

ENVIRONMENTAL NOISE ASSESSMENT

Reddam House

Produced by XCO₂ for Inspired Education Holdings Ltd

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EXECUTIVE SUMMARY

It is proposed to construct new boarding accommodation at Reddam House school in Berkshire.

In order to assess the potential for the impact of environmental noise on the development, and give minimum acoustic performance specifications for the external building fabric, a noise survey has been undertaken. Guidance on permissible internal noise levels has been taken from BS 8233: 2014 'Guidance on sound insulation and noise reduction for buildings'.

ENVIRONMENTAL NOISE ASSESSMENT

Based upon the results of the environmental noise survey, incident sound levels have been determined for the habitable rooms within the proposed building.

The results of the assessment show that typical thermal double glazing and standard trickle ventilators are capable of providing adequate control of intrusive noise to all habitable rooms across the site.

BUILDING REGULATIONS PART O

The site is located within a "moderate risk" area as defined in Approved Document O. Incident sound levels are at the upper boundary of the range of values where the Simplified Method of assessment could be employed.

Guidance has been given on the maximum equivalent area of openings permissible within the building façade, to inform the overheating assessment.

PLANT NOISE GUIDANCE

Plant noise limits have been given to enable initial design work to commence. The limits are based on meeting the requirements set out in BREEAM Credit PoI05 and providing suitable levels at buildings within the school grounds.

INTRODUCTION

It is proposed to develop land at Reddam House school in Berkshire to provide new boarding accommodation.

The site is bounded by a car park to the west, Drake House to the east, an access road to the north and other school buildings to the south. The proposal comprises 51 new student bedrooms and associated ancillary spaces.

The location is shown in Figure 1 below.

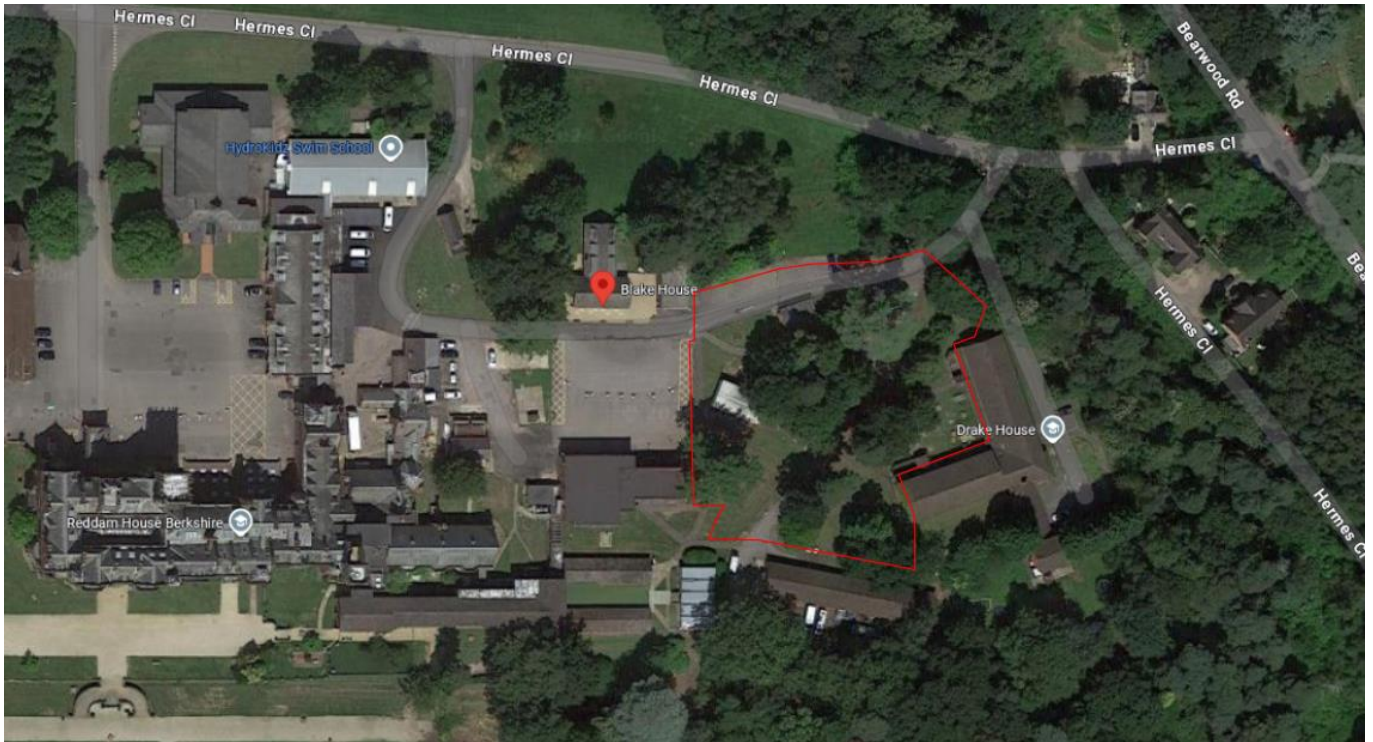


Figure 1: Site location map

PLANNING POLICIES

A great deal of change has occurred in recent years in the assessment of noise impacts and their relationship with planning decisions. The following sections introduce the applicable policies, either national or local, which ought to be considered to support the planning application. It should be highlighted that the assessment is mainly addressed to the local planning authority.

NOISE POLICY STATEMENT FOR ENGLAND

The Noise Policy Statement for England (NPSE¹), published in March 2010, sets out the long-term vision of Government noise policy. The Noise Policy aims, as presented in this document, are: *“Through the effective management and control of environmental, neighbour and neighbourhood noise within the context of Government policy on sustainable development:*

- *avoid significant adverse effects on health and quality of life;*
- *mitigate and minimise adverse effects on health and quality of life; and*
- *where possible, contribute to the improvement of health and quality of life.”*

The NPSE refers to the concepts of NOEL (No Observed Effect Level) and LOAEL (Lowest Observed Adverse Effect Level) as used in toxicology but applied to noise impacts. It also introduces the concept of SOAEL (Significant Observed Adverse Effect Level) which is described as the level above which significant adverse effects on health and quality of life occur.

