ENERGY & OVERHEATING RISK STATEMENT

8 Gloucester Gate

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EXECUTIVE SUMMARY

The energy and overheating mitigation strategy for the 8 Gloucester Gate development has been developed in line with the energy policies of the London Plan and of the London Borough of the Camden Local Plan for minor developments. The proposals incorporate a range of measures for effective adaptation of the development to climate change, in relation to energy use and overheating risk.

This report assesses the predicted energy performance and overheating risk of the proposed development at 8 Gloucester Gate, a Grade I listed townhouse of 'exceptional interest', located on the boundary of Regent's Park in the London Borough of Camden.

The proposed development comprises the refurbishment and renovation of the existing Main House consisting of five floors with a new courtyard extension. This will replace the existing Closet Wing that connects 8 Gloucester Gate and 8 Gloucester Gate Mews at the back, presumably built in the 1800s.

This document is divided into three parts:

1. Planning Policies;
2. Energy Assessment;
3. Overheating Risk Assessment.

The Planning Policy section provides an overview of the site and planning policies applicable to this development in accordance with the London Borough of Camden Local Plan 2017 and the London Plan 2021, relating to energy and overheating risk. The proposed development is a minor application therefore some policies are not applicable, but the development aims to maximise the application of sustainability measures.

Since the proposals at 8 Gloucester Gate is a 'minor' development, it would not be required to meet the zero carbon London Plan target. However, the Energy Hierarchy will be applied where possible, to promote zero carbon development by reducing carbon dioxide emissions as far as possible.

It will also be ensured that latest Building Regulations Part L 2021 requirements will be met as part of the energy strategy. The proposed development is shown to exceed Part L 2021 for extensions, based on U-values of the building fabric.

The London Plan Cooling Hierarchy has been applied to the development to reduce the risk of dwelling overheating. Since it is not a new build dwelling, Part O Building Regulations are not applicable, however an overheating risk assessment following CIBSE TM59 was conducted for the habitable spaces of the Main House, Closet Wing and Mews to assess thermal comfort. The analysis outlines proposed measures to mitigate overheating risk and adapt to climate change.

Key energy and overheating risk measures include:

- Energy strategy comprising efficient fabric U-values exceeding Part L 2021 standards;
- Highly efficient LED lighting as well as appropriate controls are also proposed to further reduce the regulated energy demand and consumption of the development;
- The proposed extension achieves a betterment in space heating demand against a notional Part L compliant extension;
- Overheating risk will be mitigated using passive design principles, including natural ventilation and solar control glazing;
- Since the Grade I listed status of the Main House limits opportunities to mitigate overheating risk, comfort cooling would be beneficial for the following habitable spaces, to meet CIBSE TM59 criteria under the DSY1 weather scenario:
    - Master Bedroom;
    - Bedrooms 2, 3, 4, 5;
    - Reception Room;
- To meet CIBSE TM59 criteria for DSY2&3 future weather scenarios, comfort cooling would also be beneficial for the following habitable spaces:
    - Activity Room (Mews);
    - Study & Kitchen (Closet Wing).

The proposals, in their entirety, reflect the client and design team's aspirations in delivering a high-quality development that underpins the sustainability of the built environment.

INTRODUCTION

The proposed development located in Gloucester Gate is in close proximity to Regent's Park, within the London Borough of Camden. This section presents the description of the site and of the development proposal.

SITE & PROPOSAL

The site is located in 8 Gloucester Gate in the London Borough of Camden. It is on a private residential road in close proximity to Regent's Park, served by a number of local amenities and public transport facilities. It is part of a Regency terraced housing built in the 1800s and is a Grade I listed building.

The development comprises three structures: the existing main house, the existing mews located behind the main house and the proposed Closet Wing that will connect the two existing structures. The main house is five-storey terraced house with five bedrooms, reception and formal dining area. The mews comprises an activity area with toilet, bath and kitchenette on the ground floor and a two-car garage on the lower ground. The proposed Closet Wing extension is a three-storey structure comprising of a studio at basement level, a kitchen with dining area on the ground floor and a study on the first floor.

The location of the development site is shown in Figure 1 below.

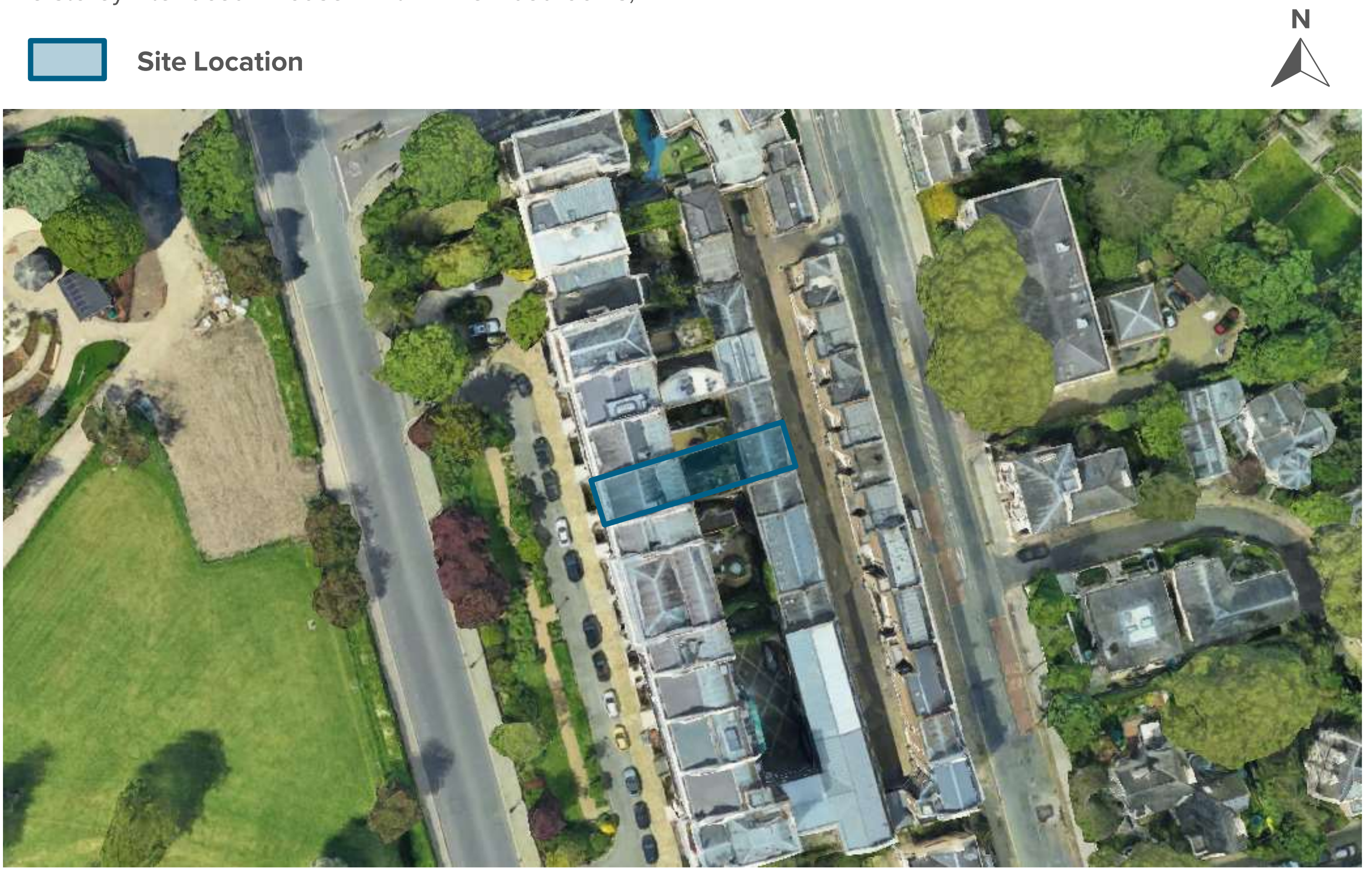

Figure 1: Location of the application site.

PROPOSED SCHEME

The proposed Closet Wing comprises a three-storey link building, with a curved façade facing onto the central courtyard of the existing dwelling.

The structure will comprise a studio at basement level, a kitchen with dining area on the ground floor and a study on the first floor.

