HOARE LEA

Stag Brewery, Mortlake

Noise Impact Assessment

For Reselton Properties

March 2022

HOARE LEA

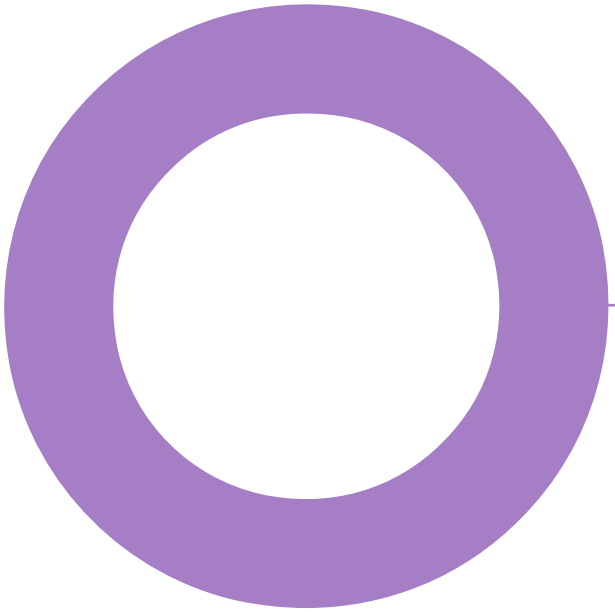
Former Stag Brewery. Mortlake.

Reselton Properties Limited.

ACOUSTICS

NOISE IMPACT ASSESSMENT

REVISION 12 – 08 MARCH 2022



Audit sheet.

Rev.	Date	Description	Prepared	Verified
00	02/02/2018	For Comment	TH	BRD
01	05/02/2018	For Issue	TH	BRD
02	09/02/2018	For Issue	TH	-
03	09/03/2018	Measurement positions updated	TH	-
04	13/09/2019	Updated application including: - Updated basis of assessment (NPPF, BCO & Richmond Local Plan); - Details of survey conducted in July 2019 included; - Updated noise emission limits within Table 13; - Updated façade requirement assessment based on new cinema use – Table 14; - Updated items of building services plant and updated assessment to reflect new plant in Tables 16 & 17; and - Consideration of balconies and external amenity areas included within Sections 6.2 and 6.3.	TH	BRD
05	11/10/2019	Minor amendments including MUGA comments	TH	-
06	24/10/2019	Figure 4 updated	TH	-
07	17/01/2020	Updated application including: – Figure 4 updated; and – Section 8 updated.	TH	-
08	08/04/2020	Updated application including: – Figure 4 updated; – Tables 14 and 15 updated; and – Section 7 updated.	TH	-
09	20/04/2020	Updated application including: – Updated executive summary & introduction; and – Updated Figure 1.	TH	-
10	21/05/2020	Minor amendments following legal review.	TH	-
11	14/07/2020	Updated introductory text	TH	
12	08/03/2022	Updated application including: – Updated executive summary & introduction; and – Updated Section 7.	TH	BRD

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Document reference: REP-1006369-TH-202200308-Noise Impact Assessment-Rev12

Contents.

Executive summary.

Hoare Lea has conducted a noise impact assessment in support of two linked planning applications for the comprehensive redevelopment of the former Stag Brewery Site in Mortlake within the London Borough of Richmond Upon Thames. The noise impact assessment considers the proposed noise sensitive uses within the Proposed Development.

The following summarises the assessment procedure and findings contained within this report:

- Background noise levels typical of the daytime and night-time as measured by Waterman IE have been used to define building services plant noise emission limits at the nearest residential dwellings at the Proposed Development.
- During the daytime and night-time, the combined building services plant noise emission contribution limit advised is 36 dB(A) and 28 dB(A) respectively, one metre from the nearest residential façade of the Proposed Development.
- An assessment of the building envelope acoustic performance is provided and indicates that the ventilation strategy should allow for full mechanical ventilation of all spaces as the level differences required are above those achievable by simple means of natural ventilation. Windows may be openable for purge ventilation.
- Notional glazing requirements and indicative primary glazing configurations have been provided for guidance purposes only. Detailed calculations will be required to be undertaken to determine refined glazing requirements during subsequent design stages.
- The building services design is conceptual at this stage and as such, it has not been possible to conduct an assessment of noise. However, it is confirmed that all building services plant will be controlled via appropriate mitigation measures such that the defined noise emission limits will be achieved at the nearest residential receivers.
- An assessment of noise associated with the proposed MUGA and 3G sports pitch has been undertaken. The assessment confirms that the proposed façade treatment and ventilation strategy will be sufficient to reduce noise associated with the MUGA and sports pitch to an appropriate level.
- Whilst not required to reduce the noise impact of the MUGA and sports pitch, a commitment has been made to include the following mitigation measures which will further reduce the noise impact:
    - A weld mesh (twin bar super rebound fence) with EPDM rubber inserts and fixings to reduce rattle and ball impact noise during play;
    - A maintenance scheme to prevent deterioration in performance of the sports facilities that could result from damaged panels, loose brackets, worn AV bushing and squeaky gates; and
    - A 2.5m acoustic barrier along the western and northern boundary of the sports pitch.

1. Introduction.

This noise impact assessment has been prepared by Hoare Lea on behalf of Reselton Properties Limited ("the Applicant") in support of two linked planning applications ("the Applications") for the comprehensive redevelopment of the former Stag Brewery Site in Mortlake ("the Site") within the London Borough of Richmond upon Thames (LBRuT).

The Applications seek planning permission for:

Application A:

Hybrid application to include the demolition of existing buildings to allow for comprehensive phased redevelopment of the site:

Planning permission is sought in detail for works to the east side of Ship Lane which comprise:

a) Demolition of existing buildings (except the Maltings and the façade of the Bottling Plant and former Hotel), walls, associated structures, site clearance and groundworks;

b) Alterations and extensions to existing buildings and erection of buildings varying in height from 3 to 8 storeys plus a basement of one to two storeys below ground;

c) Residential apartments;

d) Flexible use floorspace for:

    i. Retail, financial and professional services, café/restaurant and drinking establishment uses;
    ii. Offices;
    iii. Non-residential institutions and community use;
    iv. Boathouse;

e) Hotel / public house with accommodation;

f) Cinema;

g) Offices;

h) New pedestrian, vehicle and cycle accesses and internal routes, and associated highway works;

i) Provision of on-site cycle, vehicle and servicing parking at surface and basement level;

j) Provision of public open space, amenity and play space and landscaping;

k) Flood defence and towpath works; and

l) Installation of plant and energy equipment.

Planning permission is also sought in outline with all matters reserved for works to the west of Ship Lane which comprise:

a) The erection of a single storey basement and buildings varying in height from 3 to 8 storeys;

b) Residential development;

c) Provision of on-site cycle, vehicle and servicing parking;

d) Provision of public open space, amenity and play space and landscaping; and

e) New pedestrian, vehicle and cycle accesses and internal routes, and associated highways works.

Application B:

Detailed planning permission for the erection of a three-storey building to provide a new secondary school with sixth form; sports pitch with floodlighting, external MUGA and play space; and associated external works including landscaping, car and cycle parking, new access routes and other associated works.

Together, Applications A and B described above comprise the 'Proposed Development'.

The Applications follow earlier planning applications which were refused by the Greater London Authority. The refused applications were for:

a) Application A – hybrid planning application for comprehensive mixed-use redevelopment of the former Stag Brewery site consisting of:
    i. Land to the east of Ship Lane applied for in detail (referred to as 'Development Area 1' throughout); and
    ii. Land to the west of Ship Lane (excluding the school) applied for in outline (referred to as 'Development Area 2' throughout).

b) Application B – detailed planning application for the school (on land to the west of Ship Lane).

c) Application C – detailed planning application for highways and landscape works at Chalkers Corner.

The LBRuT (the Council) originally resolved to grant planning permission for Applications A and B but refuse Application C.

Following the LBRuT's resolution to approve the applications A and B, the Mayor called-in the applications and became the determining authority. The Mayor's reasons for calling in the applications were set out in his Stage II letter (dated 4 May 2020) but specifically related to concerns regarding what he considered was a low percentage of affordable housing being proposed for the Site and the need to secure a highways solution for the scheme following the LBRuT's refusal of Application C.

Working with the Mayor's team, the Applicant sought to meaningfully respond to the Mayor's concerns on the applications. A summary of the revisions to the scheme made and submitted to the GLA in July 2020 is as follows:

i. Increase in residential unit provision from up to 813 units to up to 1,250 units;

ii. Increase in affordable housing provision from (up to) 17%, to 30%;

iii. Increase in height for some buildings of up to three storeys;

iv. Change to the layout of Blocks 18 and 19, conversion of Block 20 from a terrace row of housing to two four storey buildings;

v. Reduction in the size of the western basement, resulting in an overall car parking spaces reduction of 186 spaces and introduction of an additional basement storey under Block 1;

vi. Internal layout changes and removal of the nursing home and assisted living in Development Area 2;

vii. Landscaping amendments, including canopy removal of four trees on the northwest corner of the Site; and

viii. Alternative options to Chalkers Corner in order to mitigate traffic impacts through works to highway land only and allow the withdrawal of Application C.