The first aim of the NPSE is to avoid significant adverse effects, taking into account the guiding principles of sustainable development (as referenced in Section 1.8 of the NPSE). The second aim seeks to provide guidance on the situation that exists when the potential noise impact falls between the LOAEL and the SOAEL, in which case: *“...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.”*

Importantly, the NPSE goes on to state that: *“This does not mean that such adverse effects cannot occur.”*

The NPSE does not provide a noise-based measure to define SOAEL, acknowledging that the SOAEL is likely to vary depending on the noise source, the receptor and the time in question. NPSE advises that: *“Not having specific SOAEL values in the NPSE provides the necessary policy flexibility until further evidence and suitable guidance is available.”*

It is therefore likely that other guidance will need to be referenced when applying objective standards for the assessment of noise, particularly in reference to the SOAEL, whilst also considering the specific circumstances of a proposed development.

¹ Noise Policy Statement for England, Defra, March 2010

NATIONAL PLANNING POLICY FRAMEWORK

A new edition of NPPF was published in December 2024 and came into effect immediately. The original National Planning Policy Framework (NPPF) was published in March 2012, with subsequent revisions made periodically - this document replaced the existing Planning Policy Guidance Note 24 (PPG 24) "Planning and Noise." The December 2023 revised edition contains no new directions or guidance with respect to noise. The paragraph references quoted below relate to the December 2024 edition.

Paragraph 187 of the NPPF states that the planning system should contribute to and enhance the natural and local environment by, (amongst others) *"preventing both new and existing development from contributing to or being put at unacceptable risk from, or being adversely affected by unacceptable levels of soil, water or noise pollution or land instability."*

The NPPF goes on to state in Paragraph 198

"planning policies and decisions 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 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 ...*

The NPPF document does not refer to any other documents or British Standards regarding noise other than the NPSE.

Paragraph 2 of the NPPF states that *"planning law requires that applications for planning permission must be determined in accordance with the development plan unless material considerations indicate otherwise."*

Paragraph 12 of the NPPF states that "The presumption in favour of sustainable development does not change the statutory status of the development plan as the starting point for decision making. Where a planning application conflicts with an up-to-date development plan (including any neighbourhood plans that form part of the development plan), permission should not usually be granted. Local planning authorities may take decisions that depart from an up-to-date development plan, but only if material considerations in a particular case indicate that the plan should not be followed "

Paragraph 124 states that *"Planning policies and decisions should promote an effective use of land in meeting the need for homes and other uses, while safeguarding and improving the environment and ensuring safe and healthy living conditions. Strategic policies should set out a clear strategy for accommodating objectively assessed needs, in a way that makes as much use as possible of previously-developed or 'brownfield' land.*

PLANNING PRACTICE GUIDANCE – NOISE

An updated Planning Practice Guidance (PPG²) for noise was published on 22 July 2019 and provides additional guidance and elaboration on the NPPF. It advises that when plan-making and decision-taking, the Local Planning Authority should consider the acoustic environment in relation to:

- Whether or not a significant adverse effect is occurring or likely to occur;
- Whether or not an adverse effect is occurring or likely to occur; and
- Whether or not a good standard of amenity can be achieved.

This guidance introduced the concepts of NOAEL (No Observed Adverse Effect Level), and UAEL (Unacceptable Adverse Effect Level). NOAEL differs from NOEL in that it represents a situation where the acoustic character of an area can be slightly affected (but not such that there is a perceived change in the quality of life). UAEL represents a situation where noise is ‘very disruptive’ and should be ‘prevented’ (as opposed to SOAEL, which represents a situation where noise is ‘disruptive’, and should be ‘avoided’).

As exposure increases above the LOAEL, the noise begins to have an adverse effect and consideration needs to be given to mitigating and minimising those effects, taking account of the economic and social benefits being derived from the activity causing the noise. As the noise exposure increases, it will then at some point cross the SOAEL boundary.

The LOAEL is described in PPG³ as the level above which “noise starts to cause small changes in behaviour and attitude, for example, having to turn up the volume on the television or needing to speak more loudly to be heard”.

PPG identifies the SOAEL as the level above which “noise causes a material change in behaviour such as keeping windows closed for most of the time or avoiding certain activities during periods when the noise is present.”

In line with the Explanatory Note of the NPSE, the PPG goes on to reference the LOAEL and SOAEL in relation to noise impact. It also provides examples of outcomes that could be expected for a given perception level of noise, plus actions that may be required to bring about a desired outcome. However, in line with the NPSE, no objective noise levels are provided for LOAEL or SOAEL although the PPG⁴ acknowledges that “...the subjective nature of noise means that there is not a simple relationship between noise levels and the impact on those affected. This will depend on how various factors combine in any particular situation.”

The relevant guidance in the PPG in relation to the adverse effect levels is summarized in Table 1.

² Planning Practice Guidance – Noise, <https://www.gov.uk/guidance/noise--2>, 22 July 2019

³ Paragraph: 005 Reference ID: 30-005-20190722

⁴ Paragraph: 006 Reference ID: 30-006-20190722

Table 1. PPG guidance on adverse effect levels

Perception	Examples of Outcomes	Increasing Effect Level	Action
No Observed Effect Level			
Not Present	No Effect	No Observed Effect	No specific measures required
No Observed Adverse Effect Level			
Present and not Intrusive	Noise can be heard, but does not cause any change in behaviour, attitude or other physiological response. 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			
Present and Intrusive	Noise can be heard and causes small changes in behaviour, attitude or other physiological response, 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. Affects the acoustic character of the area such that there is a small actual or perceived change in the quality of life.	Observed Adverse Effect	Mitigate and reduce to a minimum
Significant Observed Adverse Effect Level			
Present and Disruptive	The noise causes a material change in behaviour, attitude or other physiological response, 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
Present and very Disruptive	Extensive and regular changes in behaviour, attitude or other physiological response and/or an inability to mitigate effect of noise leading to psychological stress, e.g. regular sleep deprivation/awakening; loss of appetite, significant, medically definable harm, e.g. auditory and non-auditory	Unacceptable Adverse Effect	Prevent

The Planning Practice Guidance⁵ states the following in relation to mitigation measures:

“For noise sensitive developments, mitigation measures can include avoiding noisy locations in the first place; designing the development to reduce the impact of noise from adjoining activities or the local environment; incorporating noise barriers; and optimising the sound insulation provided by the building envelope.”

