Thermal Comfort Assessment

(in accordance with CIBSE TM59 and Part O)

Charlton Brown Architecture & Interiors

26 Rosslyn Hill
London
NW3 1PA
London Borough of Camden

SRE

Version	Revision	Date	Author	Reviewer	Project Manager
1	A	28.10.2022	Alisha Pinheiro	Yin Mui Tang	Yin Mui Tang
1	B	08.11.2022	Alisha Pinheiro	Yin Mui Tang	Yin Mui Tang
	C	05.12.2022	Alisha Pinheiro	Yin Mui Tang	Yin Mui Tang

SRE Registered Office | Greenforde Farm

Stoner Hill Road | Froxfield

Petersfield | Hampshire | GU32 1DY

01730 710044

info@sre.co.uk

www.sre.co.uk

Contents

Executive Summary....1
1.0 Introduction....3
1.1 The Proposed Development....3
2.0 Methodology....4
2.1 CIBSE Guide A: Environmental Design....4
2.2 CIBSE TM59: Design Methodology for the Assessment of Overheating Risk in Homes....4
2.3 Approved Document Building Regulations Part O....5
3.0 Dynamic Model....7
3.1 Building Fabric....9
3.2 Occupancy and internal gain profiles....10
3.3 Air Exchange....11
3.4 Window Openings....12
3.5 Shading devices....13
3.6 Space Heating and Cooling....13
4.0 Results
4.1 Current Weather File – DSY1 2020....16
4.2 Future Weather File – DSY1 2050....16
5.0 Conclusions....B
Appendix A – Floor Plans....A
Appendix B - Window Openings....A

Executive Summary

Executive Summary

This Thermal Comfort Report has been undertaken by SRE for the Proposed Development at 26 Rosslyn Hill, London (the Proposed Development) on behalf of Charlton Brown Architecture & Interiors (the Client Agent).

This report assesses thermal comfort measures for the Proposed Development, in order to ensure that the thermal condition within the building and the associated rooms meets the standards set out in CIBSE TM59 and also confirm compliance with Part O requirements.

In order to assess the thermal performance of the Proposed Development, a model of the Proposed Development has been created within the dynamic thermal analysis software IES-VE 2022. All results are based on the simulation output and should be taken as an indication of the likely final situation, but these conditions cannot be guaranteed.

This report describes the dynamic thermal modelling exercise undertaken, lists all the assumptions used and presents the results obtained.

A range of passive design measures have been incorporated, where feasible, to optimise summertime thermal comfort conditions and minimise the overheating risks. This is done through a combination of the buildings' shape, solar control glazing with a g-value of 0.50, and openable doors. Active design measures such as MVHR with purge ventilation and efficient lighting have also been incorporated into the design. Active cooling is also proposed for selected spaces, most of which are bounded by the existing front façade (Reception, Office and Flexi Room), and two in the rear (Guest Room and Drawing Room) as passive strategies alone are not able to remove sufficient heat from these spaces.

The results of the simulations indicate that under current climate conditions (London Heathrow DSY1 2020s high emissions, 50th percentile), the Proposed Development passes the assessment criteria using a combination of passive strategies and active cooling (to selected spaces), indicating a good level of thermal comfort during summer periods.

An additional simulation was carried out using a future weather file (London Heathrow DSY1 2050s high emissions, 50th percentile) to further test the robustness of the design. The results of the simulation indicate that all the spaces with active cooling pass the assessment, while measures will need to be taken to mitigate overheating of all the other spaces. It should be noted that a pass is not mandatory under the future weather file scenario.

The modelling results indicate that a thermally comfortable environment can be expected within the Proposed Development with the proposed design considerations.

In relation to CIBSE TM59 requirements and Building Regulations Part O Requirement O1, the Proposed Development meets the assessment criteria with the proposed design measures.

Introduction

1.0 Introduction

This Thermal Comfort Report has been undertaken by SRE for the Proposed Development at 26 Rosslyn Hill, London.