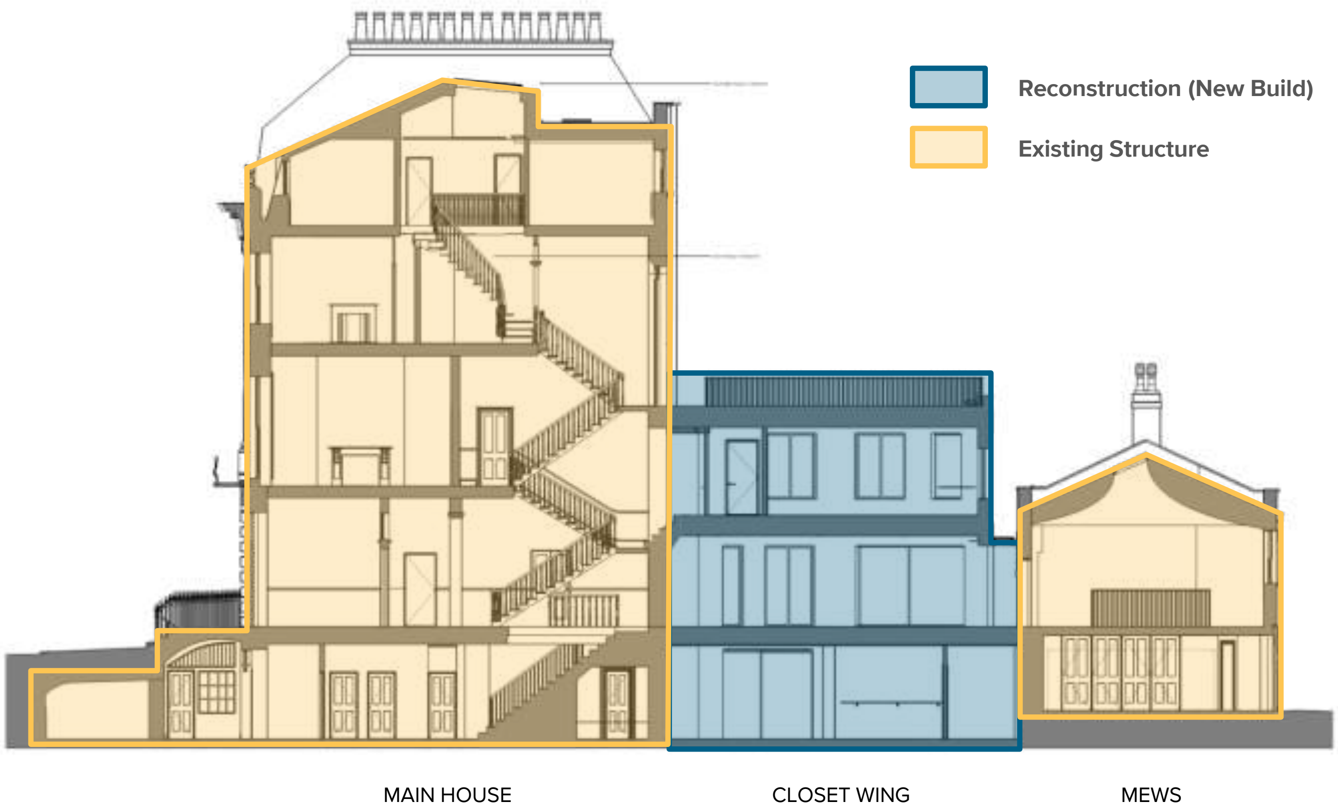

Figure 2: Section of 8 Gloucester Gate (courtesy of Dowen Farmer Architects)

PLANNING POLICIES

The proposal will seek to respond to the energy and overheating policies of the London Plan 2021 and of the policies within the Camden Local Plan 2017.

The most relevant applicable energy and overheating policies in the context of the proposed development are presented below. It should be noted that the proposed development is a minor application therefore some London Plan policies are not applicable, but the development aims to maximise the application of sustainability measures.

Furthermore, since the development comprises an extension of an existing dwelling, it is not expected that it will be required to meet the London Plan energy and carbon reduction requirements against new build Part L 2021 standards.

However, the London Plan's Energy Hierarchy has been followed in developing the energy strategy for the proposals in line with local plan guidance.

THE LONDON PLAN (2021)

The London Plan (2021) published 2nd March 2021 sets out the Mayor's overarching strategic spatial development strategy for greater London and underpins the planning framework from 2019 up to 2041. This document replaced the London Plan 2016.

The new Plan has a strong focus on energy and overheating with many new policies addressing the concern to deliver a zero carbon London.

Policy SI2 Minimising greenhouse gas emissions and Policy SI4 Managing heat risk are the key policies which address energy, carbon and overheating issues. These policies set out the requirements for major developments and therefore are not applicable to this minor development.

LOCAL BOROUGH POLICY

CAMDEN LOCAL PLAN (2017)

The Camden Local Plan, adopted in 2017, sets out the following policies: Policy CC1 is focused on Climate Change Mitigation, whilst Policy CC2 is focused on Adapting to Climate Change.

Policy CC1 promotes zero carbon developments by following the energy hierarchy to reduce operational carbon emissions, whilst Policy CC2 encourages the adoption of measures to reduce overheating risk, surface water runoff and incorporate biodiversity where possible.

POLICY CC1 CLIMATE CHANGE MITIGATION

This policy requires:

a. promote zero carbon development and require all development to reduce carbon dioxide emissions through following the steps in the energy hierarchy;
b. require all major development to demonstrate how London Plan targets for carbon dioxide emissions have been met;
c. ensure that the location of development and mix of land uses minimise the need to travel by car and help to support decentralised energy networks;
d. support and encourage sensitive energy efficiency improvements to existing buildings;
e. require all proposals that involve substantial demolition to demonstrate that it is not possible to retain and improve the existing building; and
f. expect all developments to optimise resource efficiency

POLICY CC2 ADAPTING TO CLIMATE CHANGE

This policy requires:

a. the protection of existing green spaces and promoting new appropriate green infrastructure;
b. not increasing, and wherever possible reducing, surface water runoff through increasing permeable surfaces and use of Sustainable Drainage Systems;

c. incorporating bio-diverse roofs, combination green and blue roofs and green walls where appropriate; and d. measures to reduce the impact of urban and dwelling overheating, including application of the cooling hierarchy.

DRAFT NEW CAMDEN LOCAL PLAN (2024)

The Council consulted on the draft new Local Plan between 17th January and 13th March 2024. The draft Local Plan sets out the Council's vision for development over the next 15 years and incorporates significant updates to sustainability policies.

Whilst not currently applicable, the team have considered these policies during the design process to ensure optimal energy efficiency and reduced overheating risk despite site constraints.

The key policies that would be relevant to energy and overheating risk at 8 Gloucester Gate are as follows:

POLICY CC1 RESPONDING TO THE CLIMATE EMERGENCY

A. The Council will prioritise the provision of measures to mitigate and adapt to climate change and require all development in Camden to respond to the climate emergency by:
   - i. Supporting the retrofitting of existing buildings to make them more energy efficient and reduce the energy needed to occupy the building;
   - ii. Prioritising and enabling the repurposing and re-use of existing buildings over demolition;
   - iii. Following circular economy principles, minimising waste and increasing re-use;
   - iv. Reducing whole life carbon emissions, by taking a whole life carbon approach, considering both embodied carbon and operational carbon;
   - v. Being designed and constructed to be net zero carbon in operation;
   - vi. Utilising low carbon technologies and maximising opportunities for renewable energy generation, and heat networks;
   - vii. Being designed to be resilient to climate change and meet the highest standards of sustainable design and construction;
   - viii. Minimising the risk of overheating through design and avoiding reliance on air conditioning;
   - ix. Improving water efficiency;
   - x. Minimising and avoiding the risk of flooding from all sources, and incorporating multifunctional Sustainable Urban Drainage Systems (SuDS) to reduce surface water run-off;
   - xi. Protecting and enhancing existing green spaces and water sources, enhancing biodiversity, strengthening nature recovery and providing multi-functional green infrastructure; and
   - xii. Prioritising sustainable transport.

POLICY CC5 - ENERGY REDUCTION IN EXISTING BUILDINGS

A. The Council will support adaptations and improvements to existing buildings to make them more energy efficient and reduce the energy needed to occupy the building. The Council will:
   - i. Require all development proposals for the alteration, extension and/or conversion of an existing building (including where an element of demolition is proposed) to demonstrate how they have considered and will implement energy efficient improvements. This should be detailed in the Sustainability Statement.
   - ii. Expect energy efficient improvements to be made appropriate to the scale or nature of the proposal.
   - iii. Expect energy demand in the part of the building being altered/ extended and/ or converted, to primarily be reduced through improvements to the building fabric. These improvements should comply with the U values set out in Table 6 in the supporting text below.
   - iv. Require proposals that include the addition or replacement of 500sqm floorspace or more; or developments providing one or more additional

dwellings through conversion and / or additional floorspace to:

a. reduce the amount of energy required to heat the building/s over a year, as far as possible, to meet a space heating demand of 50 kwh/m2/ year. Proposals within a conservation area or related to a listed building may be provided an additional allowance of 10 - 20 kWh/m2 where it is demonstrated to the Council's satisfaction that the above target of 50 kwh/m2/year cannot be met;
b. be fossil fuel-free, and use low carbon heat;
c. demonstrate to the Council's satisfaction that it has maximised the generation of renewable energy on-site (through solar photovoltaics (PV), as far as practical; and
d. Submit an energy statement to demonstrate how the proposal complies with the criteria above.

v. Encourage all other proposals for the alteration, extension and/or conversion of an existing building (not specified in A(iv)) to also meet the standards set out in A(iv) a, b, c and d above.

vi. Require proposals that include substantial demolition but retain part of the building to use as little energy as possible and meet an Energy Use Intensity target of 50 kWh/m2/year for residential uses. In instances where minimal existing built fabric is retained (i.e. basement; foundations; a façade; small part of the superstructure) the Council will require the development to meet all energy reduction criteria for new buildings set out in Policy CC6.