⁵ Paragraph: 010 Reference ID: 30-010-20190722

In addition, the Guide notes that it may also be relevant to consider⁶:

“... whether any adverse internal effects can be completely removed by closing windows and, in the case of new residential development, if the proposed mitigation relies on windows being kept closed most of the time (and the effect this may have on living conditions). In both cases a suitable alternative means of ventilation is likely to be necessary. Further information on ventilation can be found in the Building Regulations”.

LOCAL PLAN POLICY

WOKINGHAM BOROUGH DEVELOPMENT PLAN (FEBRUARY 2014)

For noise-sensitive developments Wokingham Borough Council requires assessments to be made of transportation noise, railway vibration and noise from existing commercial premises.

Since the site is approximately 1.6km from the nearest railway lines any possible effects of train vibration may be safely disregarded. Similarly, there are no commercial premises within the immediate vicinity of the site.

⁶ Paragraph: 006 Reference ID: 30-006-20190722

DESIGN NOISE LEVELS

The following section establishes the proposed acoustic criteria pertinent to the planning noise assessment.

BS 8233:2014 GUIDANCE ON SOUND INSULATION AND NOISE REDUCTION FOR BUILDINGS.

This Standard provides recommended guideline values for internal noise levels within dwellings which are similar in scope to guideline values contained within the World Health Organisation (WHO) document, 'Guidelines for Community Noise' (1999⁷). These guideline noise levels are shown in Table 2, below:

Table 2. BS 8233 Desirable Internal Ambient Noise Levels for Dwellings

Activity	Location	07:00 to 23:00 hours	23:00 to 07:00 hours
Resting	Living room	35 dB L _{Aeq,16h}	-
Dining	Dining room/area	40 dB L _{Aeq,16h}	-
Sleeping (daytime resting)	Bedroom	35 dB L _{Aeq,16h}	30 dB L _{Aeq,8h}

BS 8233:2014 advises that: "regular individual noise events...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."

The above criteria are considered to be appropriate for accommodation of the type considered.

BUILDING REGULATIONS – PARTS L AND F

Part L of the Building Regulations mandates that buildings become more airtight, and Part F stipulates ventilation requirements. Even though there appears to be a contradiction in this, Part L limits uncontrollable ventilation while Part F ensures that ventilation requirements are provided in a controlled manner. It should be noted that, with respect to compliance with Parts L and F, the proposed scheme is not classified as dwellings.

The 2021 edition of Approved Document F came into effect on 15 June 2022. Volume 2 sets out the requirements for ventilation of building other than dwellings. The document makes reference to the guidance in CIBSE Guide B2, Ventilation and ductwork (2016).

BUILDING REGULATIONS – PART O

Approved Document *O1: Overheating mitigation* of the Building Regulations 2010, came into force on 15 June 2022. In contrast to Parts L and F, Part O does define the development as residential for the purposes of assessment, and

⁷ World Health Organisation Guidelines for Community Noise, 1999

therefore the requirements of Part O, which is only applicable to new build dwellings, do apply to buildings of the type proposed. Section 3 in the Approved Document includes the following:

Noise

3.2 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).

3.3 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).

3.4 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)

Additional guidance provided by the Association of Noise Consultants and the Institute of Acoustics in November 2024⁸ further clarifies that:

- only bedrooms need to be considered;
- intrusive noise only needs to be considered at night;
- an initial assessment of the suitability of using the Simplified Method of assessment in Approved Document O is required;
- Intrusive L_{AFmax} sound levels are to be assessed for 2-minute measurement periods.

⁸ Approved Document O Noise Guide version 1.1, ANC/IOA, November 2024

MEASUREMENT OF NOISE LEVELS

The following section describes the methodology undertaken to establish the environmental noise levels around the site.

DETAILS OF ENVIRONMENTAL SOUND SURVEY

Continuous measurements of the environmental sound levels were undertaken between 11.45 hours on Monday 9th December and 13.30 hours on Tuesday 10th December 2024.

The sound level meter was programmed to record the A-weighted L_{eq} , L_{90} , L_{10} and L_{max} noise indices and corresponding octave band frequency information (for L_{eq}) for consecutive sample periods for the duration of the survey.

MEASUREMENT POSITION

The measurements of incident sound levels were undertaken at the location indicated in the aerial photograph below and described in Table 3.



Figure 2: On site sound pressure level and vibration measurement positions

Table 3. Description of measurement position

Position	Description
1	Lamp-post adjacent to Parents' Car Park, opposite Blake House

EQUIPMENT

Details of the equipment used during the survey are provided in Table 4 below. The sound level meter was calibrated before and after the survey; no significant change in the calibration level was noted.

Table 4. On site instrumentation

Position	Description	Model / serial no.	Calibration date	Calibration certificate no.
1	Class 1 Sound level meter	Svantek 977 / 36190	24/09/2024	1509891-1
	Condenser microphone	GRAS 40E / 86699		
	Preamplifier	Svantek SV12L / 86561		
	Calibrator	Svantek SV33A / 73430	24/09/2024	1509891-3

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WEATHER CONDITIONS

Weather conditions were determined both at the start and on completion of the survey. It is considered that the meteorological conditions were appropriate for environmental noise measurements. Table 5 presents the weather conditions recorded on site at the beginning and end of each survey period.

Table 5. Weather Conditions

Date/Time	Description	Beginning of Survey	End of Survey
11.45 9 Dec - 13.30 10 Dec 2024	Temperature (°C)	7	8
Cloud Cover Symbol Scale in oktas (eighths)  0 Sky completely clear  1  2  3  4 Sky half cloudy  5  6  7  8 Sky completely cloudy  (9) Sky obstructed from view	Precipitation:	No	No
	Cloud cover (oktas - see guide)	7	8
	Presence of fog/snow/ice	No	No
	Presence of damp roads/wet ground	Yes	Yes
	Wind Speed (m/s)	<1	<1
	Wind Direction	-	-
	Conditions that may cause temperature inversion (i.e. calm nights with no cloud)	No	No

RESULTS

The main noise source of noise at the survey location was observed to be distant road traffic, with noise from pupils leading to elevated sound levels during part of the day, as is evident on the time history graph in Appendix B.