Application A was amended to reflect these changes. Notwithstanding this, and despite GLA officers recommending approval, the Mayor refused the applications in August 2021.

The Mayor's reasons for refusal in respect of Application A were:

i. height, bulk and mass, which would result in an unduly obtrusive and discordant form of development in this 'arcadian' setting which would be harmful to the townscape, character and appearance of the surrounding area;

ii. heritage impact. The proposals, by reason of its height, scale, bulk and massing would result in less than substantial harm to the significance of several listed buildings and conservation areas in the vicinity. The Mayor considered that the less than substantial harm was not clearly and convincingly outweighed by the public benefits, including Affordable Housing, that the proposals would deliver;

iii. neighbouring amenity issues. The proposal, by reason of the excessive bulk, scale and siting of Building 20 and 21 in close proximity to the rear of neighbouring residential properties in Parliament Mews and the rear gardens of properties on Thames Bank, would result in an unacceptable overbearing and unneighbourly impact, including direct overlooking of private amenity spaces. The measures in the Design Code would not sufficiently mitigate these impacts; and

iv. no section 106 agreement in place.

Application B was also refused because it is intrinsically linked with Application A and therefore could not be bought forward without Application A.

This 3rd iteration of the scheme seeks to respond directly to the Mayors' reasons for refusal and in doing so also addresses a number of the concerns raised by the LBRuT.

The amendments can be summarised as follows:

i. A revised energy strategy is proposed in order to address the London Plan (2021) requirements;

ii. Several residential blocks have been reduced in height to better respond to the listed buildings along the Thames riverfront and to respect the setting of the Maltings building, identified as a Building of Townscape Merit (BTM) by the LBRuT;

iii. Reconfiguration of layout of Buildings 20 and 21 has been undertaken to provide lower rise buildings to better respond to the listed buildings along the Thames riverfront; and

iv. Chalkers Corner light highways mitigation works.

The school proposals (submitted under 'Application B') are unchanged. The Applicant acknowledges LBRuT's identified need for a secondary school at the Site and the Applications continue to support the delivery of a school. It is expected that the principles to be agreed under the draft Community Use Agreement (CUA) will be the same as those associated with the refused school application (LBRuT ref: 18/0548/FUL, GLA ref: GLA/4172a/07).

Overall, it is considered that together, the Applications respond successfully to the concerns raised by the GLA which also reflect some of the concerns raised by stakeholders in respect of the previous schemes and during pre-application discussions on the revised Proposed Development.

This report provides a description of the results from the noise survey, the defined external noise limits for building services plant, advice regarding the building envelope and ventilation strategy and an assessment indicating how the new mechanical services plant associated with the development will comply with the external noise limits at the new noise sensitive uses introduced as part of the Proposed Development.

To aid in the understanding of the assessment, definitions of technical terms used have been included in Appendix A.

2. Site description.

2.1 Existing site.

The Site comprises the following elements:

- The former Stag Brewery which sits between Lower Richmond Road and the river Thames, to the north of Mortlake Green;
- Land at Chalkers Corner;
- Land to the east of Ship Lane; and
- Land to the west of Ship Lane.

The former Stag Brewery Site is bounded by Lower Richmond Road to the south, the river Thames and the Thames Bank to the north, Williams Lane to the west and Bulls Alley (off Mortlake High Street) to the east. The Site is bisected by Ship Lane. The Site currently comprises a mixture of large-scale industrial brewing structures, large areas of hardstanding and playing fields.

The surrounding buildings to the wider site are generally residential in nature, with existing residential dwellings along Lower Richmond Road, Watney Road and Thames Bank. In addition to the south along Mortlake High Street is the Richmond English School and Mortlake Business Centre and along Lower Richmond Road is the Jolly Gardeners public house.

The proposed sites (indicative only) are identified in Figure 1 overleaf.

2.2 Local noise environment.

The surrounding noise climate is predominantly formed of road traffic noise from the immediate road network around the site, in particular Lower Richmond Road and Mortlake High Street to the south, but also Clifford Avenue to the west.

The noise climate was also observed to include contributions from aircraft serving Heathrow Airport (approximately 11 km to the west).

Figure 1: Existing site (indicative only). © Google Earth.

3. Basis of assessment.

3.1 National planning policy framework (NPPF): 2021.

The revised National Planning Policy Framework (1) published in July 2018, updated in February and June 2019 and subsequently updated in July 2021 sets out the Government's current planning policies for England and how these are expected to be applied. The NPPF supersedes the previous NPPF published in June 2019.

With regards to local noise and vibration, paragraph 185 states:

"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; and
c) limit the impact of light pollution from artificial light on local amenity, intrinsically dark landscapes and nature conservation."

Reference is made to the DEFRA Noise Policy Statement for England 2010 (NPSfE). This latter document is intended to apply to all forms of noise other than that which occurs in the workplace and includes environmental noise and neighbourhood noise in all forms.

The NPSfE advises that the impact of noise should be assessed on the basis of adverse and significant effect but does not provide any specific guidance on assessment methods or limit sound levels. Moreover, the document advises that it is not possible to have *"a single objective noise-based measure…that is applicable to all sources of noise in all situations"*. It further advises that the sound level at which an adverse effect occurs is *"likely to be different for different noise sources, for different receptors and at different times"*.

In the absence of specific guidance for assessment of environmental noise within the NPPF and the NPSfE, it is considered appropriate to base assessment on current British Standards and national guidance. These are considered to be Local Authority guidance, BS 4142 (2), BS 8233 (3) and the World Health Organisations (4) (WHO) guidelines.

3.2 BS 4142: 2014 + A1: 2019 – Methods for rating & assessing industrial & commercial sound.

Current Government advice to Local Planning Authorities in both England and Wales makes reference to BS 4142 as being the appropriate guidance for assessing commercial operations and fixed building services plant noise. This British Standard provides an objective method for rating the likelihood of complaint from industrial and commercial operations. It also describes means of determining noise levels from fixed plant installations and determining the background noise levels that prevail on a site.

The assessment of impacts is based on the subtraction of the measured background noise level from the rating level determined. The rating level is the source noise level (either measured or predicted) corrected for tone or character (if necessary). The difference is compared to the following criteria to evaluate the impact.

- A difference of around +10 dB or more is likely to be an indication of a significant adverse impact.
- A difference of around +5 dB indicates is likely to be an indication of an adverse impact.
- Where the rating level does not exceed the background noise level, this is an indication of the specific sound source having a low impact.

This method is only applicable for external noise levels.

3.4 BS 8233: 2014 – Guidance on sound insulation and noise reduction for buildings.

BS 8233: 2014 provides guidance for control of noise in and around buildings and suggests appropriate criteria and limits for different situations. The criteria and limits are primarily intended to guide the design of new or refurbished buildings undergoing a change of use.

Table 4 within BS 8233 provides desirable internal ambient noise levels for spaces in residential dwellings when they are unoccupied.

Activity	Location	Daytime (0700 to 2300)	Night-Time (2300 to 0700)
Resting	Living Room	35 dB $L_{Aeq,16hr}$	-
Dining	Dining Room / Area	40 dB $L_{Aeq,16hr}$	-
Sleeping (Daytime Resting)	Bedroom	35 dB $L_{Aeq,16hr}$	30 dB $L_{Aeq,8hr}$

Table 1: Indoor ambient noise levels in spaces for dwellings.

Supplementary Note 2 and 4 to Table 4 within BS 8233 are copied below for reference:

'NOTE 2 – the levels shown in Table 4 are based on the existing guidelines issued by the WHO…'

'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.'

Guidance provided within the superseded BS 8233: 1999 (5) stated that *'for a reasonable standard in bedrooms at night, individual noise events (measured with F-time weighting) should not normally exceed 45 dB L_{Amax}.'* This follows current guidelines issued by the WHO.

BS 8233 also provides guidance for indoor ambient noise levels in non-domestic buildings. These are replicated in Tables 2 and 3 below.

Objective	Typical Situations	Design Range $L_{Aeq,T}$ dB
Typical noise levels for acoustic privacy in shared spaces	Open Plan Office	45 – 50

Table 2: Indoor ambient noise levels in spaces when they are unoccupied and privacy is also important.

Activity	Location	Design Range $L_{Aeq,T}$ dB
Speech or telephone communications	Department store Cafeteria, canteen, kitchen	50 – 55
Study and work requiring concentration	Library, gallery, museum	40 – 50
	Staff / meeting room, training room	35 – 45
	Executive office	35 – 40

Table 3: Typical noise levels in non-domestic buildings.

3.5 The British Council for Offices (BCO) Guide to Specification 2019.

The British Council for Offices Guide provides guidance on sustainability, cost and value, building form, engineering systems and finishes within commercial offices. In particular, the BCO Guide provides advice within Section 11 regarding the acoustic environment within an office building, as summarised below.