Following the guidance of TM59: 2017, this study assesses the Proposed Development's overheating risk in relation to the intensity of heat gains, occupancy patterns, building orientation, dwelling layout, shading strategy and ventilation method in response to the relevant requirements for the development.

All results are based on the output from dynamic thermal simulation software IES-VE 2022, which is fully compliant with CIBSE TM33 and ASHRAE 140 standards among other software testing standards and should be taken as an indication of the likely final situation. However, these conditions cannot be guaranteed.

It is important to note that with any modelling exercise there are assumptions and approximations that have to be made. As far as possible, details of all assumptions made, and approximations used are supplied as part of the report.

1.1 The Proposed Development

The Proposed Development is a five-bedroom family house consisting of a new build house behind a retained front façade over four storeys including the lower ground, upper ground, first and second floors, as well as a small front garden. The 4-storey development will constitute a total GIA of 526 m^2. As part of the development external terrace space and associated ancillary facilities such as plant room and bin store are also included.

The site is located within the Hampstead Conservation Area, with the Proposed Development located on the north-east side of Rosslyn Hill. The Proposed Development is set back from the street front and abuts the Grade II listed Building of the Former Hampstead Police Station on its south-east side. Figure 1 below illustrates the front elevation of the Proposed Development. Floor plans of the Proposed Development can be found in Appendix A.

Figure 1 – Front Elevation of the Proposed Development (Charlton Brown Architecture & Interiors)

2.0 Methodology

2.1 CIBSE Guide A: Environmental Design

CIBSE Guide A 'Environmental Design' (2015) gives general guidance and recommendations for buildings on suitable winter and summer temperatures for a range of room and building types.

Table 1 summarises the comfort criteria for relevant room types within the Proposed Development:

		Living Rooms	Kitchen	Bedrooms
Winter period (Oct-Apr)	Operative Temperatures (°C)	22-23	17-19	17-19
	Activity (met)	1.1	1.6	0.9
	Clothing (clo)	1.0	1.0	2.5
Summer period (Oct-Apr)	Operative Temperatures (°C)	23-25	21 - 25	23-25
	Activity (met)	1.1	1.5	0.9
	Clothing (clo)	0.6	0.5	1.2

Table 1 - CIBSE Guide A, recommended comfort criteria

According to CIBSE Guide A guidance, secondary spaces which are occupied only briefly (less than 30 minutes), such as toilets, storage rooms, and circulation areas are outside the scope of this analysis.

2.2 CIBSE TM59: Design Methodology for the Assessment of Overheating Risk in Homes

The performance standards set in CIBSE TM59: 2017 have been used to assess the overheating risk within the Proposed Development. Compliance is based on passing both of the following two criteria:

1. For living rooms, kitchens and bedrooms: the number of hours during which the operative temperature exceeds the threshold comfort temperature by 1°C during the period May to September inclusive shall not be more than 3% of occupied hours. (CIBSE TM52 Criterion 1: Hours of exceedance).
2. For bedrooms only: the operative temperature in the bedroom from 10 pm to 7 am shall not exceed 26°C for more than 1% of occupied hours. (Note: 1% of occupied hours between 22:00 and 07:00 for bedrooms is 32 hours, so 33 or more hours will be recorded as a fail).

In addition to living rooms, kitchens and bedrooms, the inclusion of corridors in the overheating analysis is mandatory where community heating pipework runs through them. The overheating test for corridors should be based on the number of annual hours for which an operative temperature of 28 °C is exceeded. Whilst there is no mandatory target to meet, if an operative temperature of 28 °C is exceeded for more than 3% of the total annual hours, then this should be identified as a significant risk within the report.

The overheating risk of the spaces are assessed under the CIBSE design summer year (DSY) weather files. A pass is required using the DSY1 2020s, high emissions, 50th percentile weather file. Other files including the more extreme DSY2 and DSY3 files, as well as future files (i.e. 2050s or 2080s), should be used to further test designs of particular concern, but a pass is not mandatory.