POLICY CC8 - OVERHEATING AND COOLING

A. The Council will ensure that development is designed to minimise overheating and promote cooling. The Council will:

i. Support proposals which seek to adapt and improve existing buildings, to improve ventilation, and address overheating and promote cooling, where they are in accordance with the other policies in this Plan.

ii. Require all development to minimise the adverse impacts of overheating through the application of the London Plan cooling hierarchy. Applicants should include information demonstrating that the risk of overheating has been mitigated through the incorporation of design measures in the Sustainability Statement.

iii. Resist applications that include active cooling (air conditioning) and nonessential mechanical plant. Applications for new build development that include active cooling will only be permitted where dynamic thermal modelling demonstrates there is a clear need for it and other passive measures have been integrated into the development. Applications for existing non-residential buildings will need to demonstrate there is a clear need for additional, or replacement, active cooling equipment and that other passive measures have been integrated. Where need is demonstrated to the Council's satisfaction, the Council will also require the carbon used to operate the system to be offset through the installation of solar photovoltaics.

iv. Require applicants to incorporate measures to cool buildings through the use of materials and finishes. The Council will expect materials and finishes to have the ability to reflect sunlight.

v. Require applicants to incorporate measures to cool the spaces around and between buildings using appropriate materials, finishes, and greening. Trees should provide adequate canopy cover for greater cooling effect.

ENERGY ASSESSMENT

The energy strategy for the 8 Gloucester Gate has been developed in line with the energy policies of the London Plan and of the London Borough of Camden policies. This section of the report presents the key elements of the proposal regarding the energy efficiency and carbon emissions of the proposed Closet Wing extension. The estimated regulated CO_2 savings on site is 4.7% against a Part L 2021 and existing buildings compliant scheme with SAP10.2 carbon factors.

OVERVIEW

This report assesses the predicted energy performance and carbon dioxide emissions of the proposed development at 8 Gloucester Gate, located in the London Borough of Camden.

The development comprises three structures: the existing main house, the existing mews located behind the main house and the proposed Closet Wing that will connect the two existing structures. The main house is five-storey terraced house with five bedrooms, reception and formal dining area. The mews comprises a studio and a two-car garage below. Both structures were built in the 1800s. The proposed Closet Wing extension is a three-storey structure comprising of a gym/studio at basement level, a kitchen with dining area on the ground floor and a study on the first floor.

The energy strategy outlined in this report has been undertaken using the latest Building Regulations Part L 2021 methodology and SAP 10.2 emissions factors as per current GLA Guidance. These carbon emission factors reflect the grid decarbonisation of recent years and ensure that the assessment of new developments better reflect the actual carbon emissions associated with their expected operation.

Since the proposals at 8 Gloucester Gate is a 'minor' development, it would not be required to meet the zero carbon London Plan target. However, the Energy Hierarchy has been followed to promote zero carbon development by reducing carbon dioxide emissions as far as possible.

METHODOLOGY

SAP calculations have been carried out to demonstrate compliance with Part L 2021 Building Regulations for an extension to an existing dwelling, which represent stringent energy and carbon targets. The energy strategy for the scheme and on-site carbon savings is in line with the GLA's *Guidance on preparing energy assessments* and is as follows:

The **baseline** CO_2 emissions are first established, i.e. the emissions of a scheme that is compliant with Part L 2021 of the Building Regulations (for new build elements) and existing buildings baseline.

The software used to model and calculate the energy performance and carbon emissions is Elmhurst Design SAP10. The emissions are established by modelling the whole development and multiplying the Target Emission Rate (TER) with the total floor area to establish the total emissions.

The same approach is followed to determine the energy performance and CO_2 emissions of the proposed scheme for each of the steps of the Energy Hierarchy. The CO_2 emissions are estimated based on the SAP Dwelling Emission Rate (DER).

The consecutive steps of the Energy Hierarchy are:

- Be Lean – Use less energy;
- Be Clean – Supply energy efficiently;
- Be Green – Use renewable energy.

The Conclusions section summarises the energy strategy and associated carbon savings for the proposed development.

BE LEAN – USE LESS ENERGY

This stage involves reducing the demand for energy through a range of passive and active energy efficiency measures.

The energy efficiency measures for the proposed development include levels of insulation beyond Building Regulations requirements and use efficient lighting, utilisation of natural light, and installation of a more efficient ventilation and heating system.

PASSIVE DESIGN MEASURES

ENHANCED U-VALUES

The heat loss of different building fabric elements is dependent upon their U-value. A building with low U-values provides better levels of insulation and reduced heating demand during the cooler months.

The proposed Closet Wing extension will incorporate high levels of insulation and high performance triple-glazing beyond Part L 2021 minimum requirements and notional building specifications, in order to reduce the demand for space heating. Target U-values for this element of the development are shown in Table 1.

Table 1: U-values for Closet Wing

Closet Wing targets (U-values in W/m².K)			
Element	**Building Regulations**	**Proposed**	**Improvement**
Wall	0.18	0.15	17%
Floor	0.18	0.10	44%
Roof	0.15	0.10	33%
New Glazing	1.4	0.80	43%

Furthermore, upgrades to the existing dwelling thermal elements are proposed where it is deemed feasible to do so, with consideration to the Grade I Listed Building status. Proposals to upgrade insulation and windows for the Main House consider the heritage value and other constraints.

Replacement windows in the Mews and Main House will prioritise high-performance double glazing. The new exposed floor of the mews and roof of the mews and the main house will aim to maximise thermal performance, as indicated within Table 2. Figure 3 and 4 indicate portions of the house external envelope that are proposed to be upgraded or replaced.

Table 2: U-values for new elements within Existing Dwelling

Existing Dwelling targets (U-values in W/m².K)			
Element	**Building Regulations**	**Proposed**	**Improvement**
Floor	0.18	0.15	17%
Roof	0.15	0.10	33%
Replaced Glazing	1.4	1.20	14%
Roof Light	2.2	1.20	45%

Where fabric upgrades are not possible, assumptions of existing thermal performance/U-values have been used in both notional and proposed calculations.

ACTIVE DESIGN MEASURES

HIGH EFFICACY LIGHTING

The development intends to incorporate low energy lighting fittings throughout. All light fittings will be specified as low energy lighting and will accommodate LED or compact fluorescent (CFLs) only.

REDUCING THE NEED FOR ARTIFICIAL LIGHTING

The development has been designed to maximise daylight in all habitable spaces as a way of improving the health and wellbeing of its occupants. All habitable areas will benefit from large areas of glazing to increase the amount of daylight within the internal spaces where possible. This is expected to reduce the need for artificial lighting whilst delivering pleasant, healthy spaces for occupants.

LOW-ENERGY EXTRACT FANS

The development will have low energy extract fans throughout the dwelling, including the kitchen, all bathrooms, and the sauna. Modern fans use less energy and contribute less heat loss. Additionally, the motors operate with less noise compared with older fans, also indicating a more efficient utilisation of energy to achieve the same airflow.

EFFICIENT HEATING SYSTEM

The proposed development will have a more efficient condensing boiler, aiming for a seasonal efficiency of at least 92%, to replace the existing boiler to provide heating and domestic hot water for the whole dwelling, via an LTHW circuit serving an underfloor system and radiators.

Figure 3: Floor plan showing building fabric improvements (courtesy of Dowen Farmer Architects).

Figure 4: Section showing building fabric improvements (courtesy of Dowen Farmer Architects).

BE CLEAN – SUPPLY ENERGY EFFICIENTLY

This stage involves using an efficient decentralised energy source to supply as much of the remaining energy demand as possible (e.g. by connecting to a district energy network or developing a site-wide CHP network).

There is no district heating network available in the local vicinity of the development and given the scale of the proposal it would not be suitable to warrant a connection to such a network, therefore, it was not found feasible to incorporate the supply of decentralised low carbon heating. Therefore, no carbon savings are achieved for this step of the Energy Hierarchy.

BE GREEN – USE RENEWABLE ENERGY

This stage involves incorporating of renewable technologies to offset part of the carbon emissions of the development. The uptake of renewable technologies is based on feasibility and viability considerations, including their compatibility with the energy system determined in the previous step.

The provision of PVs and air source heat pumps on the Closet Wing roof has been considered; however, it is not currently proposed due to visual impacts associated with the Grade I Listed Building status of the development.

RESULTS

It was found that the efficient building fabric of the proposed extension reduced the heating demand of the dwelling, by preventing increased heat loss. This demonstrated improved energy, carbon, and fabric efficiency in comparison with a ‘notional’ Part L compliant extension.

The SAP calculation results for the ‘notional’ and ‘proposed’ extension are shown in Table 3, demonstrating compliance with Part L 2021. Please note that results are shown for the existing dwelling plus the respective proposed extension models.