External noise intrusion levels should not be more than the following ratings when measured in terms of $L_{eq,T}$.

- Open plan offices: NR 40 ($L_{eq,T}$)
- Speculative offices: NR 38 ($L_{eq,T}$)
- Cellular offices / meeting rooms: NR 35 ($L_{eq,T}$)

In addition, $L_{A01,1hr}$ noise intrusion levels should not normally be more than 55 dB in open plan / speculative offices or 50 dB in cellular offices.

3.6 Building Bulletin 93.

Building Bulletin 93 (BB93) (6) is the current Building Control requirement document for the acoustic design of schools and its performance standards are applicable for secondary schools. The document provides performance standards suitable to provide acoustic conditions in schools that facilitate clear communication of speech between teachers and students, and that do not interfere with study activities.

BB93 states that the sound insulation performance of the building envelope needs to be sufficient to reduce the external environmental noise in sensitive areas to the internal ambient noise levels in Table 1. The indoor ambient noise level includes noise contributions from external sources outside the school premises (including road, rail and air traffic) and building services.

Table 4 below provides the performance standards for typical secondary school spaces as shown within BB93 when they are unoccupied and unfurnished.

Type of room	Upper limit for the indoor ambient noise level $L_{Aeq,30min}$ dB
Secondary school: classrooms, general teaching areas, seminar rooms, tutorials rooms, language laboratories	35

Table 4: Performance standards for indoor ambient noise levels within secondary schools.

3.7 Regional planning policy.

3.7.1 The London Plan – The Spatial Development Strategy for Greater London, March 2021.

The London Plan sets out an overall strategic plan for London and sets out an integrated economic, environmental, transport and social framework for the development of London over the next 20-25 years. The Plan brings together the Mayor's strategies, including policy on a range of environmental issues, such as climate change, air quality, noise and waste. London Boroughs' Development Plan Documents and Neighbourhood Plans need to be in general conformity with the London Plan and its policies guide decisions on planning applications by councils and the Mayor.

The London Plan contains two policies that relate to noise; these are Policy D13 Agent of Change and Policy D14 Noise. In particular, Policy D14 states the following:

"A - In order to reduce, manage and mitigate noise to improve health and quality of life, residential and other non-aviation development proposals should manage noise by:

1) *Avoiding significant adverse noise impacts on health and quality of life.*
2) *Reflecting the Agent of Change principle as set out in Policy D13 Agent of Change.*
3) *Mitigating and minimising the existing and potential adverse impacts of noise on, from, within, as a result of, or in the vicinity of new development without placing unreasonable restrictions on existing noise generating uses.*
4) *Improving and enhancing the acoustic environment and promoting appropriate soundscapes (including Quiet Areas and spaces of relative tranquillity).*

5) *Separating new noise sensitive development from major noise sources (such as road, rail, air transport and some types of industrial use) through the use of distance, screening, layout, orientation, uses and materials – in preference to sole reliance on sound insulation.*

6) *Where it is not possible to achieve separation of noise sensitive development and noise sources without undue impact on other sustainable development objectives, then any potential adverse effects should be controlled and mitigated through applying good acoustic design principles.*

7) *Promoting new technologies and improved practices to reduce noise at source, and on the transmission path from source to receiver.*

B – Boroughs, and others with relevant responsibilities, should identify and nominate new Quiet Areas and protect existing Quiet Areas in line with the procedure in Defra's Noise Action Plan for Agglomerations."

3.8 Local planning policy.

3.8.1 London Borough of Richmond Upon Thames, Local Plan, Adopted July 2018.

The LBRuT Local Plan adopted in July 2018 sets out policies and guidance for the development of the borough over the next 15 years.

In respect of noise, the local plan contains two policies: *Policy LP 8 – Amenity and Living Conditions* and *Policy LP 10 – Local Environmental Impacts, Pollution and Land Contamination.*

3.8.1.1 Policy LP 8 – Amenity and Living Conditions.

Policy LP 8 states the following:

'All development will be required to protect the amenity and living conditions for occupants of new, existing, adjoining and neighbouring properties. The Council will:

1. *Ensure the design and layout of buildings enables good standards of daylight and sunlight to be achieved in new development and in existing properties affected by new development, where existing daylight and sunlight conditions are already substandard, they should be improved where possible;*
2. *Ensure balconies do not raise unacceptable overlooking or noise or disturbance to nearby occupiers; height, massing or siting, including through creating a sense of enclosure;*
3. *Ensure that proposals are not visually intrusive or have an overbearing impact as a result of their height, massing or siting, including through creating a sense of enclosure;*
4. *Ensure there is no harm to the reasonable enjoyment of the use of buildings, gardens and other spaces due to increases in traffic, servicing, parking, noise, light, disturbance, air pollution, odours or vibration or local micro-climatic effects."*

3.8.1.2 Policy LP 10 – Local Environmental Impacts, Pollution and Land Contamination.

Policy LP 10 states the following:

'A. The Council will seek to ensure that local environmental impacts of all development proposals do not lead to detrimental effects on the health, safety and the amenity of existing and new users or occupiers of the development site, or the surrounding land. These potential impacts can include, but are not limited to, air pollution, noise and vibration, light pollution, odours and fumes, solar glare and solar dazzle as well as land contamination.

Developers should follow any guidance provided by the Council on local environmental impacts and pollution as well as on noise generating and noise sensitive development. Where necessary, the Council will set planning conditions to reduce local environmental impacts on adjacent land uses to acceptable levels.

Noise and Vibration

C. The Council encourages good acoustic design to ensure occupiers of new and existing noise sensitive buildings are protected. The following will be required, where necessary:

1. *A noise assessment of any new plant and equipment and its impact upon both receptors and the general background noise levels;*
2. *Mitigation measures where noise needs to be controlled and managed;*
3. *Time limits and restrictions for activities where noise cannot be sufficiently mitigated;*
4. *Promotion of good acoustic design and use of new technologies;*
5. *Measures to protect the occupiers of new developments from existing sources.'*

3.9 Proposed standards.

Given the lack of specific guidance contained within the LBRuT's adopted planning policy, it is deemed appropriate to base assessment on guidance contained within relevant standards and guidance. These are considered to be BS 8233: 2014, the BCO Guide, BB 93 and BS 4142: 2014 + A1: 2019.

3.9.1 Environmental noise – internal noise levels.

On the basis of guidance contained within BS 8233: 2014 and BB 93, the development shall be designed to enable achievement of the internal noise levels stated within Table 5 below.

Location	Daytime (0700 to 2300)	Night-Time (2300 to 0700)
Residential dwellings		
Living room	35 dB $L_{Aeq,16hr}$	-
Bedroom	35 dB $L_{Aeq,16hr}$	30 dB $L_{Aeq,8hr}$ & 45 dB $L_{Amax,T}$
Dining rooms	40 dB $L_{Aeq,16hr}$	-
School		
Classrooms, general teaching areas	35 dB $L_{Aeq,30min}$	-
Commercial spaces		
Retail / restaurant space	40 dB $L_{Aeq,T}$	-
Open plan office space	45 dB $L_{Aeq,T}$ & 55 dB $L_{Amax,T}$	-
Cinema*	30 dB $L_{Aeq,T}$ & 35 dB $L_{Amax,T}$	-

Table 5: Proposed internal noise levels.

*Note *:* *These are generic internal noise levels. Specific criteria may be required at a later stage by the Cinema Operator.*

3.9.2 Building services – noise.

On the basis of guidance contained within BS 4142: 2014, noise emissions from building services plant shall be limited to at least 10 dB below the measured background noise levels.

4. Environmental noise survey.

An acoustic survey was carried out by Waterman Infrastructure & Environment (Waterman IE) in June 2016 and July 2019. Full details of the noise surveys undertaken by Waterman IE are provided within the ES Noise & Vibration Chapter, however, for ease of reference, a summary of each survey is provided within this Section.

4.1 Noise survey – June 2016.

4.1.1 Methodology

The noise survey comprised five days of unattended automatic noise measurements at four strategic locations from Friday 24th June 2016 to Wednesday 29th June 2016. For ease of reference, the table summarising the measurement locations and the figure identifying the measurement locations are replicated in Table 6 below and Figure 2 overleaf.