EXTERIOR NOISE LEVELS

The single figure free-field noise indices recorded are presented in tabular and graphical format within Appendix B. The relevant results of the survey have been summarised in Table 6.

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Table 6. Summary of survey results (free-field levels)

Position	Measurement period	Range of recorded sound pressure levels (dB)			
		$L_{Amax, T}$	$L_{Aeq, T}$	$L_{A10, T}$	$L_{A90, T}$
1	Daytime (07.00 – 23.00 hours)	47-76	51-97	48-79	45-62
	Night-time (23.00 – 07.00 hours)	45-59	52-81	47-61	42-52

As the focus of this report is on the intrusive noise to the boarding rooms during normal periods, noise levels attributable to play activities during the daytime and abnormally high L_{Amax} events at night have been excluded from the following analysis and the subsequent assessment.

Table 7. Daytime and night-time equivalent levels (free field levels)

Measurement period	Measurement	Sound Pressure Level (dBA)
		Pos 1
Monday 9 th December 2024	L_{Aeq}^*	55
9-10 December 2024	L_{Aeq} (8 hours)	50
Tuesday 10 th December 2024	L_{Aeq}^*	57
Overall – day	$L_{Aeq, 16 \text{ hour}}$	56
Overall – night	$L_{Aeq, 8 \text{ hour}}$	50

*not complete 16 hour measurements.

MEASURED SOUND PRESSURE LEVELS

A summary of free-field incident sound levels at the measurement position is given in Table 8. These sound levels are considered to be representative of the area, with all new building elevations subject to the same incident sound levels.

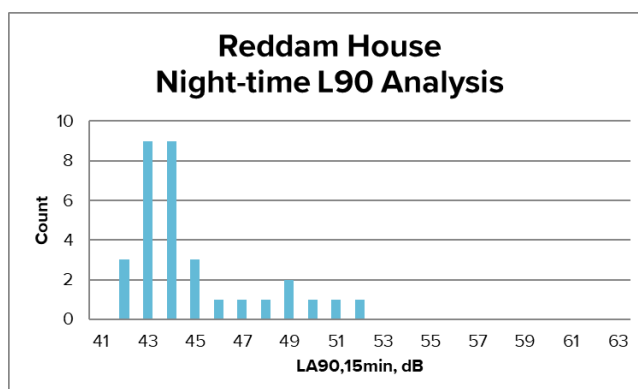
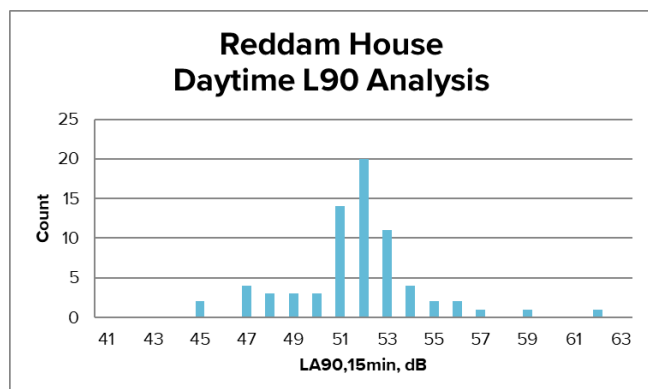
Table 8. Summary of free-field environmental noise levels at octave band centre frequencies.

Period	Incident free field sound pressure levels (dB) at Octave Band Centre Frequencies (Hz)								dB(A)
	63	125	250	500	1000	2000	4000	8000	
Daytime L_{eq} , 16 hours	61	56	53	52	52	47	42	40	56
Night-time L_{eq} , 8 hours	52	50	49	47	45	38	39	34	50
Spectrum of typical night-time L_{max}	62	54	51	53	50	49	62	61	65

For each survey position the night-time L_{max} data quoted are for the 10th-highest $L_{AFMax,2 \text{ minute}}$ typical noise event during the night-time, in accordance with the methodology described in the ANC/loA guidance document referenced previously.

BACKGROUND SOUND LEVELS

A statistical analysis of the daytime and night-time background sound levels at the survey at position Parents' Car Park, opposite Blake House, is shown in the histograms below.



From the histograms the representative background sound levels at the site are considered to be:

- 45dB $L_{A90 \ 15min}$ during the daytime
- 42dB $L_{A90 \ 15min}$ during the night-time

ASSESSMENT OF ENVIRONMENTAL NOISE IMPACTS

The following section presents the assessment of the various noise impacts in line with the methodology outlined in the preceding sections.

INDOOR LEVELS

In order to assess the site in relation to the applicable policy aims, it is important to review the internal noise levels due to incident noise ingress inside the proposed accommodation.

The composite acoustic performance required of any portion of the building envelope will depend on its location relative to the principal noise sources around the site and the nature of the spaces behind it (noise criteria, size, room finishes etc.).

To demonstrate that the site is suitable for the proposed development an assessment is required to review whether products with the minimum sound reduction properties (to offer building regulations compliance) will provide sufficient noise reduction for proposed rooms affected by the incident sound levels measured. In order that a representative assessment may be made, without calculating for every combination of room size and window area, it is appropriate to predict the intrusive noise level for rooms with the most-onerous combination of conditions (i.e. largest ratio of window area to room volume). This gives a worst-case situation, resulting in the highest internal noise level based on given external incident noise level and building envelope acoustic performance.