2.3 Approved Document Building Regulations Part O

The approved document Building Regulations Part O has been written with the aim to protect the health and welfare of occupants of the building by reducing the occurrence of high indoor temperatures.

Compliance with requirement O1 can be demonstrated by using one of the following methods:

a. The simplified method for limiting solar gains and providing a means of removing excess heat

b. The dynamic thermal modelling method

This report details a dynamic thermal modelling method for demonstrating compliance with requirement O1. It provides a standardised approach to predicting overheating risk for residential buildings using dynamic thermal modelling as an alternative to the simplified method.

CIBSE's TM59 method requires the modeller to make choices. The dynamic thermal modelling method in Part O applies limits to these choices, including:

a. When a room is occupied during the day (8am to 11pm), openings should be modelled to do all

of the following:

i. Start to open when the internal temperature exceeds 22°C.
ii. Be fully open when the internal temperature exceeds 26°C.
iii. Start to close when the internal temperature falls below 26°C.
iv. Be fully closed when the internal temperature falls below 22°C.

b. At night (11pm to 8am), openings should be modelled as fully open if both of the following apply:

i. The opening is on the first floor or above and not easily accessible.
ii. The internal temperature exceeds 23°C at 11pm.

c. When a ground floor or easily accessible room is unoccupied, both of the following apply:
i. In the day, windows, patio doors and balcony doors should be modelled as open, if this can be done securely.
v. At night, windows, patio doors and balcony doors should be modelled as closed.

d. An entrance door should be included, which should be shut all the time.

Based on Building Regulations Part O, mechanical cooling may only be used where insufficient heat is capable of being removed from the indoor environment without it. The building should be constructed to meet requirement O1 using passive means as far as reasonably practicable. It should be demonstrated to the building control body that all practicable passive means of limiting unwanted solar gains and removing excess heat have been used first before adopting mechanical cooling. Any mechanical cooling (air-conditioning) is expected to be used only where requirement O1 cannot be met using openings.

Dynamic Model

3.0 Dynamic Model

The thermal modelling has been carried out using IES-VE 2022. IES-VE is a fully dynamic analysis tool which is compliant with CIBSE TM33 and ASHRAE 140 standards among other software testing standards. A 3D thermal model of the Proposed Development has been created based on the architectural drawings provided by the Client Agent.

The following images are taken from the 3D IES-VE model and show the full geometry of the Proposed Development within the thermal model. As with any modelling exercise, some approximations have to be made, but care has been taken to ensure that the scale and dimensions of the model are as close as practical to the design drawings, and that glazing areas are accurately represented.

