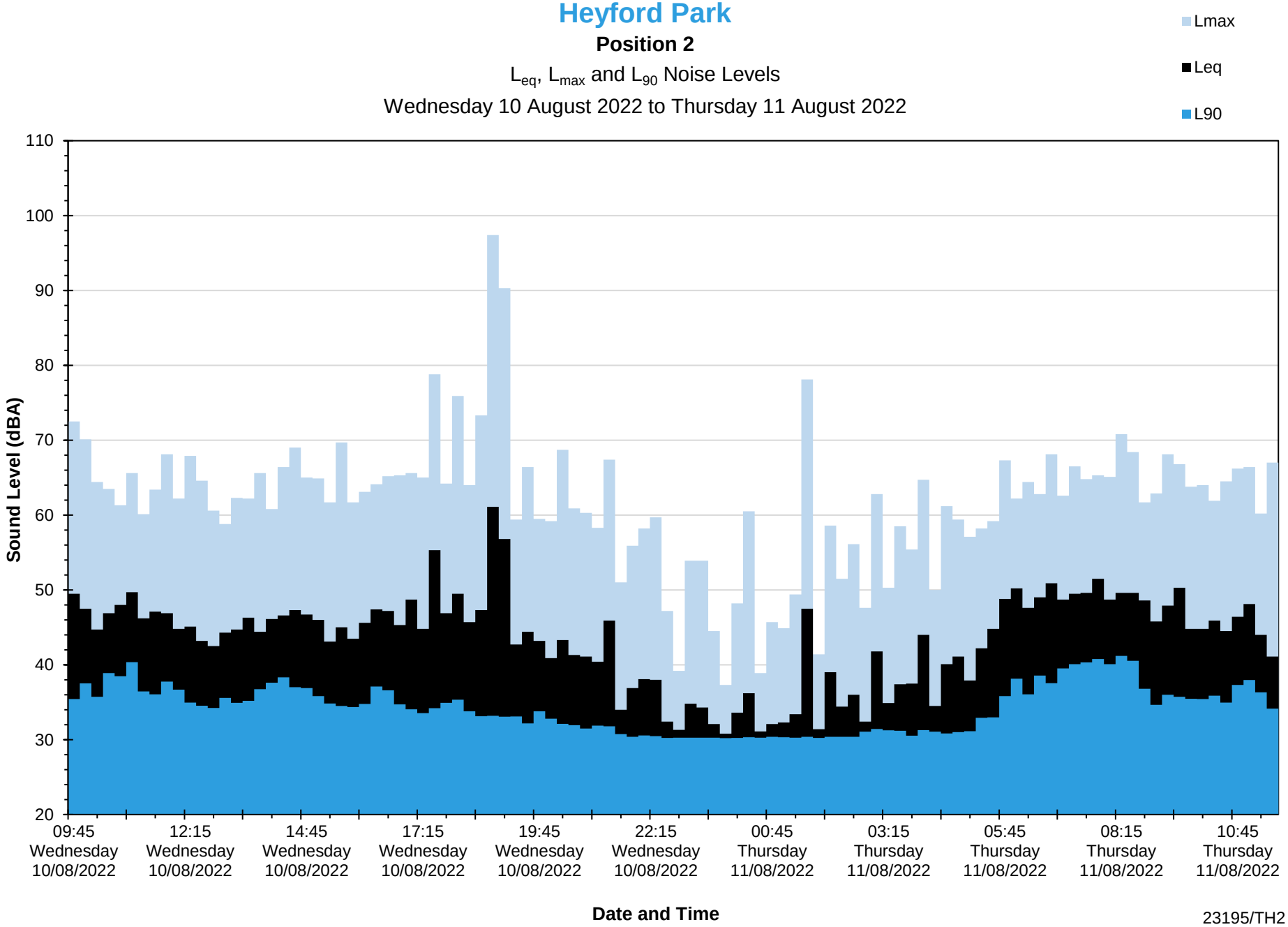
23195/TH1

Heyford Park

Position 2

L_{eq}, L_{max} and L_{90} Noise Levels

Wednesday 10 August 2022 to Thursday 11 August 2022