The detailed calculation methodology described in BS 8233:2014 will be used in the assessment using the following equation⁹ as detailed in the British Standard:

$$L_{eq,2} = L_{eq,ff} + 10\log_{10} \left(\frac{A_0}{S} 10^{\frac{-D_{n,e}}{10}} + \frac{S_{w1}}{S} 10^{\frac{-R_{wi}}{10}} + \frac{S_{ew}}{S} 10^{\frac{-R_{ew}}{10}} + \frac{S_{rr}}{S} 10^{\frac{-R_o}{10}} \right) + 10\log_{10} \left(\frac{S}{A} \right) + 3$$

To provide an assessment which is robust but not overly complex, the worst-case rooms have been considered. Table 9 presents the input data¹⁰ used to predict the resultant internal noise level in a bedroom and a kitchen/dining room subject to the highest external noise levels. These sizes are at the lower end of what is likely to be provided in practice – subject to detailed building design – and therefore offer a robust assessment of intrusive noise.

⁹ See page 65 and 66 of BS8233:2014 for an explanation of the various terms used in the equation.

¹⁰ Approximate values

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Table 9. Room information used in the noise break in assessment

Bedroom	
Room Volume (m ³)	27
Room Furnishings	Curtains, bed, carpet floor finish
Area of window (m ²)	3.8
Area of wall (m ²)	4.1
Kitchen/Dining rooms	
Room Volume (m ³)	65
Room Furnishings	Curtains, hard floor finish
Area of window (m ²)	11.5
Area of wall (m ²)	14.4

Different types of glazing will control noise to differing amounts and will vary according to the type of noise that should be reduced. The performance of glazing is established by measurement in the laboratory.

GLAZING AND VENTILATOR PERFORMANCE

The following assessment is based on typical standard thermal double glazing and the use of standard trickle ventilators, as shown in Table 10.

Table 10. Octave band performance specification for external building elements

Item		Sound reduction (dB) at Octave Band Centre Frequency (Hz)							
		63	125	250	500	1000	2000	4000	8000
Type A (Typ. 4mm glass / 16mm / 4mm glass)	SRI	21	24	20	25	34	37	40	40
Standard trickle ventilator	D _{ne}	30	32	32	31	33	31	31	31
Non-vision wall – all areas Cavity brick-block construction (or cladding with dry-lining with similar acoustic performance)	SRI	35	41	45	45	54	58	55	55

It should be noted that glazing configurations and other constructions described above are for guidance and costings purposes only. It will be the responsibility of the manufacturer to provide evidence of compliance with the required octave band sound reduction performances. Please note that the requirements are for the complete assembly, including frames and seals, and not the glass panels alone.

RESULTING INTERNAL NOISE LEVELS

The results of the assessment are shown in Table 11 overleaf.

Table 11. Internal sound levels (closed windows)

Façade	Room Type	Period	Sound pressure level, dB(A)			
			External façade level	Internal	BS 8233:2014 guidance	Excess
ALL	Kitchen-dining	Daytime $L_{eq, 16 \text{ hours}}$	56	29	40	-11
	Bedroom	Daytime $L_{eq, 16 \text{ hours}}$	56	28	35	-7
		Night-time $L_{eq, 8 \text{ hours}}$	50	23	30	-7
		Night-time L_{max}	65	35	45	-10

The assessment has shown that the resultant internal noise levels meet the guidance in BS 8233:2014 and therefore the second aim of the NPPF will be met in relation to internal amenity.

In the event that ventilation is provided by MVHR or centralised air handling plant the intrusive noise levels will be lower than tabulated above.

BUILDING REGULATIONS PART O

It is important to note that the building envelope sound insulation specifications and associated advice given in this report are based on meeting the design criteria under the “Whole Dwelling Ventilation” conditions set out in Approved Document F (and formerly referred to as “background ventilation” in previous editions of the AD), as distinct from “Extract Ventilation” or “Purge Ventilation” conditions within the AD, and from the overheating condition (which is only briefly mentioned in AD F).

INITIAL ASSESSMENT

The site falls within an area with a “moderate risk” of overheating as described in Section 1 of Approved Document O. The ANC/IoA guidance document referenced previously states that

... the resulting outside-to-inside level difference for window openings necessary to satisfy the simplified method of AD-O are expected to be approximately 5 dB for ‘high’ risk locations and 10 dB for ‘medium’ risk locations.

... this implies the following limiting external free-field levels above which external noise precludes the use of the simplified method, and dynamic thermal modelling should be used to demonstrate compliance

Table 12 External Noise Levels Above Which the Simplified Method Cannot Be Used (Table 1 in ANC/IoA guide)

Parameter	High Risk Location	Moderate Risk Location
$L_{Aeq,8h}$, averaged over 8 hours (between 11pm and 7am)	45dB	50dB
L_{AFmax} , more than 10 times a night (between 11pm and 7am)	60dB	65dB

By comparison with the night-time sound levels summarised in Table 8 it can be seen that the sound levels at the site are at the upper boundary of the range within which the Simplified Method could be used.

INFORMATION FOR OVERHEATING RISK ASSESSMENT

In January 2020 the Association of Noise Consultants (ANC) and Institute of Acoustics (IoA) published a Residential Design Guide on Acoustic Ventilation and Overheating (“the AVO Guide”), which sets out some of the acoustic design issues associated with the control of overheating. The night-time thresholds suggested in the AVO Guide have been superseded by the limits set out in Approved Document O.

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Table 13 Sound insulation required (overheating condition)

Façade	Room Type	Period	External façade level	Sound pressure level, dB(A)		
				Overheating category (see Table 14)	Criterion	Attenuation required
ALL	Bedroom	Daytime L_{eq} , 16 hours	56	n/a	50*	6
		Night-time L_{eq} , 8 hours	50	ADO02	40**	10
		Night-time L_{max}	65	ADO02	55**	10

*AVO guidance; **Part O criterion

Note:

Mitigation of overheating risk by opening windows likely to be acceptable, subject to calculation of effective open area required. To meet the guidance in Approved Document O the maximum equivalent area of the opening would be equivalent to 4% of the nett floor area of the bedroom (i.e. excluding the en-suite bathroom).