Monitoring Location (Figure 9.1)	Description	Observations and Predominant Noise Sources
LT1	Free-field measurement at the south-western Site boundary overlooking Lower Richmond Road (the A3003). Microphone located 1.2 m Above Ground Level (AGL).	Noise climate dominated by constant vehicular traffic on Lower Richmond Road / Mortlake High Street. Although intermittent in comparison, noise from low flying aircraft movements into Heathrow Airport (located approx. 11 km to the west) was significant, with approximately one plane every minute going over the Site. Contributory noise from human activities, distant road noise and distant aircraft also influence the noise climate to some extent.
LT2	Façade measurement on the second floor of the Stag Brewery Co. building at the south-eastern Site boundary overlooking Mortlake High Street. Microphone located 6.0 m AGL.	
LT3	Façade measurement on the boundary wall to the north-east of the Site overlooking the River Thames. Microphone located 4.0 m AGL.	Noise climate dominated by aircraft noise, as detailed above. Contributory noise from local and distant road traffic and occasional passing cyclists and joggers on the footpath over the river.
LT4	Free-field measurement at the south-western boundary of the Site orientated towards Clifford Avenue / Chiswick Bridge (the A316). Microphone located 2.5 m AGL.	Noise climate influenced by constant vehicular traffic on Clifford Avenue. Contributory noise from domestic activates from nearby residential dwellings.
ST1	Free field measurement at the centre of existing sports ground.	Noise climate influenced by distant road traffic noise and some intermittent low flying aircraft noise.
ST 2	Free field measurement north western corner of existing sports ground adjacent to Williams Lane.	Noise climate influenced by distant road traffic noise associated with Clifford Avenue and some intermittent low flying aircraft noise.
ST 3	Free field measurement north western corner of existing sports ground adjacent to Williams Lane.	Noise climate influenced by constant vehicular traffic on Clifford Avenue.
ST 4	Free field measurement adjacent to Ship Lane.	Noise climate influenced by distant road traffic noise and some intermittent low flying aircraft noise.
ST 5	Free field measurement adjacent to Ship Lane.	Noise climate influenced by distant road traffic noise and some intermittent low flying aircraft noise.

Monitoring Location (Figure 9.1)	Description	Observations and Predominant Noise Sources
ST 6	Free field measurement on southern site boundary adjacent to Lower Richmond Road.	Noise climate influenced road traffic noise associated with Lower Richmond Road.
ST 7	Free field measurement on eastern site boundary with Bulls Alley.	Noise climate influenced road traffic noise associated with Lower Richmond Road.
ST 8	Fee field noise measurement on Lower Richmond Road at Chalkers Corner.	Noise climate influenced road traffic noise associated with Lower Richmond Road.

Table 6: Noise monitoring locations – June 2016 (ref: Waterman IE).

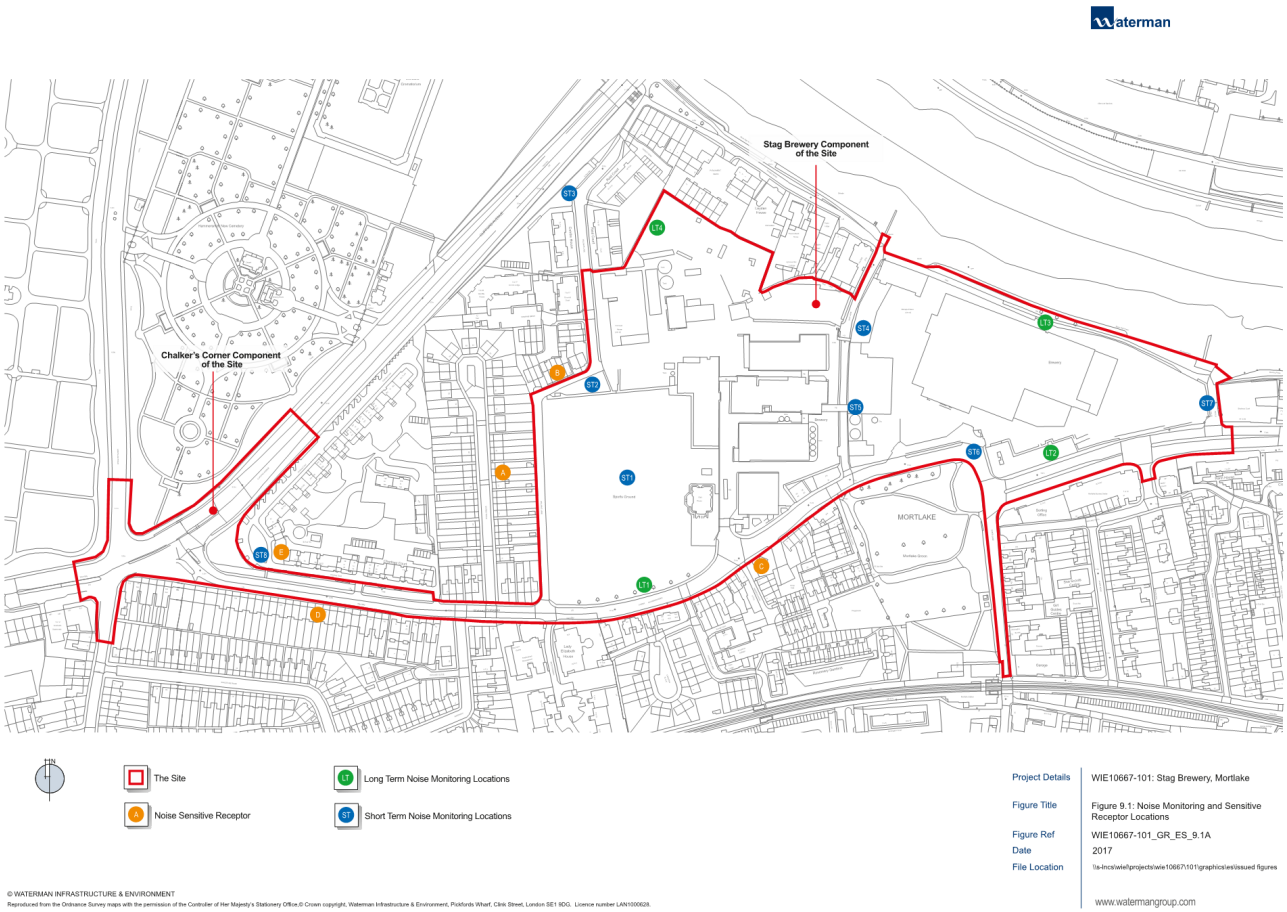


Figure 2: Location plan of the Site and noise monitoring locations – June 2016 (ref: Waterman IE).

4.1.2 Results summary.

A summary of the results from the noise survey conducted by Waterman IE is provided below in Tables 7 and 8 overleaf.

Monitoring Location	Period	Duration	Average $L_{Aeq,T}$ dB	Average $L_{A10,T}$ dB	Average $L_{A90,T}$ dB	90th Percentile $L_{AFmax,5min}$ dB
LT1	Day	12 hr	71	74	59	86
	Evening	4 hr	69	73	52	83
	Night	8 hr	65	65	42	83
LT2	Day	12 hr	70	71	62	89
	Evening	4 hr	68	69	57	85
	Night	8 hr	63	63	43	80
LT3	Day	12 hr	61	63	50	78
	Evening	4 hr	59	61	47	75
	Night	8 hr	55	51	42	73
LT4	Day	12 hr	60	64	48	76
	Evening	4 hr	58	61	46	74
	Night	8 hr	55	50	39	73

Table 7: Summary of unattended baseline noise measurements (free-field) – June 2016 (ref. Waterman IE).

Monitoring Location	Period	Duration	Average $L_{Aeq,T}$ dB	Average $L_{A10,T}$ dB	Average $L_{A90,T}$ dB	Average $L_{AFmax,5min}$ dB
ST1	Day	30 mins	61	64	54	74
ST2	Day	30 mins	66	63	53	76
ST3	Day	25 mins	75	78	65	88
ST4	Day	20 mins	61	65	51	72
ST5	Day	20 mins	61	64	50	77
ST6	Day	30 mins	69	71	64	80
ST7	Day	20 mins	65	68	57	76
ST8	Day	3 hrs	72	76	62	84

Table 8: Summary of attended baseline noise measurements (free-field) – June 2016 (ref. Waterman IE).

4.2 Noise survey – July 2019.

4.2.1 Methodology

The noise survey comprised five days of unattended automatic noise measurements at the same locations as the 2016 survey between Thursday 11th July to Tuesday 16th July 2019. In addition, short term measurements were undertaken at new positions to specifically monitor road traffic along Lower Richmond Road and Clifford Avenue, as well as two CRTN monitoring locations within Chertsey Court and along Williams Lane.

For ease of reference, the table summarising the new measurement locations and the figure identifying the measurement locations are replicated in Table 9 below and Figure 3 overleaf.

Monitoring Location (Refer to Figure 9.1)	Description	Observations and Predominant Noise Sources
ST1	Free-field measurement along Lower Richmond Road (A3003) approx. 3m from carriageway edge. Microphone located approx. 1.2m AGL.	Noise climate dominated by road traffic along Lower Richmond Road. Traffic flow was intermittent with periods of idling due to the traffic lights at the Lower Richmond Road / Clifford Avenue junction.
ST2	Free-field measurement along Clifford Avenue approx. 5m from carriageway edge. Microphone located approx. 1.2m AGL.	Noise climate dominated by road traffic along Clifford Avenue. Traffic flow was intermittent with periods of idling due to the traffic lights at the Lower Richmond Road / Clifford Avenue junction.
CRTN1	Free-field measurement within Chertsey Court car park approx. 50m from Lower Richmond Road / Clifford Avenue Junction. Microphone located approx. 1.2m AGL.	Noise climate in the area dominated by noise from both Lower Richmond Road (A3003) and Clifford Avenue. Occasional cars passing through the Chertsey Court car park and aircraft passing overhead also contributed to the noise climate at this location.
CRTN2	Free-field measurement along Williams Lane approx. 1m from road edge. Microphone located approx. 1.2m AGL.	Noise climate in the area dominated by distant road traffic from Lower Richmond Road and the surrounding transport network. Occasional cars passing along Williams Lane and aircraft passing overhead also contributed to the noise climate at this location.