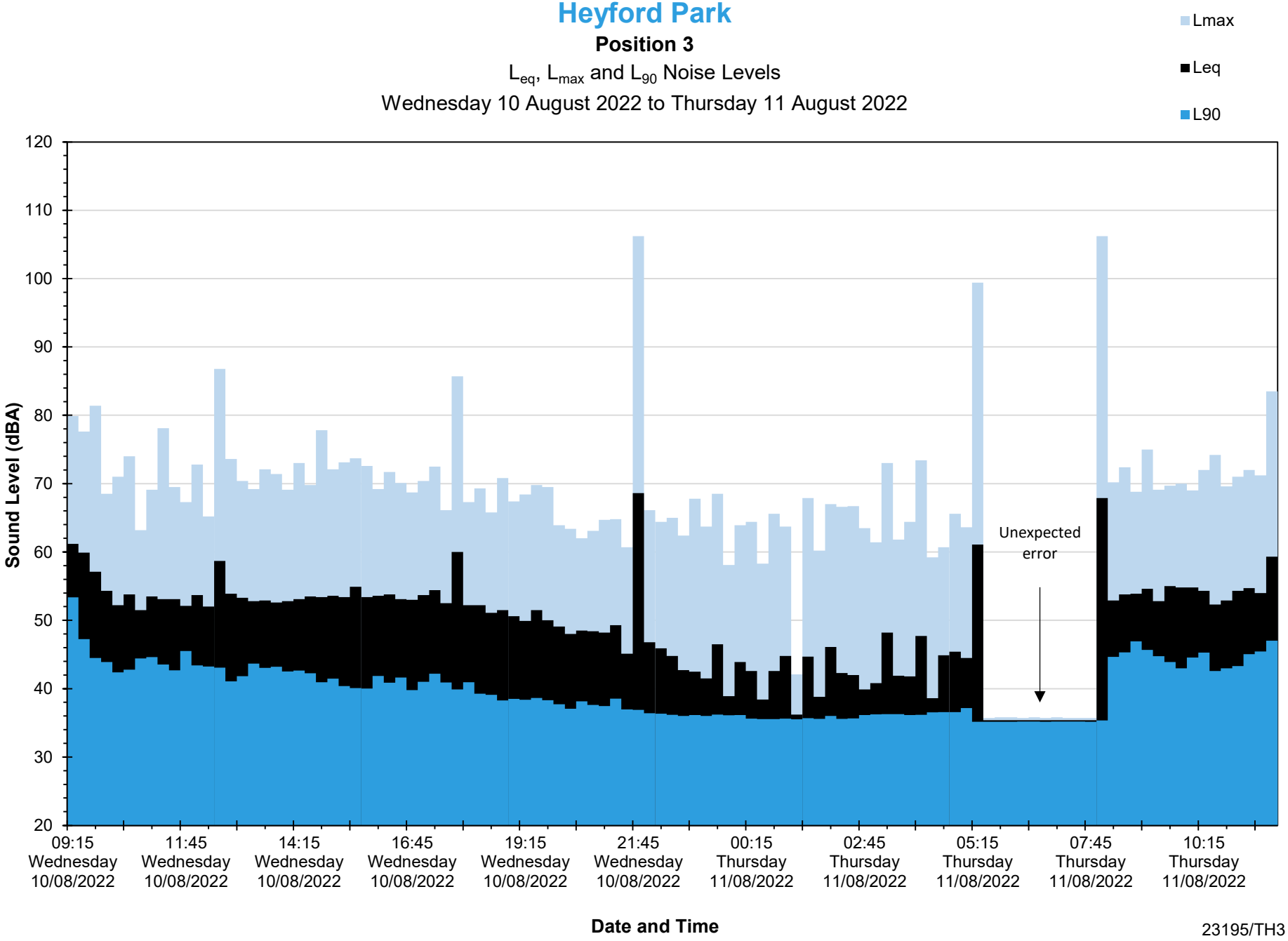
23195/TH2

Heyford Park

Position 3

L_{eq}, L_{max} and L_{90} Noise Levels

Wednesday 10 August 2022 to Thursday 11 August 2022