Table 3: SAP Energy Assessment Results

SAP Results			
	Dwelling Emission Rate ($kgCO_2/m^2/yr$)	**Dwelling Fabric Energy Efficiency ($kWh/m^2/yr$)**	**Dwelling Primary Energy Rate ($kWh/m^2/yr$)**
Notional (Part L 2021 compliant)	28.36	125.44	153.42
Proposed Extension	27.02	122.13	14.11
Saving (%)	4.7	2.6	4.8

A saving of 4.7% in carbon emissions and 2.6% in fabric energy efficiency against a compliant ‘notional’ dwelling including the extension is achieved. This demonstrates an improvement beyond already challenging Part L 2021 standards and target U-values.

It should be noted that the energy and carbon emissions from a potential comfort cooling system for future weather overheating risk mitigation has not been included within the calculations. In such a case, the system will be required to meet system specific guidance outlined within the Approved Document L.

OVERHEATING RISK ASSESSMENT

The existing Main House and Mews and the proposed Closet Wing have been assessed against CIBSE TM59 recommended criteria for domestic habitable spaces. Solar control measures such as low g-value glazing, and night ventilation are recommended measures to minimise overheating risk as far as possible to reduce annual overheating hours.

SUMMARY

The whole development has been modelled using thermal dynamic simulation software IES VE to assess the potential risk of overheating, to test the design of the proposed scheme and mitigate overheating risk as far as possible. This will ensure the comfort of the occupants as well as future-proof the scheme by taking into account projected increased ambient air temperatures from climate change.

In order to assess the thermal performance of the development, models were constructed within thermal simulation software. The internal temperature, lighting and ventilation conditions were estimated for the internal spaces. The proposed building has been assessed using London Weather Centre DSY1 weather data for the 2020s, based on a high emissions scenario of 50%.

With the aim of giving the most robust consideration, performance of the space was compared with CIBSE Technical Memorandum 59 performance recommendations. These are rigorous targets that determine the acceptability of overheating based on the temperature differential between the internal and the external environment (ΔT), considering the frequency of high temperature difference beyond which the level of overheating is considered unacceptable.

The overheating strategy uses passive measures to mitigate risk as far as possible, including natural ventilation, low g-value glazing, and night ventilation.

The thermal simulations indicate the following:

- Fully opening windows in the daytime allow air flow and prevent heat build-up when indoor temperatures are higher than outdoors.
- Solar control measure such as low-g-value for new windows in the Closet Wing and the Mews was identified as one of the effective passive measures to mitigate overheating risk.
- The inclusion of night ventilation while considering security in the bedrooms as part of the overheating risk strategy can reduce overheating hours but not enough to meet CIBSE TM59 criteria.
- Due to limited opportunities to retrofit the existing building spaces with overheating mitigation measures because of the Grade I Listed status, comfort cooling would need to be installed to achieve present and future occupant thermal comfort levels in habitable spaces, especially for the bedrooms.

METHODOLOGY

3D thermal models of the whole residence have been developed as shown in Figures 5 and 6, based on the planning architectural drawings.

The overheating risks of all habitable spaces were assessed for current and future climate scenarios. Although there are no planning or regulatory requirements to assess existing buildings for overheating risk, the habitable spaces in the existing portion of the house have also been assessed against CIBSE TM59 criteria to test thermal comfort levels.

Following the methodology set out in CIBSE TM59, the following Design Summer Years for London were selected to form the set of probabilistic future weather scenarios:

- DSY1 (1989) for the 2020s, high emissions, 50% percentile scenario;
- DSY2 (2003) for the 2020s, high emissions, 50% percentile scenario;
- DSY3 (1976) for the 2020s, high emissions, 50% percentile scenario

These files are climate-change adjusted versions of the current DSY. The first of these years, 1989, is the current DSY and represents a moderately warm summer, as is interpreted in current CIBSE guidance. The years 1976 and 2003 were chosen as more extreme years with different types of summer: the former is a year with a long period of persistent warmth, whereas the latter has a more intense single warm spell. The 2020 period is of particular interest as this relates to the period 2011-2040, which is the period we have now entered. The 50% percentile changes may be viewed as the 'best guess' level of change.

The buildings have been modelled using dynamic thermal simulation software which is fully compliant with CIBSE Applications Manual AM11. The software can compute operative temperatures using CIBSE weather data sets, building fabric specification, window areas and opening, all aspects of solar and internal gains as well as natural ventilation flows within buildings. Compliance of the new and existing portions of the house with the CIBSE TM59 criteria has been sought and recommendations are formulated to future-proof the design for further interventions in the future.

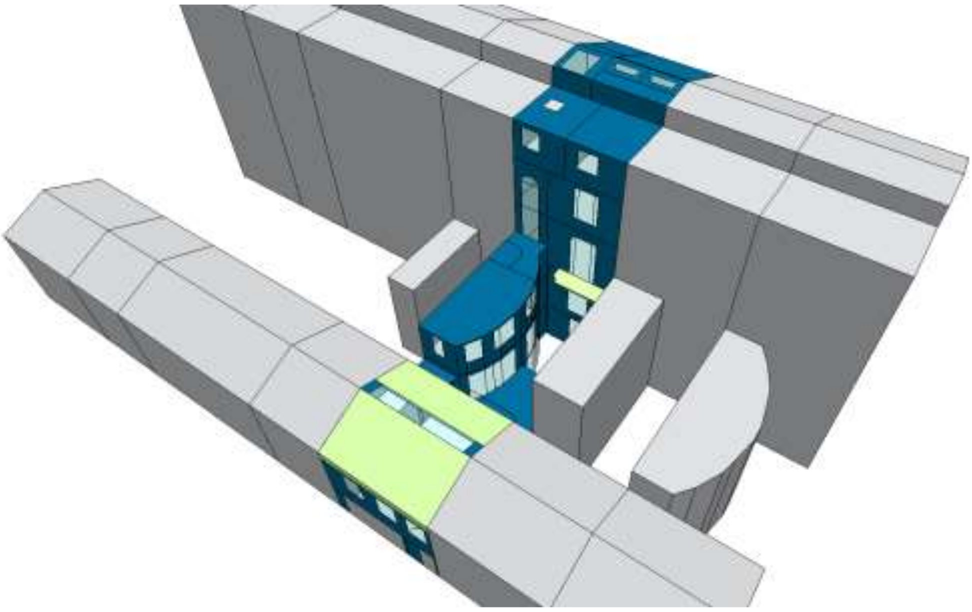

Figure 5: An axonometric view of the 8 Gloucester Gate, showing north and east elevations.

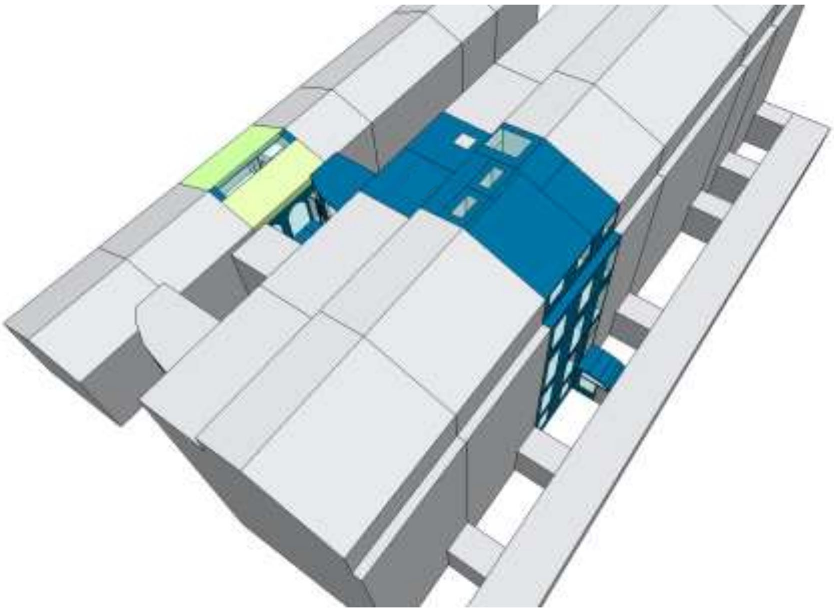

Figure 6: An axonometric view of the 8 Gloucester Gate, showing north and west elevations.

ASSESSMENT CRITERIA

The performance standards set out within CIBSE TM59 have been used to assess the overheating risk within the proposed development. CIBSE TM59 recommends the following assessment criteria for overheating risk in habitable spaces:

1. **For living rooms, kitchens and bedrooms:** the number of hours during which ΔT is greater than or equal to one degree (K) during the period May to September inclusive shall not be more than 3% of occupied hours.

2. **For bedrooms only:** to guarantee comfort during the sleeping hours the operative temperature in the bedroom from 10 pm to 7 am shall not exceed 26°C for more than 1% of annual hours (< 32 hours).

MODELLING ASSUMPTIONS

FABRIC PERFORMANCE

The specification of the fabric is aligned with the proposals at planning stage as outlined in the energy section of this report.

For the existing structure, building fabric u-values were based on Reduced Data SAP for existing dwellings (Appendix S), under Age Band A. The u-value of 4.8 and solar transmittance of 0.85 for the existing single glazed windows were taken from Table S14. In the absence of documentary evidence for the existing windows, this was deemed a reasonable estimate.