Table 9: Noise monitoring locations – July 2019 (ref: Waterman IE).

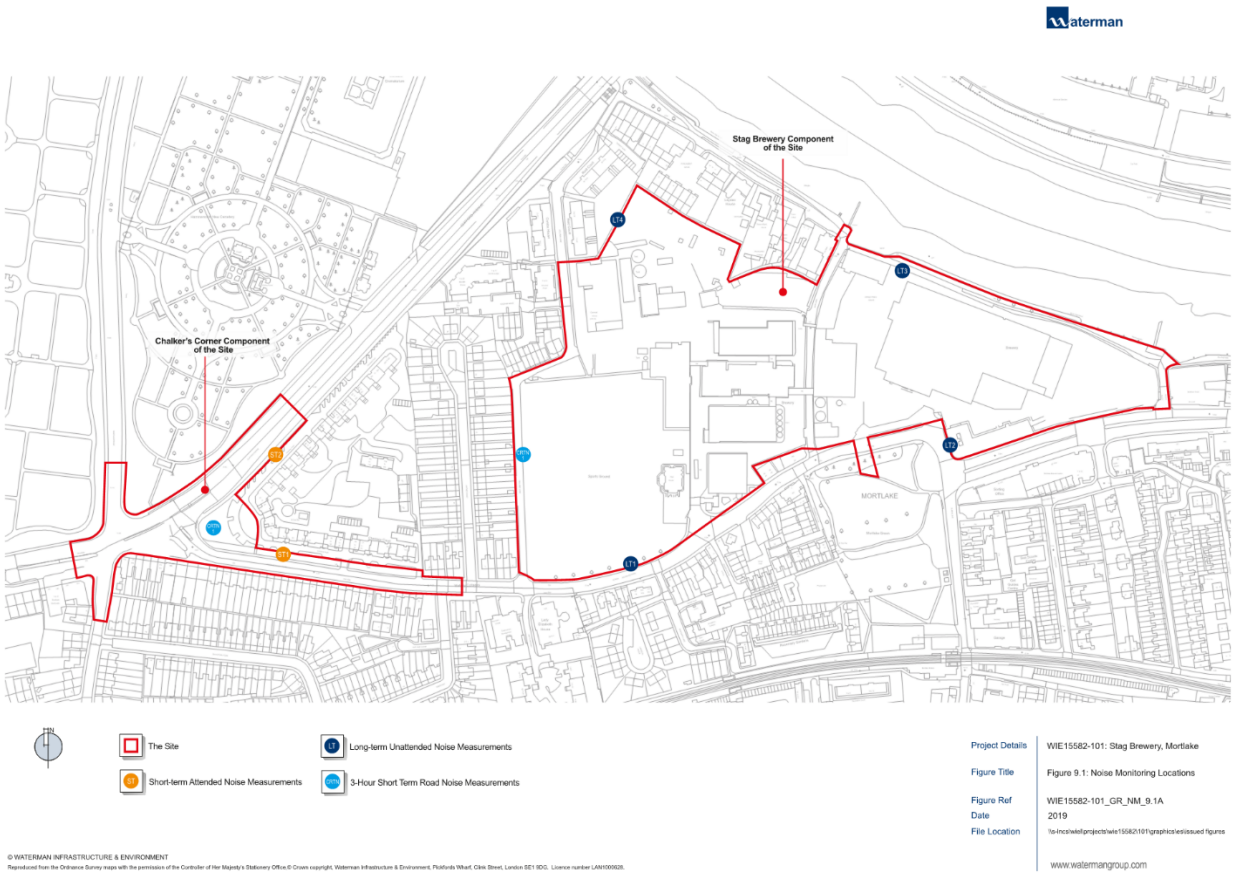


Figure 3: Location plan of the Site and noise monitoring locations – July 2019 (ref: Waterman IE).

4.2.2 Results summary.

A summary of the results from the noise survey conducted by Waterman IE is provided below in Tables 10 and 11 overleaf.

Monitoring Location	Period	Duration	Average $L_{Aeq,T}$ dB	Average $L_{A10,T}$ dB	Average $L_{A90,T}$ dB	90th Percentile $L_{AFmax,5min}$ dB
LT1	Day	12 hr	71	74	59	86
	Evening	4 hr	71	74	55	87
	Night	8 hr	66	66	41	84
LT2	Day	12 hr	68	69	61	85
	Evening	4 hr	69	69	57	86
	Night	8 hr	63	64	42	77
LT3	Day	12 hr	59	60	51	75
	Evening	4 hr	55	56	49	72
	Night	8 hr	53	50	41	70
LT4	Day	12 hr	56	57	48	74
	Evening	4 hr	55	56	47	73
	Night	8 hr	53	48	38	72

Table 10: Summary of unattended baseline noise measurements (free-field) – July 2019 (ref. Waterman IE).

Monitoring Location	Period	Duration	Average $L_{Aeq,T}$ dB	Average $L_{A10,T}$ dB	Average $L_{A90,T}$ dB	Average $L_{AFmax,5min}$ dB
ST1	Day	1 hour	73	74	62	85
ST2	Day	1 hour	70	73	61	78
CRTN1	Day	3 hours	63	65	57	76
CRTN2	Day	3 hours	58	61	45	74

Table 11: Summary of attended baseline noise measurements (free-field) – July 2019 (ref. Waterman IE).

5. Noise emissions of fixed plant.

Limits for noise levels due to building services serving the proposed development have been defined by Waterman IE on the basis of the measured background noise levels. The plant noise emission limits for the nearest off-site noise sensitive receptors as defined by Waterman IE are replicated in Table 12 below. These limits apply one metre from the nearest noise sensitive area.

Nearest noise sensitive receptor	Period	Representative $L_{A90,5min}$	Plant Noise Emission Limit $L_{Aeq,T}$ dB
6-68 Watney Road & 4-24 William Lane	Daytime (0700 to 2300)	48	38
	Night-time (2300 to 0700)	39	35
1-69 Lower Richmond Road	Daytime (0700 to 2300)	59	45
	Night-time (2300 to 0700)	42	35

Table 12: Building services noise emission limits at nearest off-site noise sensitive receptors.

Noise emission limits for future residential dwellings within the Proposed Development have been defined in accordance with the requirements of the LBRuT, as specified in Section 3.9.2 above.

Nearest noise sensitive receptor	Period	Representative $L_{A90,5min}$	Plant Noise Emission Limit $L_{Aeq,T}$ dB
Future residential dwellings within the Development	Daytime (0700 to 2300)	46	36
	Night-time (2300 to 0700)	38	28

Table 13: Building services noise emission limits at future residential properties within the Development.

6. Building envelope & ventilation strategy.

The sound insulation properties of the building envelope depend upon the external noise levels present at the façade and the proposed design criteria for the internal noise levels of specific rooms, dependant on their use. Table 14 overleaf assumes compliance with the internal noise levels stated in Table 5 and shows the level differences for varying spaces within the proposed development.

The examples shown represent the highest level differences required for each block as identified in Figure 4 below, based on the noise levels measured by Waterman IE.