Table 14. Overheating risk assessment categories

Ref.	Colour	Average external noise level, L_{Aeq} 8hr	10 th -highest L_{A10Max} noise event	Part O Requirement for Bedrooms
ADO01		≥54dB	≥69dB	Energy assessment (e.g. TM59) to show that bedrooms on these facades will not overheat at night with windows fully closed and ventilators fully open
ADO02		45-53dB	60-68dB	Energy assessment (e.g. TM59) to show that bedrooms on these facades will not overheat at night with windows partially open (e.g. approx. 2% of floor area, typically around 20cm ²) and ventilators fully open
ADO03		≤44dB	≤59dB	Compliant with Part O 'simplified method'. Energy assessment (e.g. TM59) to show that bedrooms on these facades will not overheat at night with windows open (e.g. 13% of floor area, for a "high risk site", which is typically around 1.3m ²) and ventilators fully open

PLANT NOISE GUIDANCE

The full extent and specification of services plant is to be established. The following outline guidance is made to permit initial plant selections and identify at an early stage any likely need for attenuation.

It is likely that plant will comprise one or more Air Source Heat Pumps (ASHPs) on the roof of the north wing of the building.

EXISTING NOISE ENVIRONMENT

As described previously, background sound levels are expected to be 45dB $L_{A90,15min}$ during the day (07.00 – 23.00) and 42 dB $L_{A90,15min}$ at night.

CRITERIA

For similar developments and plant installations, the local authority typically requires that the rating level from fixed plant should be no higher than the representative background noise level (L_{90}), at the nearest noise sensitive receptor.

It is understood that it is proposed to target the Credit available under BREEAM PoI05, which can be awarded where:

... a noise impact assessment compliant with BS4142:2014 is commissioned. Noise levels must be measured or determined for:

2.a Existing background noise levels:

2.a.i at the nearest or most exposed noise-sensitive development to the proposed assessed site

2.a.ii including existing plant on a building, where the assessed development is an extension to the building

2.b Noise rating level from the assessed building.

3 The noise impact assessment must be carried out by a suitably qualified acoustic consultant.

4 The noise level from the assessed building, as measured in the locality of the nearest or most exposed noise sensitive development, must be at least 5dB lower than the background noise throughout the day and night.

5 If the noise sources from the assessed building are greater than the levels described in criterion 4, measures have been installed to attenuate the noise at its source to a level where it will comply with the criterion.

The noise criteria for the BREEAM credit are therefore more onerous than would usually be required by the local authority.

In addition, it is proposed that noise levels at other buildings within the school grounds due to the new plant should be no higher than 45dBA during the daytime and no higher than 40dBA at night. Resulting sound levels at those façades would therefore be at least 5dB below the existing lowest-measured $L_{Aeq 15min}$ sound levels and not result in an appreciable increase in the ambient sound level.

To meet these targets, plant noise should therefore not exceed the limits set out in table 15 overleaf.

Table 15: Plant noise limits, 1m from residential window

Receptor	Period	Maximum plant sound level at window, dB(A)
Nearest houses (Hermes Close)	Day (07.00 – 23.00 hours)	40dB L _{Ar,1hr} (rating level)
	Night (23.00 – 07.00 hours)	37dB L _{Ar,1hr} (rating level)
On-site façades	Day (07.00 – 23.00 hours)	45dB L _{Aeq} (specific level)
	Night (23.00 – 07.00 hours)	40dB L _{Aeq} (specific level)

PLANT NOISE GUIDANCE

From the criteria above, and the relative locations of the plant and the nearest receptors, the total permissible sound power level of the ASHPs has been calculated and is shown in Table 16.

Table 16: Maximum permissible ASHP sound power level

Item	Sound Power Level, dB re 10 ⁻¹² W	
	Day	Night
Permissible total ASHP sound power level	79dBA	74dBA

Subject to final designs and selections, typical air source heat pumps are likely to require attenuation in order that the above limits are met.

In the event that the cumulative noise level of the selected plant is higher than the limits shown in table 16, attenuation will be required to bring the plant noise back down to the permissible level.

ADDITIONAL CONSIDERATIONS

All plant should be fitted with suitable vibration isolators, to prevent vibration from entering the structure and re-radiating within the building.

Airborne noise transmission from the plant into the building must also be considered as part of the acoustic design of the building structure.

CONCLUSIONS

ENVIRONMENTAL NOISE ASSESSMENT

Based upon the results of the environmental noise survey, incident sound levels have been determined for the habitable rooms within the proposed building.

The results of the assessment show that typical thermal double glazing and standard trickle ventilators are capable of providing adequate control of intrusive noise to all habitable rooms across the site.

BUILDING REGULATIONS PART O

The site is located within a “moderate risk” area as defined in Approved Document O. Incident sound levels are at the upper boundary of the range of values where the Simplified Method of assessment could be employed.

Guidance has been given on the maximum equivalent area of openings permissible within the building façade, to inform the overheating risk assessment.

PLANT NOISE GUIDANCE

Plant noise limits have been given to enable initial design work to commence. The limits are based on meeting the requirements set out in BREEAM Credit PoI05 and providing suitable noise levels for nearby buildings within the school grounds.