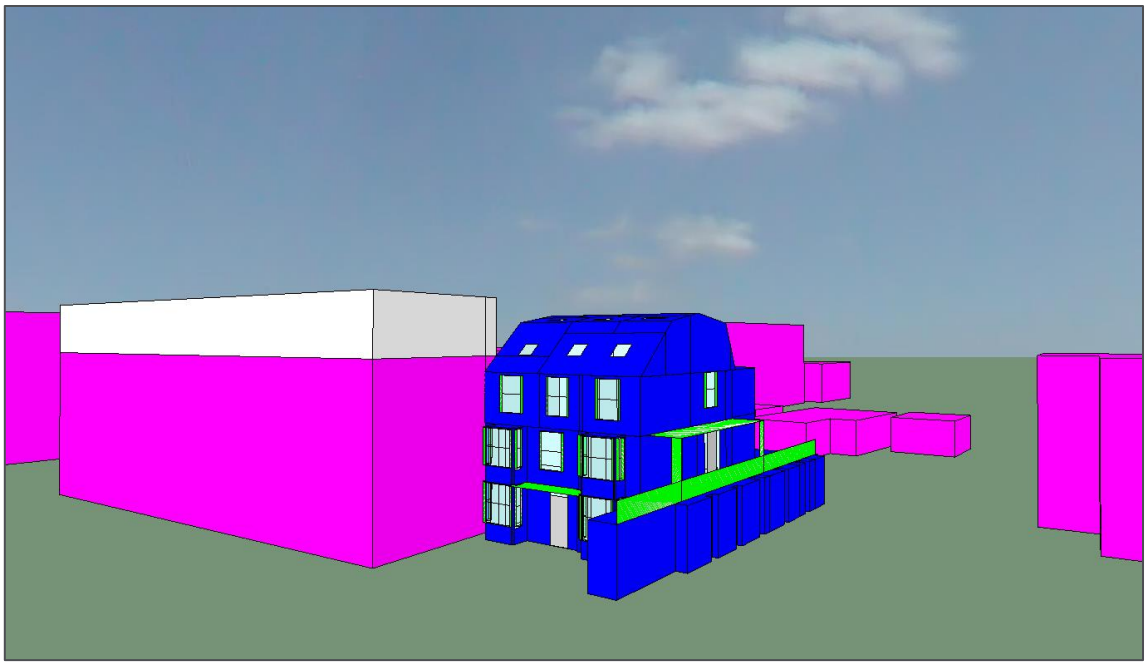


Figure 2 - Image of the 3D model in the IES-VE 2022 software, view from the Southeast

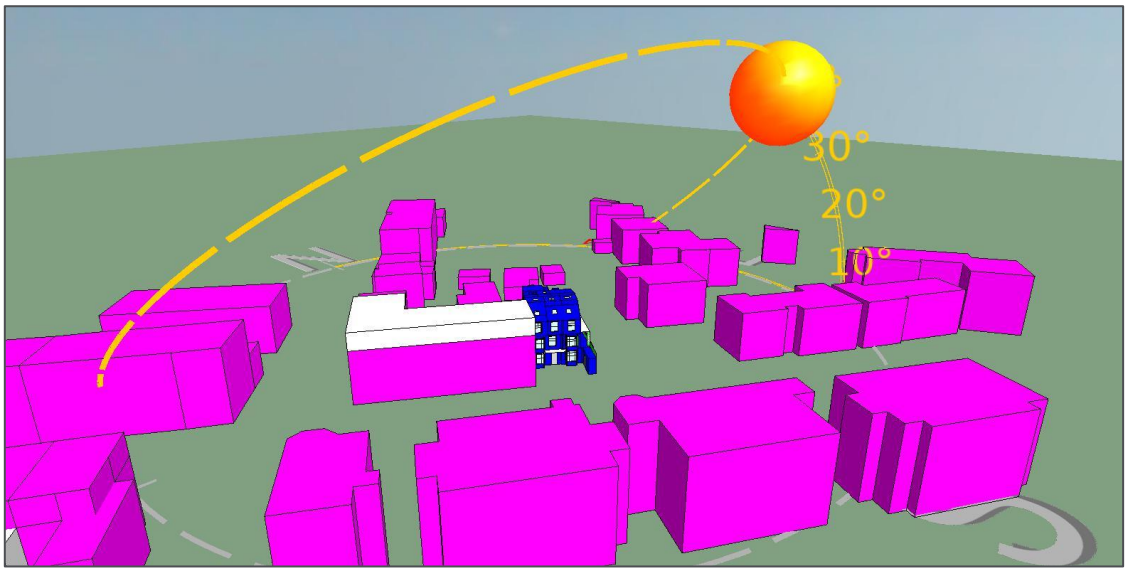


Figure 3 - Image of the 3D model in the IES-VE 2022 software, view from the Southwest

The building has been divided into different zones in relation to use. Appropriate profiles and internal gains have been assigned in the different areas, but only the results of the main occupied spaces have been assessed in this study. Secondary spaces, occupied only briefly (less than 30 minutes), such as toilets and cupboards are outside the scope of this study.