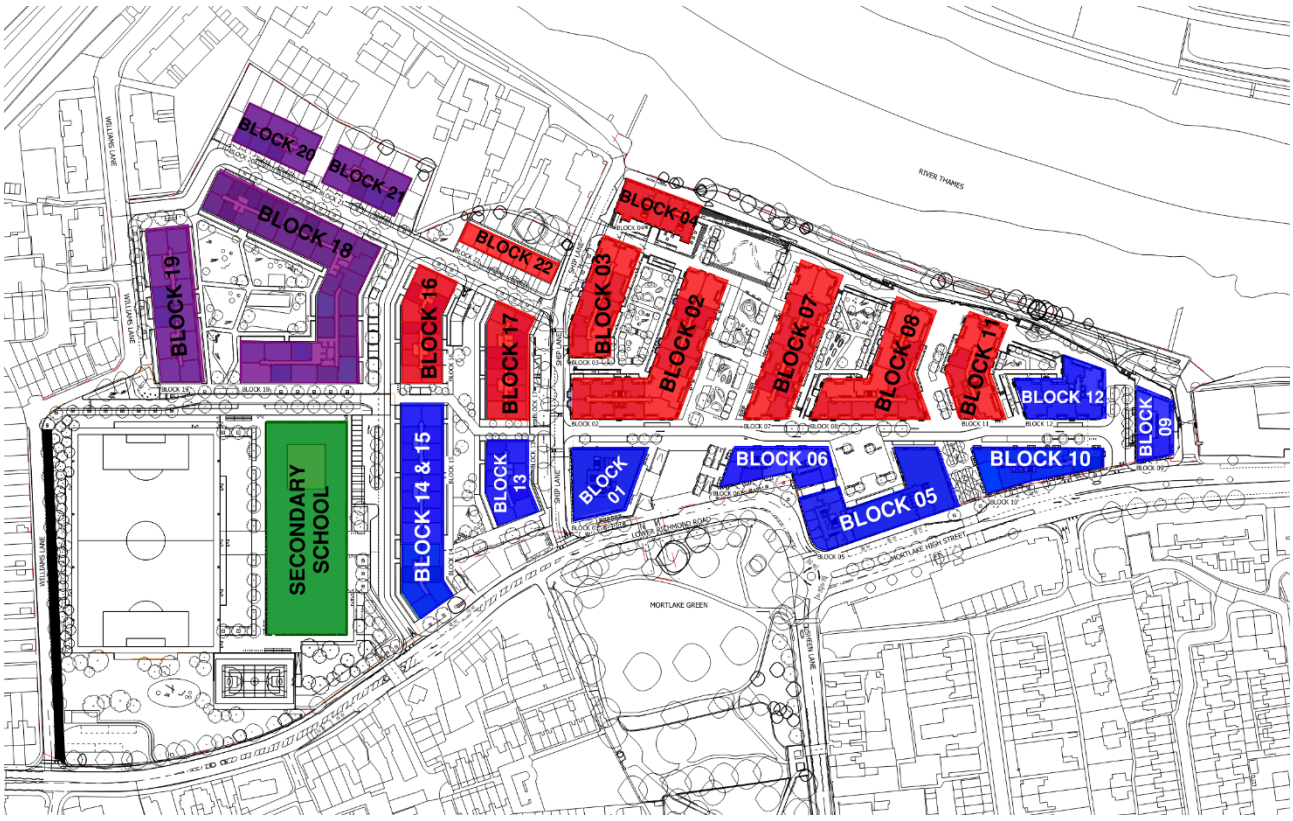


Figure 4: Block locations.

It should be noted that the highest level difference (D) shown for bedrooms and offices within Table 14 takes precedence.

Blocks	Room Use	Noise Levels (dB)		
		Measured External	Proposed Internal (Maximum)	Minimum Level Difference D
Blocks 02, 03, 04, 07, 08, 11, 16, 17 & 22	Commercial	61	40	21
	Living room[1]	61	35	26
	Bedroom[1]	56	30	26
	Bedroom (L_{Amax})[2]	73	45	28
Blocks 01, 05, 06, 09, 10, 12, 13 &15	Cinema auditoria[3]	70	30	40
	Cinema auditoria (L_{Amax})[3]	89	35	54
	Commercial	70	40	30
	Open plan office	70	45	25
	Office (L_{Amax})	89	55	34
	Living room[1]	69	35	34
	Bedroom[1]	63	30	33
	Bedroom (L_{Amax})[2]	80	45	35
Secondary School	Classroom	71	35	36
Blocks 18, 19, 20 & 21	Living room[1]	59	35	24
	Bedroom[1]	55	30	25
	Bedroom (L_{Amax})[2]	73	45	28

Table 14: Notional sound insulation values of proposed façade construction.

Note 1: Living rooms $L_{Aeq,16hr}$ (0700 to 2300) and bedroom $L_{Aeq,8hr}$ (2300 to 0700).

Note 2: Bedrooms $L_{Amax,T}$ (2300 to 0700).

Note 3: The cinema internal noise criteria are notional and will be subject to the Cinema Operator.

Simple natural ventilation through the use of opening windows will provide a level difference (D) in the order of 10 dB. It can be seen from Table 14 above that all internal spaces require greater levels of sound insulation based on the measured external noise levels.

As such, although windows may be openable for purge ventilation, provision for alternative forms of ventilation will need to be made such that windows are not required to be opened for ventilation purposes.

Table 15 below details the minimum required $R_w + C_{tr}$ of all window elements (glazing, seals, frames etc.) to each room on each block.

It is noted that no windows are provided to the cinema auditoria in Block 01 and the proposed building structure is masonry. As such, suitable internal noise levels will be achieved within the cinema auditoria.

Blocks	Minimum Required $R_w + C_{tr}$ (dB)				
	Commercial	Open Plan Office	Classroom	Living Room	Bedroom
Blocks 02, 03, 04, 07, 08, 11, 16, 17 & 22	21*	-	-	26*	28*
Blocks 01, 05, 06, 09, 10, 12, 13 & 15	30*	34	-	34	35
Secondary School	36	-	-	-	-
Blocks 18, 19, 20 & 21	-	-	-	24*	28*

Table 15: Minimum required $R_w + C_{tr}$ of glazed elements.

*Note *: Achievable with a standard thermal double-glazing unit.*

It should be noted that at this stage it is assumed that the non-glazed element on all blocks will be capable of achieving a sound reduction of 46 dB $R_w + C_{tr}$. An example of an external wall capable of achieving this requirement is a 100mm cavity wall construction.

Examples of primary glazing configurations capable of achieving the minimum required $R_w + C_{tr}$ detailed within Table 15 are provided below:

- $R_w + C_{tr}$ 30 dB – 10mm glass, 16mm air gap, 4mm glass.
- $R_w + C_{tr}$ 34 dB – 6mm glass, 16mm air gap, 8.8mm acoustic glass.
- $R_w + C_{tr}$ 36 dB – 8mm glass, 16mm air gap, 10.4mm acoustic glass.

It should be noted that at this stage the required glazing sound insulation values have been based on a level difference comparison only. Detailed calculations will be required to be undertaken to determine refined glazing requirements during subsequent design stages of the project when finalised drawings are available. As such, the sound insulation values stated within Table 15 are indicative and for guidance purposes only.

The above guidance has also been based on an open-plan office. If the space is to be sub-divided to create cellular offices, an increased and more detailed glazing specification will be required to enable achievement of the internal ambient noise levels stated within BS 8233:2014 and the BCO Guide for cellular offices and meeting rooms.

Similarly, the requirements for the secondary school have been based on the internal noise level requirements for a standard teaching space (e.g. seminar room, laboratory etc.). Should specialist areas be proposed (e.g. music recital rooms, drama studios, SEN spaces etc.) then an increased glazing specification will be required.

It should also be noted that this assessment has been conducted on the basis that all buildings are constructed. It is understood that the development will be phased and as such, consideration for building façades that are exposed to higher noise levels until later phases are completed will need to be given. This may mean that façade requirements are increased in these circumstances.

6.1 Compliance

In order to confirm the suitability of the proposed glazed and non-glazed elements, evidence of the laboratory sound insulation performance will be required for the entire unit as it will be installed (including glass, frame, seals, mullions and transoms). All acoustic testing shall be undertaken in controlled laboratory conditions in accordance with ISO 10140-2: 2010 – "*Acoustics – Laboratory measurement of sound insulation of building elements. Part 2: Measurement of airborne sound Insulation*". (7)

6.2 Balconies.

The Proposed Development will comprise balconies, which are proposed on Buildings 02, 03, 05, 06, 07, 08, 09, 10, 11 & 12, although these are limited in number on the most exposed façades.

For a seated resident on these balconies, the acoustic screening effect of a glazed balustrade is expected to reduce façade levels by approximately 3 dB(A). This would reduce noise levels for a seated receptor on the majority of balconies that do not have a direct line of site to Mortlake High Street and Lower Richmond Road to less than 55 dB(A). This would therefore achieve the WHO and BS 8233 recommendation for external amenity areas.

For a limited number of balconies overlooking Mortlake High Street and Lower Richmond Road, noise levels will exceed the WHO recommendation for amenity areas. However, it is considered unlikely that in the urban context of the site, noise would significantly impact upon their intended amenity use with similar balconies appearing to be well utilised on developments in the surrounding area which experience similar levels of noise exposure.

6.3 External amenity areas.

Several external amenity areas are also proposed across the site at ground floor level, in particular to the north of the site. For the vast majority of these areas, including the area between blocks 18 & 19, between blocks 2, 3 & 4, between blocks 7 & 8 and between blocks 11 & 12, the built form of the development will provide screening of road traffic noise such that noise levels are expected to be less than 55 dB(A) during the daytime and therefore achieve the WHO and BS 8233 recommendation for external amenity spaces.

7. Building services plant.

At this stage the building services design is conceptual, however the proposals are understood to enclose all boiler plant and landlord area ventilation units within several basement level plant rooms and a dedicated energy centre. In addition, several air source heat pumps are proposed at roof level and local ventilation units will be provided on each floor for the supply and extract of air from bathrooms, WCs and utility rooms.