APPENDIX A

Table 17. Acoustic Terminology

Parameter	Description
Ambient Noise Level	The totally encompassing sound in a given situation at a given time, usually composed of a sound from many sources both distant and near ($L_{Aeq,T}$).
Decibel (dB)	A scale for comparing the ratios of two quantities, including sound pressure and sound power. The difference in level between two sounds s_1 and s_2 is given by $20 \log_{10} (s_1/s_2)$. The decibel can also be used to measure absolute quantities by specifying a reference value that fixes one point on the scale. For sound pressure, the reference value is $20\mu\text{Pa}$. The threshold of normal hearing is in the region of 0 dB and 140 dB is the threshold of pain. A change of 1 dB is only perceptible under controlled conditions.
dB(A), L_{Ax}	Decibels measured on a sound level meter incorporating a frequency weighting (A weighting) which differentiates between sounds of different frequency (pitch) in a similar way to the human ear. Measurements in dB(A) broadly agree with people's assessment of loudness. A change of 3 dB(A) is the minimum perceptible under normal conditions, and a change of 10 dB(A) corresponds roughly to halving or doubling the loudness of a sound. The background noise in a living room may be about 30 dB(A); normal conversation about 60 dB(A) at 1 metre; heavy road traffic about 80 dB(A) at 10 metres; the level near a pneumatic drill about 100 dB(A).
Fast Time Weighting	Setting on sound level meter, denoted by a subscript F, that determines the speed at which the instrument responds to changes in the amplitude of any measured signal. The fast time weighting can lead to higher values than the slow time weighting when rapidly changing signals are measured. The average time constant for the fast response setting is 0.125 (1/8) seconds.
Free-field	Sound pressure level measured outside, far away from reflecting surfaces (except the ground), usually taken to mean at least 3.5 metres
Façade	Sound pressure level measured at a distance of 1 metre in front of a large sound reflecting object such as a building façade.
$L_{Aeq,T}$	A noise level index called the equivalent continuous noise level over the time period T. This is the level of a notional steady sound that would contain the same amount of sound energy as the actual, possibly fluctuating, sound that was recorded.
$L_{max,T}$	A noise level index defined as the maximum noise level recorded during a noise event with a period T. L_{max} is sometimes used for the assessment of occasional loud noises, which may have little effect on the overall L_{eq} noise level but will still affect the noise environment. Unless described otherwise, it is measured using the 'fast' sound level meter response.
$L_{10,T}$	A noise level index. The noise level exceeded for 10% of the time over the period T. L_{10} can be considered to be the "average maximum" noise level. Generally used to describe road traffic noise. $L_{A10,18h}$ is the A-weighted arithmetic average of the 18 hourly $L_{A10,1h}$ values from 06:00-24:00.
$L_{90,T}$	A noise level index. The noise level exceeded for 90% of the time over the period T. Generally used to describe background noise level.

APPENDIX B

Table 18. Results of environmental noise measurements at Position 1

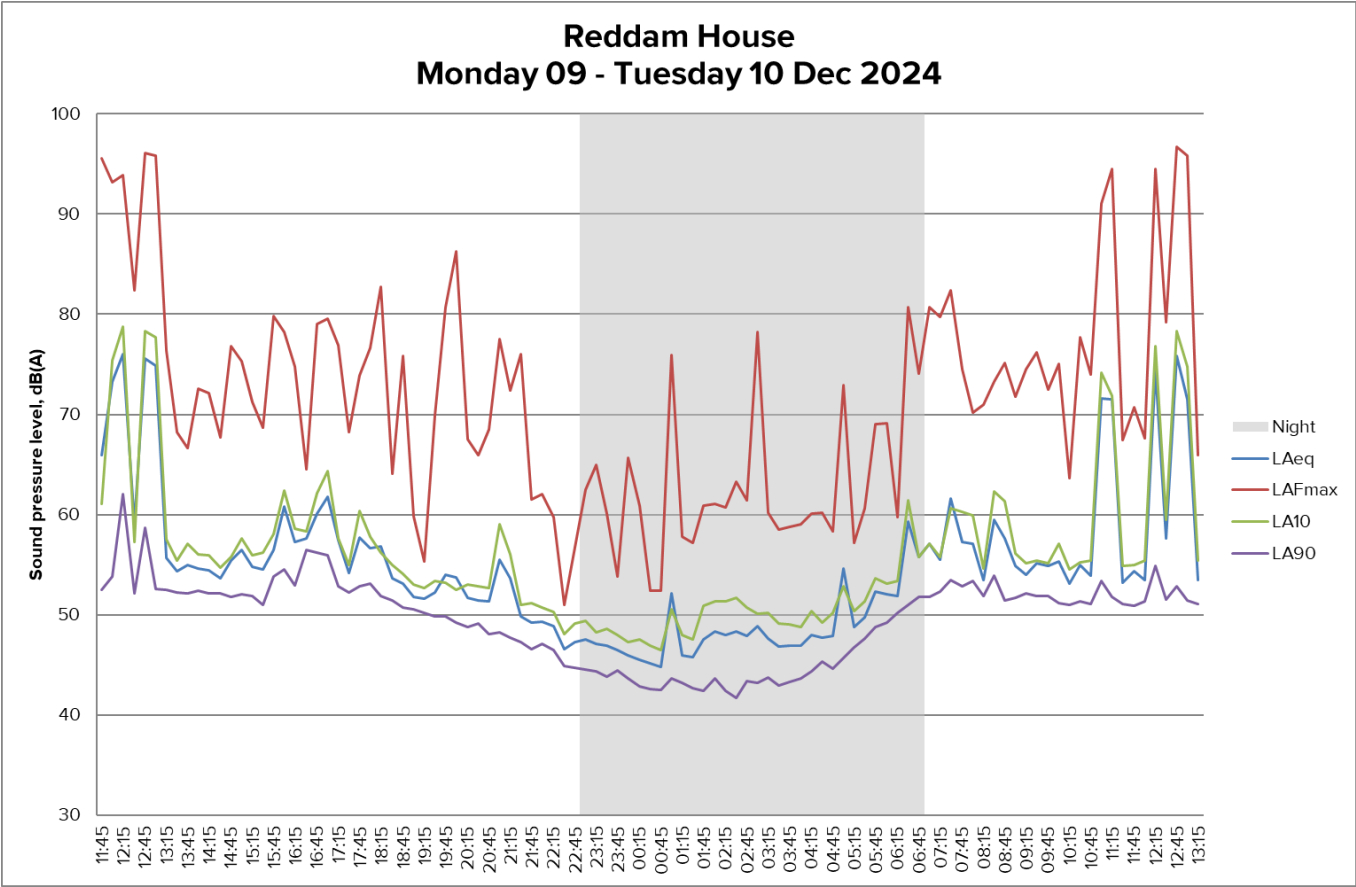
Date & time	L _{Aeq} [dB]	L _{AFmax} [dB]	L _{A10} [dB]	L _{A90} [dB]
09/12/2024 13:15	55.7	76.4	57.5	52.5
09/12/2024 13:30	54.3	68.2	55.4	52.2
09/12/2024 13:45	55.0	66.6	57.1	52.1
09/12/2024 14:00	54.6	72.6	56.0	52.4
09/12/2024 14:15	54.4	72.1	55.9	52.1
09/12/2024 14:30	53.6	67.7	54.7	52.1
09/12/2024 14:45	55.4	76.8	55.8	51.8
09/12/2024 15:00	56.5	75.3	57.6	52.0
09/12/2024 15:15	54.8	71.2	55.9	51.9
09/12/2024 15:30	54.5	68.7	56.2	51.0
09/12/2024 15:45	56.5	79.8	58.1	53.8
09/12/2024 16:00	60.8	78.2	62.4	54.5
09/12/2024 16:15	57.3	74.8	58.6	52.9
09/12/2024 16:30	57.6	64.5	58.3	56.5
09/12/2024 16:45	60.1	79.0	62.1	56.2
09/12/2024 17:00	61.8	79.6	64.3	55.9
09/12/2024 17:15	57.4	76.9	57.6	52.8
09/12/2024 17:30	54.2	68.2	55.0	52.2
09/12/2024 17:45	57.7	73.9	60.4	52.8
09/12/2024 18:00	56.6	76.6	57.8	53.1
09/12/2024 18:15	56.8	82.7	56.2	51.9
09/12/2024 18:30	53.6	64.1	55.0	51.4
09/12/2024 18:45	53.1	75.8	54.1	50.7
09/12/2024 19:00	51.8	59.8	53.0	50.5
09/12/2024 19:15	51.6	55.3	52.7	50.2
09/12/2024 19:30	52.2	69.9	53.4	49.8
09/12/2024 19:45	54.0	80.7	53.2	49.8
09/12/2024 20:00	53.7	86.3	52.5	49.2
09/12/2024 20:15	51.7	67.5	53.0	48.8
09/12/2024 20:30	51.4	65.9	52.8	49.1
09/12/2024 20:45	51.3	68.5	52.7	48.1
09/12/2024 21:00	55.5	77.5	59.0	48.2
09/12/2024 21:15	53.6	72.4	56.0	47.7