For the new-build portion, base assumptions were identified as specified below:

Table 4: Building fabric base assumptions for New Build.

Element	Specification
	U-Value [W/m².K]
Wall	0.15
Floor	0.10
Roof	0.10
Windows & Doors	0.80
Glazing g-value	0.63

OCCUPANCY

The TM59 methodology specifies the hours during which spaces are anticipated to be occupied and these have been used within the overheating assessment calculations. Table 5 sets out the predicted occupancy patterns for the assessed space in line with the TM59 requirements; these are programmed into the dynamic software model to calculate the relative occupancy gains for the designated spaces. The assumption for the number of occupants in the gym/studio and study were based on the expected occupancy of these spaces indicated by the planning architectural drawings, while the kitchen assumed a worst-case scenario of a maximum occupancy of five people.

Table 5: Occupancy assumptions.

Key Areas	TM59 Predicted occupation pattern
Main House	
Master Bedroom, Bedroom 2, Bedroom 4 and Bedroom 5	Double Bedroom
Bedroom 3	Single Bedroom
Reception and Sitting Room	5-bedroom apartment: living room
Closet Wing	
Gym/Studio and Study	2-bedroom apartment: living room
Kitchen	5-bedroom apartment: living & kitchen
Mews	
Activity Area	5-bedroom apartment: living room

INTERNAL GAINS

Similar to the predicted occupancy hours, the internal gains (lighting, equipment, people) for occupied areas are incorporated within the model in line with the guidance set out in TM59.

Table 6 sets out the internal gains assumed for each key area. This has been modelled based on the typical internal gains for living rooms and kitchens as specified within the TM59 methodology.

Table 6: Internal Gains modelled for each key area.

Area	Predicted Internal Gains		
	Lighting [W/m²]	People [peak W]	Equipment [peak W]
Main House			
Master Bedroom, Bedroom 2, Bedroom 4 and Bedroom 5	2.0	150.0	80
Bedroom 3	2.0	75.0	80
Reception and Sitting room	2.0	281.25	150
Closet Wing			
Gym/Studio and Study	2.0	112.5	150.0
Kitchen	2.0	93.75	450.0
Mews			
Activity area	2.0	375	150

VENTILATION

Natural ventilation is possible through the series of windows along the curved wall of the Closet Wing to allow air flow and alleviate heat buildup during periods of hot weather.

The assumptions on the window type, operation, and free area for each room summarized in Table 7 and shown in Figures 7 to 9 were modelled.

Table 7: Opening types modelled for each room.

Area	Opening Type	
	Opening Category	Openable Area %
Main House		
Master Bedroom	Sash window	50
Bedroom 2	Sash window	50
Bedroom 3	Sash window	50
Bedroom 4	Side-hung window	90
Bedroom 5	Sash window	50
Reception	Sash window	50
Sitting Room	Sash window	50
Closet Wing		
Gym/Studio	Sliding door*	90
Kitchen	Sliding door*	90
Study	Side hung window	90
Mews		
Activity Area	Side hung door	90
	Sash window	50

**Indicated openable area for sliding operation only accounts the movable portion.*

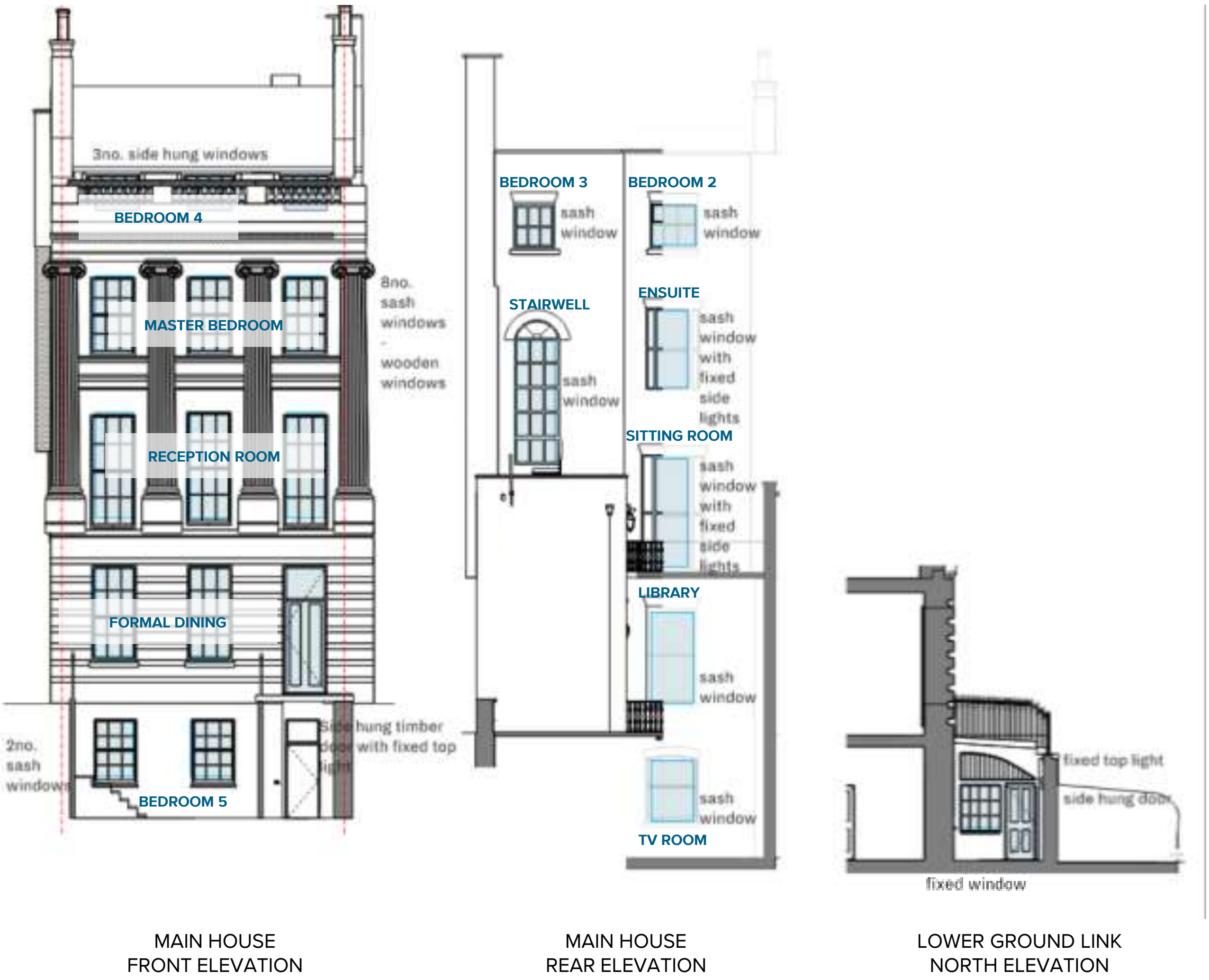

Figure 7: Opening type designation per area – Main House (courtesy of Dowen Farmer Architects).

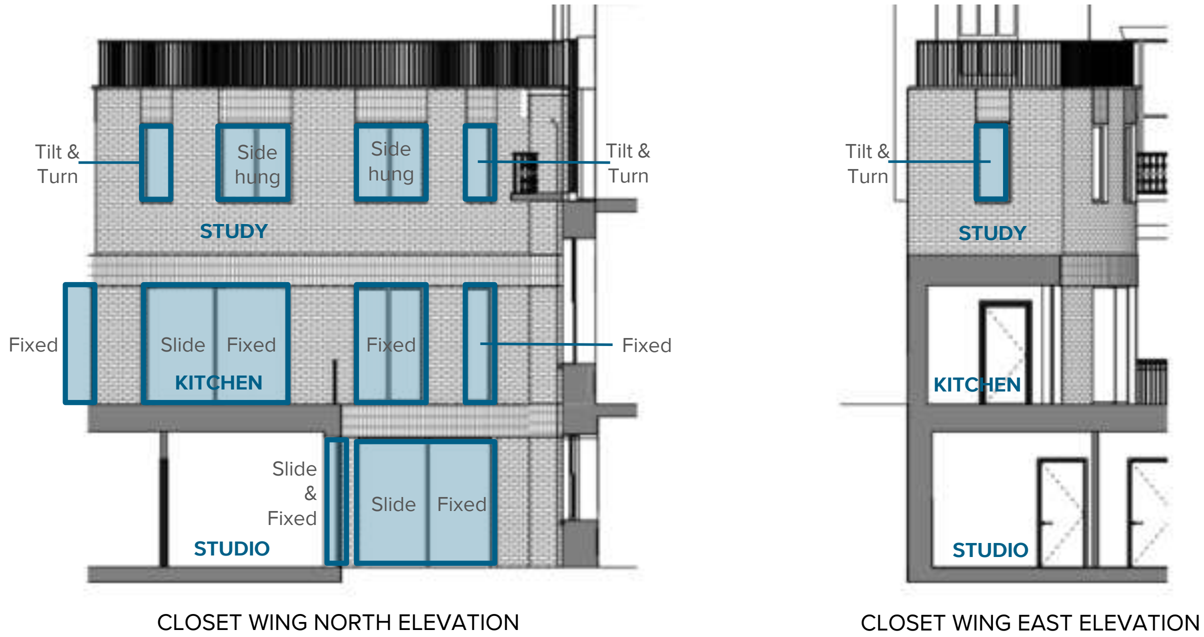

Figure 8. Opening type designation per area - Closet Wing (courtesy of Dowen Farmer Architects).