The design will be subject to further detailed development should planning permission be granted for the scheme. Appropriate mitigation of all items of plant will be incorporated within the design such that the noise emission limits stated within Table 12 and Table 13 are achieved at the nearest residential receptors. At this stage, spatial and cost provision should be made for the following noise control measures:

- Low noise equipment to be selected;
- Appropriate silencers fitted to all air handling units and extract fans;
- Acoustic enclosures, screens and louvres to be provided; and
- Anti-vibration mounts fitted to all equipment.

Hoare Lea Acoustics can undertake an assessment to confirm precise specification of the required noise control measures once finalised plant details become available.

8. Multi-use games area & 3G sports pitch.

As part of the Proposed Development a multi-use games area (MUGA) and 3G sports pitch are proposed to the west of the site as shown in Figure 5 below.

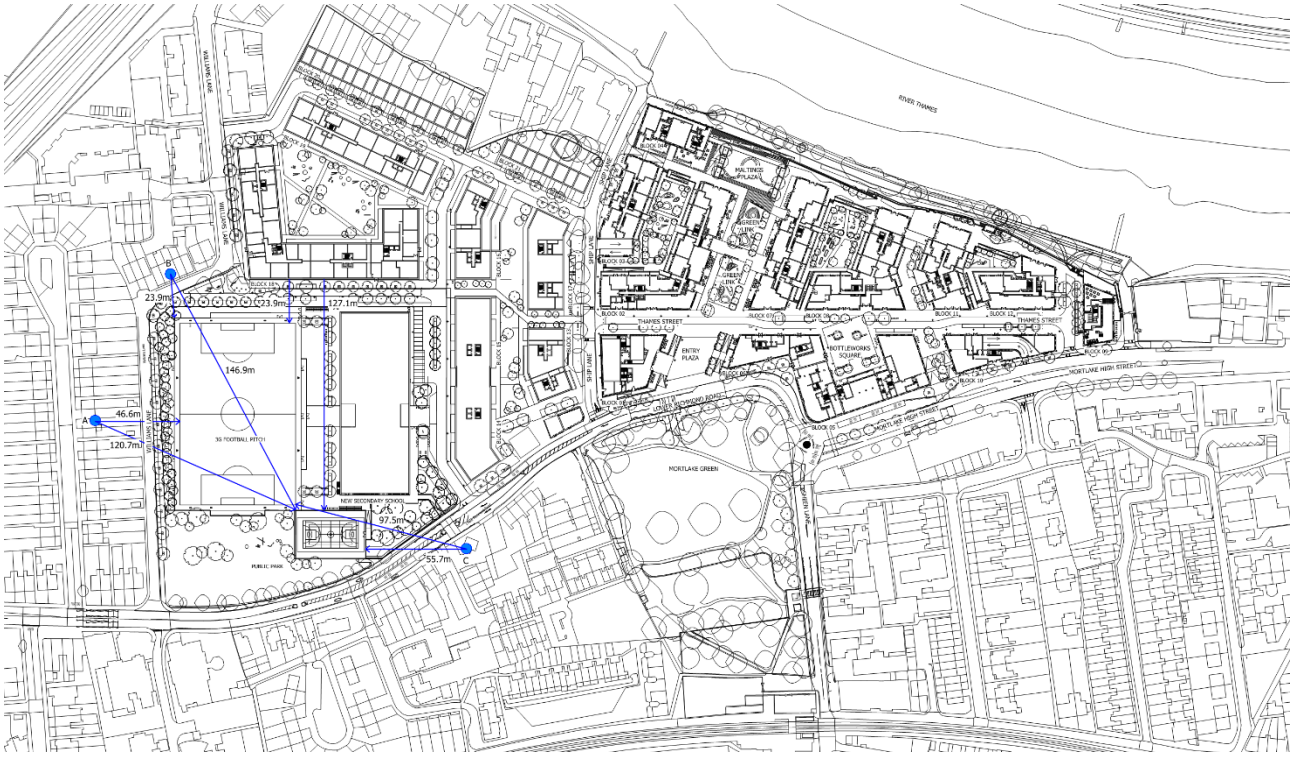


Figure 5: MUGA & 3G sports pitch - typical ground floor plan.

The use of the MUGA and sports pitch will be during the daytime and evening hours only, with typical operational hours of play being restricted to 9pm Monday to Saturday and 8pm on Sundays and Bank Holidays.

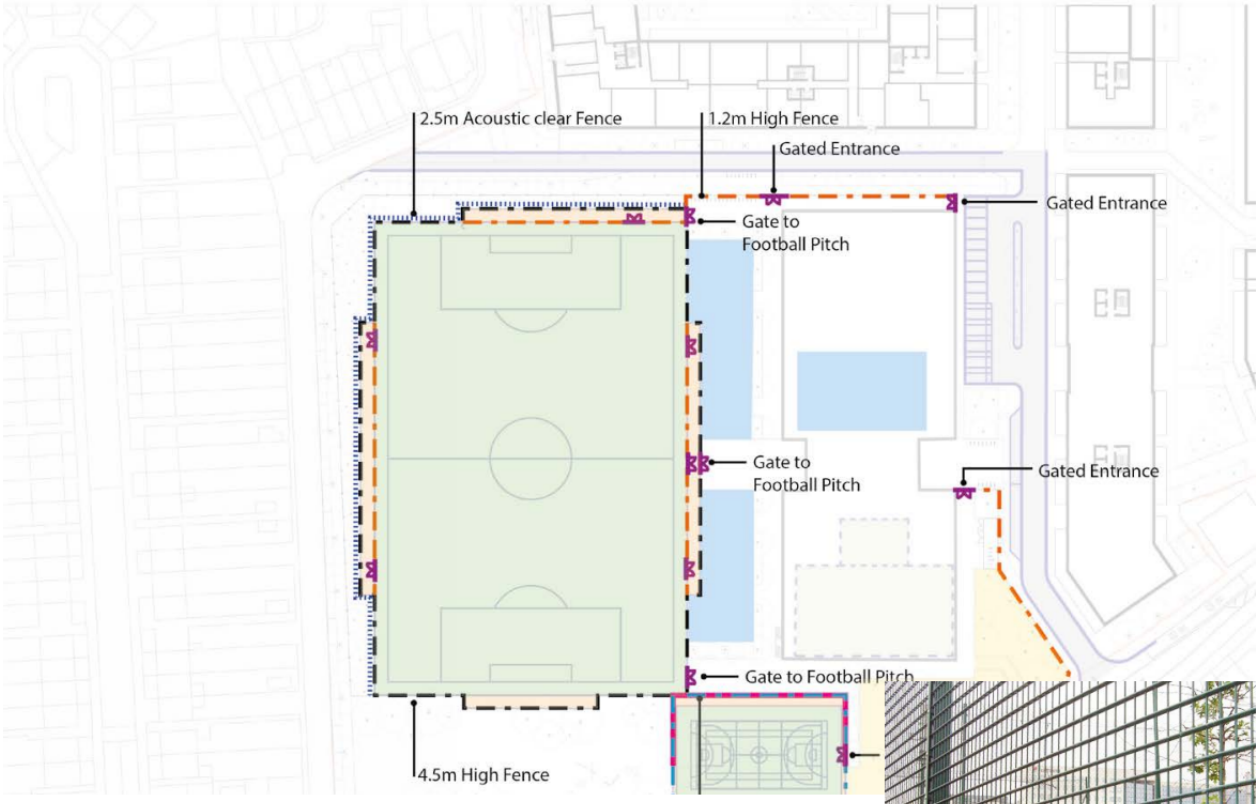
As shown in Figure 5, the nearest new residential receptor proposed as part of the Proposed Development is Block 18 and is approximately 24m from the 3G sports pitch and 127m from the MUGA.

As discussed in Section 6, the residential dwellings will be designed such that internal noise levels do not exceed 35 dB L_{Aeq}, during the daytime and 30 dB L_{Aeq} and 45 dB L_{Amax} at night from anonymous source of noise such as road traffic.

Given the distance between the sports pitch / MUGA and new residential receptors, the general noise levels from anonymous sources will be greater than those expected from the sports pitch and MUGA. As such, the required façade treatment and ventilation strategy detailed in Section 6 will be sufficient to reduce noise associated with the sports pitch and MUGA to an appropriate level.

Whilst not specifically required to reduce the noise impact of the sports pitch and MUGA, a commitment has been made to include the following mitigation measures, as shown in Figure 6 overleaf, which will further reduce the noise impact:

- A weld mesh (twin bar super rebound fence) with EPDM rubber inserts and fixings to reduce rattle and ball impact noise during play;
- A maintenance scheme to prevent deterioration in performance of the sports facilities that could result from damaged panels, loose brackets, worn AV bushing and squeaky gates; and
- A 2.5m acoustic barrier along the western and northern boundary of the sports pitch.



Precedent image from manufacturer ZAUN

Figure 6: Plan identifying adopted mitigation measures to MUGA & 3G sports pitch.

9. Summary & conclusions.

Hoare Lea has conducted a noise impact assessment in support of two linked planning applications for the the comprehensive redevelopment of the former Stag Brewery Site in Mortlake within the London Borough of Richmond Upon Thames.