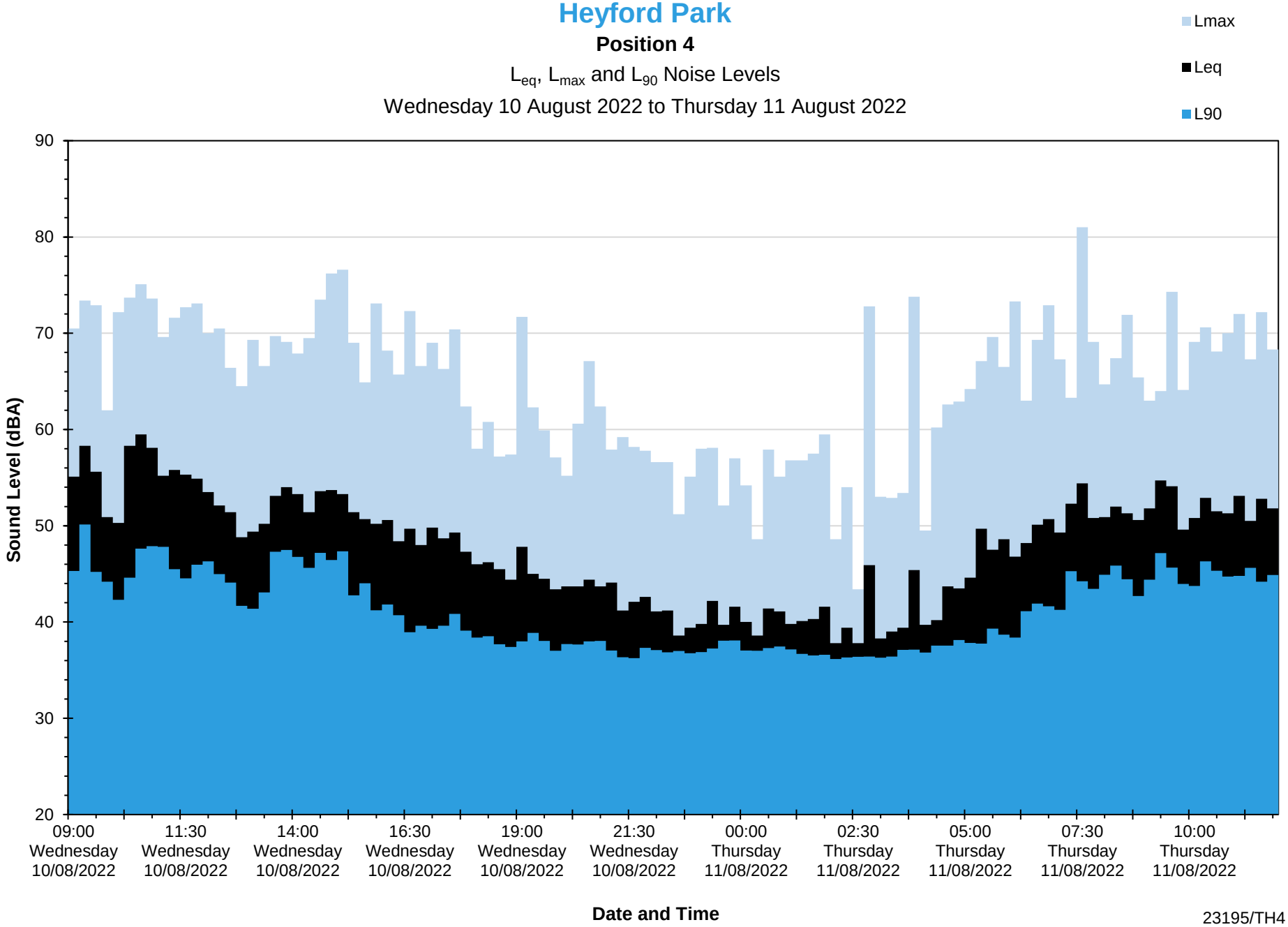
23195/TH3

Heyford Park

Position 4

L_{eq}, L_{max} and L_{90} Noise Levels

Wednesday 10 August 2022 to Thursday 11 August 2022



23195/TH4