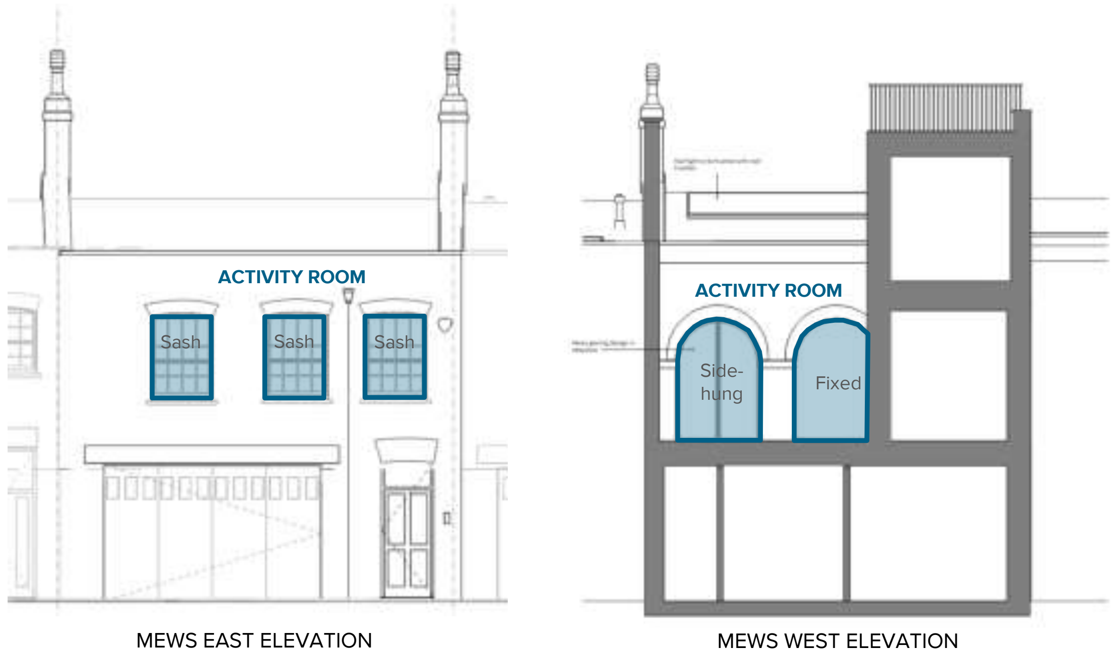

Figure 9. Opening type designation per area – Mews (courtesy of Dowen Farmer Architects).

RESULTS

This section presents the results summary for each of the tests carried out for the existing and new build portions of the proposed development.

EXISTING STRUCTURES

The habitable spaces within the existing structures (Main House and Mews) include 5 bedrooms and 3 living rooms.

Table 10 and Figure 10 shows the overheating risks of these spaces for London Weather Centre DSY1 weather data, and how each compare against CIBSE TM59 criteria.

The improvement measures tested were identified to minimise the annual overheating hours to the extent possible while taking into consideration night-time security and constraints relevant to a Grade I listed building.

The following observations can be made from the results:

- The spaces with the highest risk of overheating are those that are facing west. Their heritage windows are not excessively sized and allow good levels of free area for ventilation. However, these are single glazed and therefore have a high solar transmittance factor, which leads to overheating through solar gains.
- The inclusion of night ventilation by opening of the windows improved diurnal thermal conditions but not enough to meet TM59 Criterion 2 target for bedrooms as shown in Figure 11. This is under the assumption that nighttime openings will be limited to 10% free area for security considerations.

Table 8: Overheating assessment results of habitable spaces within the existing structure for London Weather Centre DSY1, 2020s, high emissions, 50% percentile scenario

ID	Design change	Bedrooms	KLDs	g-value	Internal Doors	KLDs TM59 Criterion 1	Bedrooms TM59 Criterion 1	Bedrooms TM59 night-time 26°C Criterion 2
		Window opening degree and profile				No. of rooms not meeting criteria		
0	Base Case	Sash & Side hung 90% free area in daytime	Sash 90% free area in daytime	Existing=0.85 Replaced=0.63	Open daytime	1/3	1/5	5/5
1	Night-time ventilation in the Main House; Lower g-value for replaced windows in the Mews	Sash & Side hung 90% Day, 10% Night	Sash 90% Day 10% Night	Existing=0.85 Replaced=0.5	Open daytime	1/3	0/5	5/5

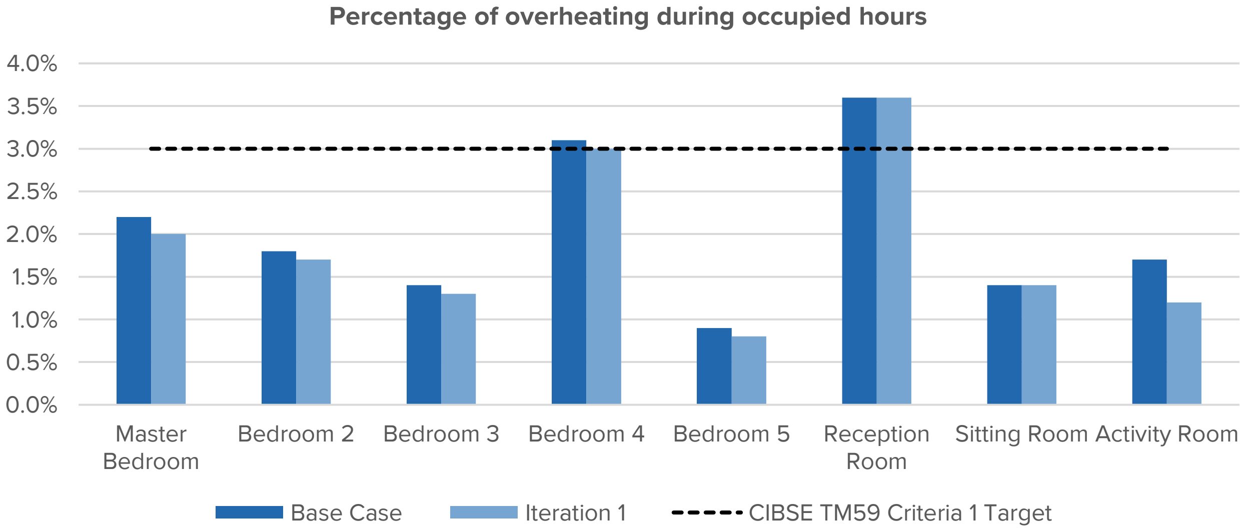

Figure 10: Percentage of overheating hours of each key areas for each iteration.

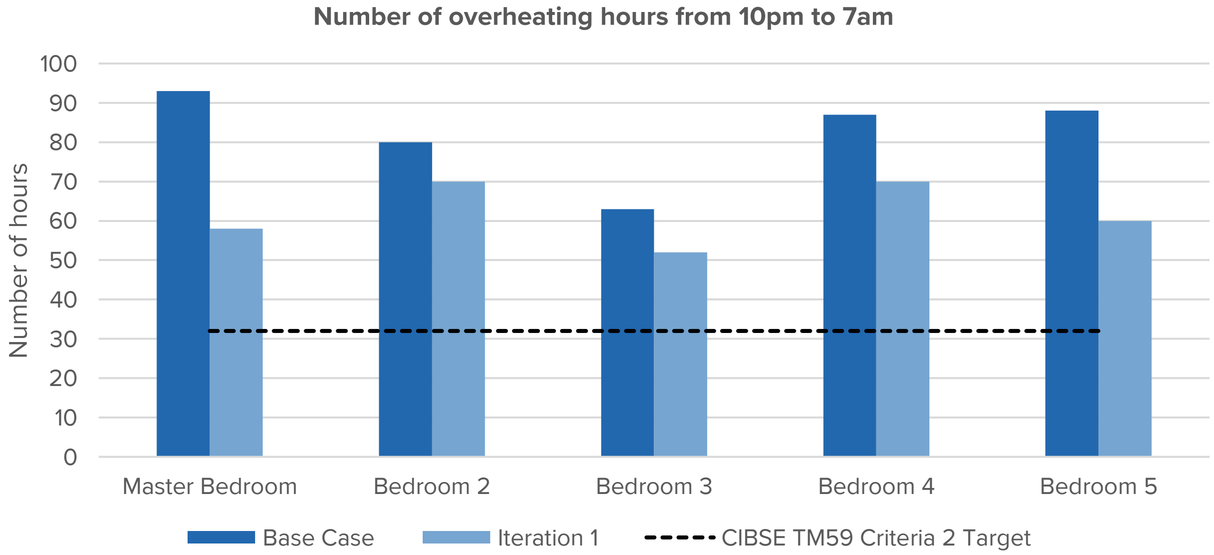

Figure 11. Number of overheating hours in bedrooms during nighttime occupied hours.