Background noise levels typical of the daytime and night-time as measured by Waterman IE have been used to define building services plant noise emission limits at future residential receptors as part of the Proposed Development.

During the daytime and night-time, the combined building services plant noise emission contribution limit advised is 36 dB(A) and 28 dB(A) respectively, one metre from the nearest residential façade of the Proposed Development.

An assessment of the building envelope acoustic performance is provided with the minimum level difference (D) in accordance with the internal ambient noise levels stated within BS 8233 and BB 93. The ventilation strategy should allow for the full mechanical ventilation of all spaces as the level differences required are above those achievable by simple means of natural ventilation.

Notional glazing requirements for various internal spaces and indicative primary glazing configurations have been provided however, it should be noted that these performances are for guidance purposes only. Detailed calculations will be required to be undertaken to determine refined glazing requirements during subsequent design stages of the project.

The building services design is conceptual at this stage and as such, it has not been possible to conduct an assessment of noise. However, it is confirmed that all building services plant will be controlled via appropriate mitigation measures such that the defined noise emission limits will be achieved at the nearest residential receivers.

An assessment of noise associated with the proposed MUGA and 3G sports pitch has been undertaken. The assessment confirms that the proposed façade treatment and ventilation strategy will be sufficient to reduce noise associated with the MUGA and sports pitch to an appropriate level. Whilst not required to reduce the noise impact of the MUGA and sports pitch, a commitment has been made to include the following mitigation measures which will further reduce the noise impact:

- A weld mesh (twin bar super rebound fence) with EPDM rubber inserts and fixings to reduce rattle and ball impact noise during play;
- A maintenance scheme to prevent deterioration in performance of the sports facilities that could result from damaged panels, loose brackets, worn AV bushing and squeaky gates; and
- A 2.5m acoustic barrier along the western and northern boundary of the sports pitch.

The guidance provided within this report meets the requirements of the London Borough of Richmond upon Thames.

10. References.

1. *National Planning Policy Framework, Department for Communities and Local Government, July 2021.*

2. *BS 4142: 2014 + A1: 2019: 'Method for rating and assessing industrial and commercial sound'.*

3. *BS 8233: 2014, "Guidance on Sound Insulation and Noise Reduction for Buildings", BSI.*

4. *World Health Organisation (WHO) - Environmental Noise Guidelines for the European Region, 2018.*

5. *BS 8233: 1999, 'Sound Insulation and Noise Reduction for Buildings - Code of Practice'.*

6. Department for Education and Skills. *Building Bulleting 93, Acoustic Design of Schools.*

7. *ISO 10140-2: 2010, "Acoustics - Laboratory Measurement of Sound Insulation of Building Elements. Part 2: Measurement of Airborne Sound Insulation.".*

Appendix A – Acoustic terminology.

Sound
Sound is produced by mechanical vibration of a surface, which sets up rapid pressure fluctuations in the surrounding air.

The Sound Pressure
The Sound Pressure is the force (N) of sound on a surface area (m2) perpendicular to the direction of the sound. The SI-units for the Sound Pressure are Nm-2 or Pa (Pascal).

Sound is measured with microphones responding proportionally to the sound pressure – p. The power is proportional to the square of the sound pressure.

The Sound Pressure Level
The human ear has an approximately logarithmic response to sound pressure over a very large dynamic range. The lowest audible sound pressure approximately 2 x 10-5 Pa (2 ten billionths of an atmosphere) and the highest is approximately 100 Pa.

It is therefore convenient to express the sound pressure as a logarithmic decibel scale related to this lowest human audible sound, where:

$$L_p = 10\ \log\left(\frac{p^2}{p_{ref}^2}\right) = 10\ \log\left(\frac{p}{p_{ref}}\right)^2 = 20\ \log\left(\frac{p}{p_{ref}}\right)$$

Where: L_p *= sound pressure level (dB)*

p *= sound pressure (Pa)*

p_{ref} *= 2 x 10-5 – reference sound pressure (Pa)*

In accordance with the logarithmic scale, doubling the sound pressure level gives an increase of 6 dB.

Decibel (dB)
The decibel is the unit used to quantify sound pressure levels as well as sound intensity and power levels.

In accordance with the logarithmic scale, an increase of 10 dB in sound pressure level is equivalent to an increase by a factor of 10 in the sound pressure level (measured in Pa). Subjectively, this increase would correspond to a doubling of the perceived loudness of the sound.

Sound Pressure Level of Some Common Sources
An indication of the range of sound levels commonly found in the environment is given in the following Table.

Source	Sound Pressure Level dB
Threshold of Hearing	0
Rustling Leaves	20
Quiet Whisper	30
Home	40
Quiet Street	50
Conversation	60
Inside a Car	70
Loud Singing	80
Motorcycle (10m)	90
Lawn Mower (1m)	100
Diesel Truck (1m)	110
Amplified Music (1m)	120
Jet Plane (1m)	130

Frequency
The rate at which the pressure fluctuations occur determines the pitch or frequency of the sound. The frequency is expressed in Hertz (Hz) or cycles per second.

Octave and Third Octave Bands
An octave is the interval between two points where the frequency at the second point is twice the frequency of the first.

There are many methods of describing the frequency content of a noise. The most common methods split the frequency range into defined bands, in which the mid-frequency is used as the band descriptor and in the case of octave bands is double that of the band lower. For example, two adjacent octave bands are 250 Hz and 500 Hz.

Third octave bands provided a fine resolution by dividing each octave band into three bands. For examples, third octave bands would be 160 Hz, 250 Hz and 315 Hz for the same 250 Hz octave band.

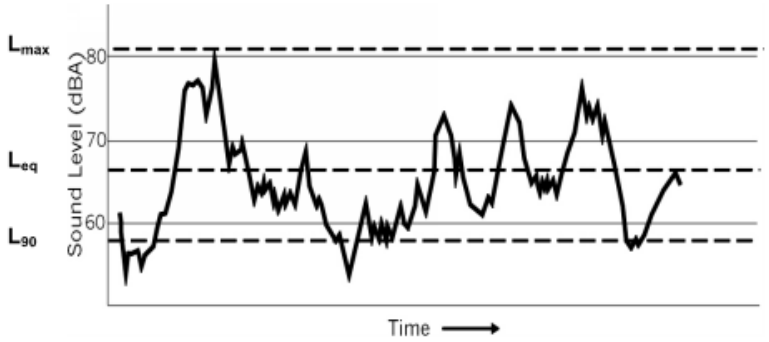
The human ear is sensitive to sound over a range of frequencies between approximately 20 Hz to 20 kHz and is generally more sensitive to medium and high frequency than to low frequencies within the range. This is the basis of the A-weighting.

A-Weighting
The A-weighting is a correction term applied to the frequency range in order to mimic the sensitivity of the human ear to noise. It is generally used to obtain an overall noise level from octave or third octave band frequencies.

An A weighted value would be written as dB(A), or including A within the parameter term.

Noise Units
In order to assess environmental noise, measurements are carried out by sampling over specific periods of time, such as five minutes, the statistically determined results being used to quantify various aspects of the noise.

The figure below shows an example of sound level varying with time. Because of this time variation the same period of noise can be described by several different levels. The most common of these are described below.



$L_{eq,T}$
The $L_{eq,T}$ is a parameter defined as the equivalent continuous sound pressure level over a defined time period 'T'. It is the sound pressure level equivalent to the acoustic energy of the fluctuating sound signal.

The $L_{eq,T}$ can be thought of as an 'average' sound pressure level over a given time period (although it is not an arithmetic average). Typically the $L_{eq,T}$ will be an A-weighted noise level in dB(A) and is commonly used to describe all types of environmental noise sources.

$L_{01,T}$
The $L_{01,T}$ is a parameter defined as the sound pressure level exceeded for 1% of the measurement period 'T'.

It is a statistical parameter and cannot be directly combined to other acoustic parameter.

$L_{10,T}$
The $L_{10,T}$ is a parameter defined as the sound pressure level exceeded for 10% of the measurement period 'T'.

It is a statistical parameter and cannot be directly combined to other acoustic parameter and is generally used to describe road traffic noise.

$L_{90,T}$
The $L_{90,T}$ is a parameter defined as the sound pressure level exceeded for 90% of the measurement period 'T'.

It is a statistical parameter and cannot be directly combined to other acoustic parameter and is generally used to describe the prevailing background noise level.

$L_{max,T}$
The $L_{max,T}$ is a parameter defined as the maximum noise level measured during the specified period 'T'.

Specific Noise Level, $L_{Aeq,Tr}$.
This is the equivalent continuous A-weighted sound pressure level at the assessment position due to a specific noise source operating over a given time interval.

Free Field
A measurement taken in the free field is at least 3.5m from reflecting vertical surfaces and 1.2m from the ground.

Façade
A measurement is influenced by the reflection of sound from the façade of a building within 3.5m. A façade measurement is made 1m in front of the vertical building surface.

R_w
A single-number quantity which characterizes the airborne sound insulation of a material or building element in the laboratory. See BS EN ISO 717-1: 1997.

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