ENVIRONMENTAL NOISE ASSESSMENT

Date & time	L _{Aeq} [dB]	L _{AFmax} [dB]	L _{A10} [dB]	L _{A90} [dB]
09/12/2024 21:30	49.8	76.0	51.0	47.3
09/12/2024 21:45	49.2	61.5	51.2	46.6
09/12/2024 22:00	49.3	62.0	50.7	47.1
09/12/2024 22:15	48.9	59.7	50.3	46.5
09/12/2024 22:30	46.6	51.0	48.1	44.9
09/12/2024 22:45	47.3	56.7	49.1	44.7
09/12/2024 23:00	47.5	62.5	49.4	44.5
09/12/2024 23:15	47.1	65.0	48.2	44.3
09/12/2024 23:30	46.9	60.1	48.6	43.8
09/12/2024 23:45	46.5	53.8	48.0	44.4
10/12/2024 00:00	45.9	65.7	47.3	43.6
10/12/2024 00:15	45.5	60.9	47.5	42.8
10/12/2024 00:30	45.1	52.4	46.9	42.6
10/12/2024 00:45	44.8	52.4	46.5	42.5
10/12/2024 01:00	52.1	75.9	50.5	43.6
10/12/2024 01:15	45.9	57.8	48.0	43.2
10/12/2024 01:30	45.8	57.2	47.5	42.7
10/12/2024 01:45	47.5	60.9	50.9	42.4
10/12/2024 02:00	48.3	61.1	51.3	43.6
10/12/2024 02:15	48.0	60.7	51.3	42.4
10/12/2024 02:30	48.3	63.3	51.7	41.7
10/12/2024 02:45	47.9	61.4	50.7	43.4
10/12/2024 03:00	48.9	78.2	50.1	43.2
10/12/2024 03:15	47.6	60.2	50.2	43.7
10/12/2024 03:30	46.8	58.5	49.1	42.9
10/12/2024 03:45	46.9	58.8	49.0	43.3
10/12/2024 04:00	46.9	59.0	48.8	43.6
10/12/2024 04:15	48.0	60.1	50.4	44.3
10/12/2024 04:30	47.7	60.2	49.2	45.3
10/12/2024 04:45	47.9	58.3	50.2	44.6
10/12/2024 05:00	54.6	72.9	52.8	45.7
10/12/2024 05:15	48.8	57.2	50.4	46.7
10/12/2024 05:30	49.7	60.6	51.3	47.6
10/12/2024 05:45	52.3	69.0	53.6	48.8
10/12/2024 06:00	52.0	69.1	53.1	49.2
10/12/2024 06:15	51.9	59.7	53.4	50.2

ENVIRONMENTAL NOISE ASSESSMENT

Date & time	L _{Aeq} [dB]	L _{AFmax} [dB]	L _{A10} [dB]	L _{A90} [dB]
10/12/2024 06:30	59.3	80.7	61.4	51.0
10/12/2024 06:45	55.8	74.1	55.8	51.8
10/12/2024 07:00	57.1	80.7	57.1	51.8
10/12/2024 07:15	55.5	79.7	55.8	52.3
10/12/2024 07:30	61.6	82.4	60.6	53.5
10/12/2024 07:45	57.3	74.5	60.3	52.8
10/12/2024 08:00	57.1	70.2	59.9	53.4
10/12/2024 08:15	53.5	71.0	54.6	51.9
10/12/2024 08:30	59.5	73.3	62.3	53.9
10/12/2024 08:45	57.6	75.1	61.3	51.4
10/12/2024 09:00	54.9	71.8	56.1	51.7
10/12/2024 09:15	54.0	74.5	55.1	52.1
10/12/2024 09:30	55.1	76.2	55.4	51.9
10/12/2024 09:45	54.9	72.5	55.1	51.9
10/12/2024 10:00	55.3	75.0	57.1	51.2
10/12/2024 10:15	53.1	63.6	54.5	51.0
10/12/2024 10:30	55.0	77.7	55.2	51.3
10/12/2024 10:45	53.9	74.0	55.4	51.1
09/12/2024 13:15	55.7	76.4	57.5	52.5
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09/12/2024 13:45	55.0	66.6	57.1	52.1
09/12/2024 14:00	54.6	72.6	56.0	52.4
09/12/2024 14:15	54.4	72.1	55.9	52.1
09/12/2024 14:30	53.6	67.7	54.7	52.1
09/12/2024 14:45	55.4	76.8	55.8	51.8
09/12/2024 15:00	56.5	75.3	57.6	52.0



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