Table 9: Overheating assessment results of habitable spaces within the existing structure for the London Weather Centre, DSY1, DSY 2 & DSY3, 2020s, high emissions, 50% percentile scenario

ID	Weather File	Number of rooms not meeting criteria		
		KLDs TM59 Criterion 1	Bedrooms TM59 Criterion 1	Bedrooms TM59 night-time 26°C Criterion 2
2	DSY1 - moderately warm summer	1/3	0/5	5/5
3	DSY2 - short, intense warm spell	3/3	4/5	5/5
4	DSY3 - long, less intense warm spell	3/3	4/5	5/5

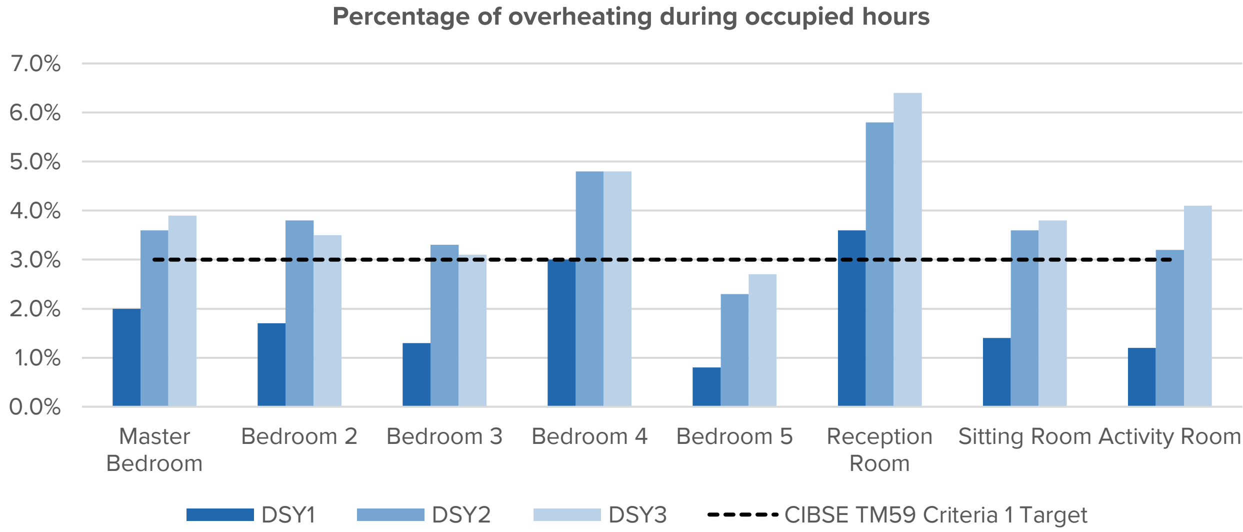

Figure 12: Percentage of overheating hours of iteration 1 for each Design Summer Year (DSY) weather scenario.

The last iteration was applied with DSY2 and DSY3 weather scenarios. These are more severe scenarios and whilst it is recommended to report results, it is not expected that these will be met for most projects. However, they indicate whether future thermal comfort will be achieved. The result summary for these years is shown in Table 11. Figure 12 also demonstrates how each space performs against CIBSE TM59 criteria 1.

With the exception of the basement Bedroom 5, all the spaces have high risks of overheating in extreme warmer weather scenarios as portrayed by DSY2 and DSY3. Further assessment on other passive measures to achieve thermal comfort in DSY2&3 is recommended. This could include larger window openings, external shutters or lower g-value. However, these measures are not likely to be feasible due to heritage constraints, e.g. the existing single-glazed windows are not likely to be replaced due to the conservation of the Grade I Listed building status.

The results for the current design scenario based on passive measures indicates a risk of overheating against TM59 criteria, which assumes a natural ventilation scenario comprising windows fully open in the daytime and windows open 10% at night-time. For DSY1, this includes all bedrooms and the reception room not achieving compliance, whilst all spaces fail the criteria for future weather scenarios. It is expected that it is not possible to implement further passive measures due to the Grade I Listed status of the building, so energy-efficient comfort cooling could be installed to improve occupant thermal comfort.

NEW BUILD STRUCTURES

The habitable spaces within the new build structure (Closet Wing) include the Studio, Kitchen and Study.

Table 10 and Figure 13 shows the modelling iterations undertaken for London Weather Centre DSY1 weather data, the sequential improvement measures that are proposed to be incorporated for each iteration and the performance of each key areas against CIBSE TM59 Criteria 1 for each of the modelling iterations.

The purpose of the improvement measures proposed is to minimise the annual overheating hours to the extent possible, taking into consideration viability, feasibility, security and other design constraints.

The following observations can be made from the results:

- The habitable spaces in the Closet Wing have low risks of overheating. The TM59 overheating criteria for living room and kitchen can be met through passive mitigation measures such as natural ventilation by opening windows in the daytime during occupied hours.
- Solar control measures such as reducing the glazing g-value to 0.50 reduces the annual overheating hours further, and allow partial compliance with more severe DSY2 and DSY3 future weather scenarios.

Table 10: Overheating assessment results for London Weather Centre DSY1, 2020s, high emissions, 50% percentile scenario

ID	Passive measures	Key Areas in the Closet Wing		
		Studio	Kitchen	Study
0	Base Design: g-value 0.63, all openings and internal doors are open in daytime.	Pass	Pass	Pass
1	Reduce glazing g-value to 0.50.	Pass	Pass	Pass

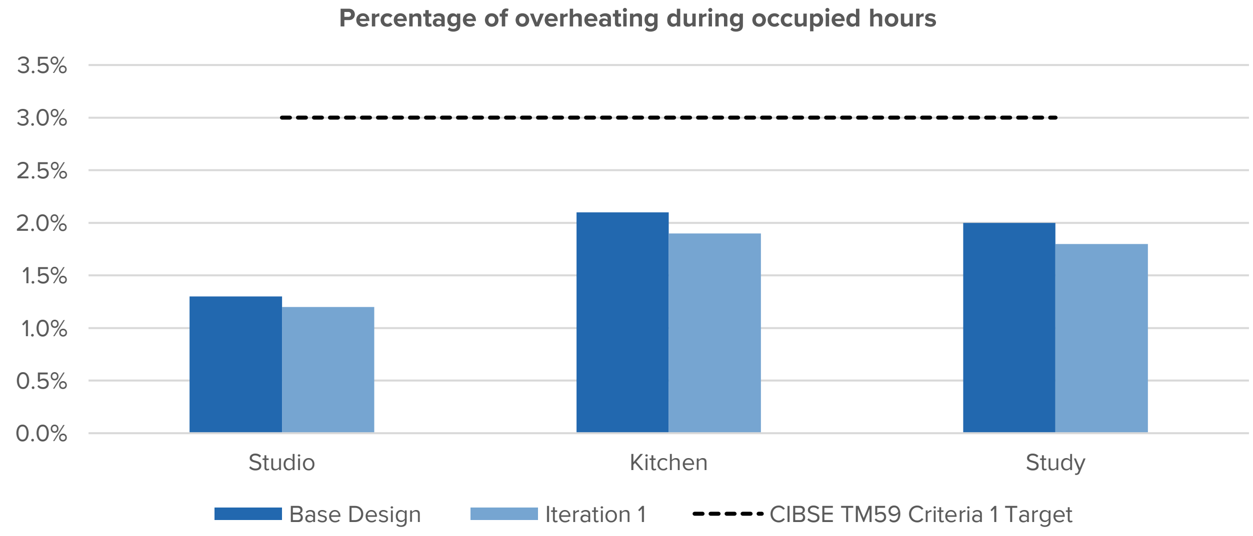

Figure 13: Percentage of overheating hours of each key areas for each iteration.

The last iteration was applied with DSY2 and DSY3 weather scenarios. These are more severe scenarios and whilst it is recommended to report results, it is not expected that these will be met for most projects. The result summary for these years is shown in Table 11. Figure 14 also demonstrates how each space performs against CIBSE TM59 criteria 1.

While DSY1 and DSY2 passes based on passive measures as described, further assessment on other passive measures to achieve thermal comfort in DSY3 is recommended. This could include more window openings, nighttime ventilation, external shutters or even lower g-value; however, due to the glazing orientation further measures to reduce solar gain are not likely to have a significant benefit to mitigate overheating risk.

Nonetheless, energy-efficient active cooling could be considered to future-proof the Closet Wing to improve levels of occupant thermal comfort.

Table 11: Overheating assessment results of Iteration 1 for the London Weather Centre, DSY1, DSY 2 & DSY3, 2020s, high emissions, 50% percentile scenario

ID	Weather File	Key Areas in the Closet Wing		
		Studio	Kitchen	Study
2	DSY1 - moderately warm summer	Pass	Pass	Pass
3	DSY2 - short, intense warm spell	Pass	Pass	Pass
4	DSY3 - long, less intense warm spell	Pass	Fail	Fail

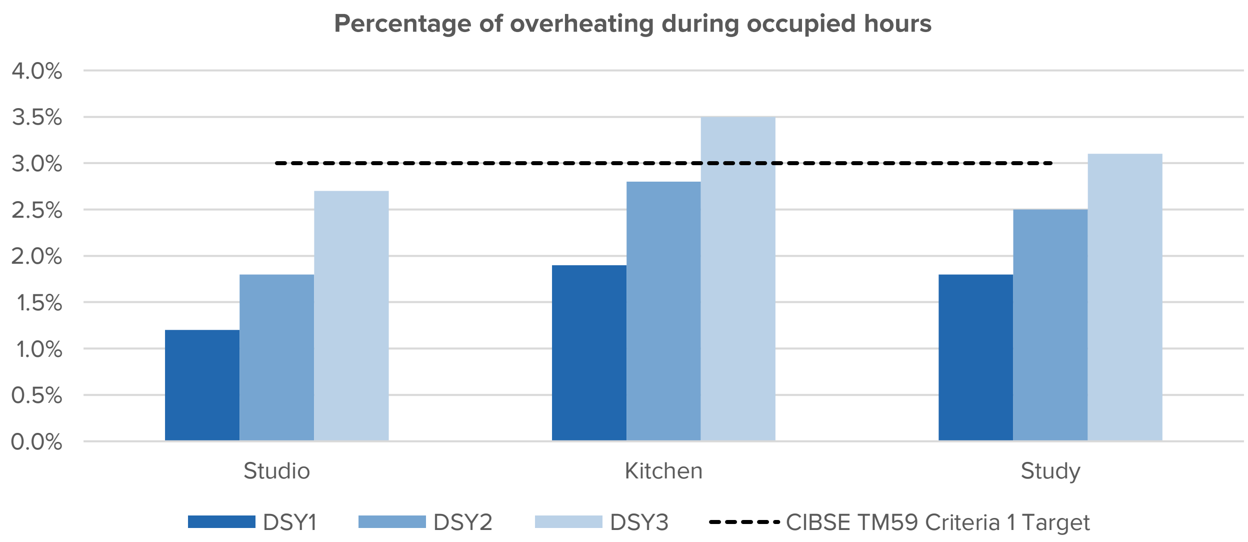

Figure 14: Percentage of overheating hours of iteration 1 for each Design Summer Year (DSY) weather scenario.

RECOMMENDATIONS

The results show that the Closet Wing can achieve compliance with CIBSE TM59 overheating risk criteria for London Weather Centre DSY1 weather data, provided that adequate passive design considerations are taken into account.

The results detailed in the previous pages demonstrate that natural ventilation and solar control strategies such as low g-value glazing, are essential to minimise internal heat build-up and solar gains as far as feasible. A g-value of 0.50 has been targeted in order to minimise excessive solar gains while the viability of which should be further reviewed during the next design phase.

The results for the habitable spaces in the Main House show a high risk of overheating based on the passive measures tested. This includes the master bedroom, bedroom 2, bedroom 3, bedroom 4, bedroom 5 and the reception room not achieving compliance for DSY1, whilst all spaces fail the criteria for warmer weather scenarios. It is expected that it is not possible to implement further passive measures due to the listed status of the building, so comfort cooling is likely to be required to ensure occupant thermal comfort within the habitable spaces.

The whole development achieves partial compliance with CIBSE TM59 Criterion 1 and failing Criterion 2. Table 12 summarises the design recommendations that contribute to reducing overheating risk, in line with the London Plan Policy SI4 and the Cooling Hierarchy, as follows:

Table 12: Summary of recommendations for the proposed development.

Measure	Implementation
1. Minimise internal heat generation through energy efficient design	
High efficiency lighting installation	High efficiency LED lighting will be installed to minimise heat gains. It is also expected that the demand for artificial lighting will be very low due to the high levels of natural daylight within the proposed building.
Insulating heat sources and pipe works	The distribution of heat infrastructure will be designed to reduce the lateral pipework lengths within the internal spaces to reduce heat loss.
2. Reduce the amount of heat entering the building in summer through orientation, shading, albedo, fenestration, insulation and green roofs and walls	
Solar control glazing	New windows in the Closet Wing and Mews will incorporate solar control glazing to achieve g-value = 0.50 (through thin film or glazing specification). External shading was also considered however not adopted, since the glazing orientation would mean less of a benefit from shading measures.
3. Manage the heat within the building through exposed internal thermal mass and high ceilings	
High ceilings	The ceiling height of the Closet Wing and Mews should be maintained as higher than the national standard, allowing greater levels of air circulation to reduce the impact of heat build-up.
4. Passive ventilation	
Natural ventilation	Fully opening adjacent windows and internal doors towards the garden, terrace and adjacent spaces in the daytime can alleviate heat build-up through air flow.
Night ventilation	Opening sash and side-hung windows at night but limited to 10% free area for security considerations, especially in the bedrooms.
5. Mechanical ventilation	
Not currently proposed since adequate natural ventilation is provided.	
6. Active cooling systems	
Energy-efficient (i.e. high-EER) comfort cooling could be installed to maintain occupant thermal comfort within the key spaces in the Main House (Master Bedroom, Bedroom 2, Bedroom 3, Bedroom 4, Bedroom 5 and Reception Room) to achieve TM59 compliance. Furthermore, installing comfort cooling in the Closet Wing (Study, Kitchen) and Mews (Activity Room) would be beneficial as a future-proofing measure in cases of extreme warmer conditions as portrayed by DSY2&3 weather scenarios.	

CONCLUSIONS

The energy and overheating strategy for the scheme at 8 Gloucester Gate has been developed in line with the relevant policies of the London Plan and of the Camden Local Plan to achieve effective adaptation of the development to climate change.

ENERGY STRATEGY

The proposal is a minor application therefore some policies are not applicable, but the development aims to maximise energy savings and reduce overheating risk, in line with the approaches set out by Camden Council and the Greater London Authority.

Since the development is an extension of an existing dwelling, it is not expected that it will be required to meet the London Plan energy and carbon reduction requirements against new build Part L 2021 standards.

However, SAP calculations have been carried out to demonstrate compliance with Part L 2021 Building Regulations for an extension to an existing dwelling, which represent challenging energy and carbon targets.

It was found that the efficient building fabric of the proposed extension comprising low U-values reduced the heating demand of the dwelling, by minimising heat loss through the fabric. These improvements demonstrated improved energy, carbon, and fabric efficiency in comparison with a 'notional' Part L compliant extension.

Despite constraints regarding the Grade I Listed status of the dwelling, some upgrades to the mews building and select windows are proposed to improve energy performance further.

Furthermore, the natural daylight strategy will minimise the artificial lighting requirement significantly and it will also be ensured that any lighting installed will be highly efficient LED fittings.

As part of the works, it is proposed that the existing gas boiler will be replaced with a modern high-efficiency gas boiler system to provide heating and hot water to the whole dwelling, via underfloor heating and radiators. Low-energy extract fans will also be installed to minimise auxiliary energy use and heat loss through ventilation.

OVERHEATING

Dynamic thermal simulations using IES VE modelling software have been carried out to assess the risk of overheating within the proposed space.

The overheating strategy uses passive measures to mitigate risks, in line with the Cooling Hierarchy. These measures include natural ventilation in daytime through fully openable windows, solar control measures including a low glazing g-value of 0.50, and night ventilation allowing a secure opening of 10% free area for sash and side-hung windows in bedrooms.

The Closet Wing building was able to meet CIBSE TM59 recommended criteria for living rooms and kitchens based on the London Weather Centre DSY1 weather scenario (2020s, high emissions, 50% percentile) following implementation of the passive measures.

On the other hand, the habitable spaces in the Main House demonstrated a high risk of overheating despite the passive measures tested under DSY1 weather scenario. Since the Grade I listed status of the building limits retrofitting options to mitigate overheating, comfort cooling would be required for the habitable spaces of the Main House to meet CIBSE TM59 criteria based on DSY1 current weather scenario.

The following habitable spaces within the Main House would benefit from comfort cooling to meet the CIBSE TM59 thermal comfort criteria under the DSY1 current weather scenario:

- Master Bedroom;
- Bedroom 2;
- Bedroom 3;
- Bedroom 4;
- Bedroom 5;
- Reception Room.

Whilst developments are not expected to achieve compliance with the criteria based on simulations ran with warmer weather scenarios DSY2 and DSY3, energy-efficient comfort cooling would be beneficial for further habitable building spaces within the Closet Wing and Mews buildings to demonstrate compliance with these parameters, to ensure the dwelling occupants are comfortable during spells of hotter temperatures.

The following habitable spaces within the Closet Wing and Mews would benefit from comfort cooling to meet the CIBSE TM59 thermal comfort criteria under the DSY2&3 future weather scenario:

- Activity Room (Mews);
- Study (Closet Wing);
- Kitchen (Closet Wing).

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