The assessed occupied spaces in the Proposed Development are listed below:

Space	Floor area (m^2)
LGF Family Room	29.06
LGF Flexi Room	17.86
LGF Kitchen/Living/Dining	72.82
GF Reception Room	29.06
GF Office	15.09
GF Drawing Room	29.05
FF Kids Bedroom 1	16.48
FF Kids Bedroom 2	15.96
FF Main Bedroom	28.25
SF Accessible Bedroom	20.81
SF Guest Room	17.00

Table 2 – List of assessed occupied spaces and their area Statement

Figure 4 below indicates the thermal templates applied to each space type. Floor plans of the assessed spaces can be found in Appendix A.

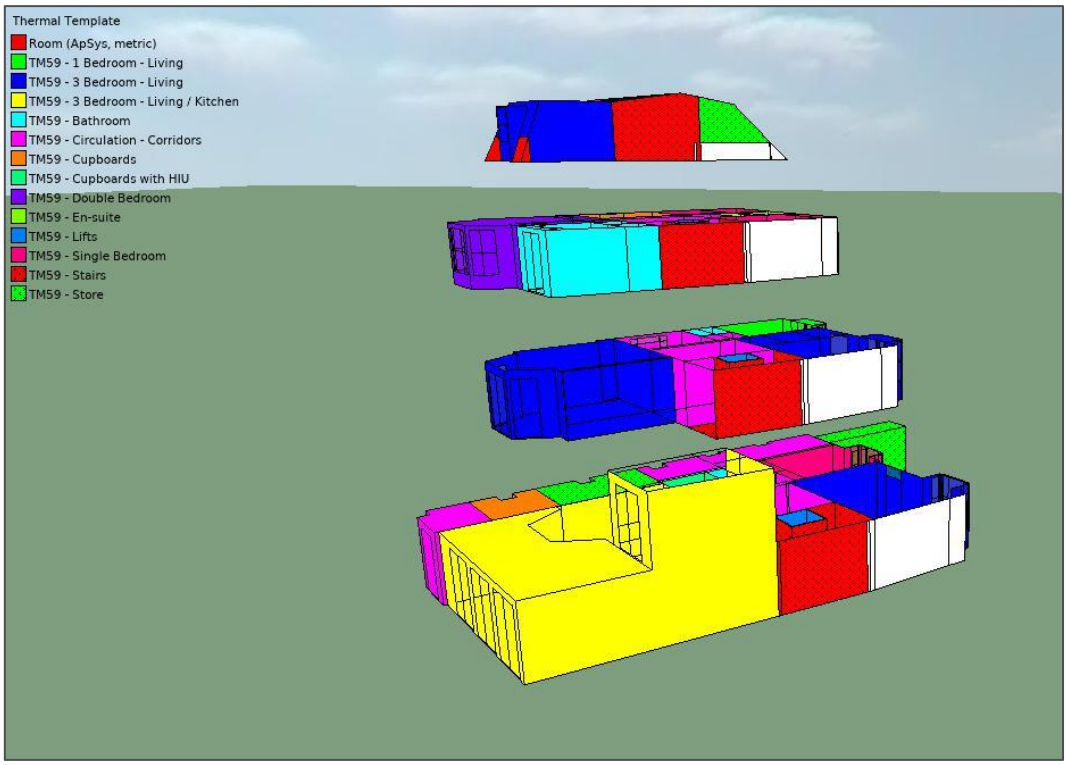


Figure 4 - Thermal zones of assessed spaces within the Proposed Development

3.1 Building Fabric

High performance fabric has been specified to eliminate heat transfer between the internal conditioned areas and the ambient environment. Table 3 summarises the U-Values of all the fabric elements in the model.

Fabric Element	Proposed U-Value
External Walls (Existing Façade)	0.27
External Walls	0.15
Exposed Floor	0.12
External Roof	0.10
External Flat Roof	0.10
Ground Floor	0.10
External Windows and Glazed Doors (Existing Façade)	1.0 (g=0.50)
External Windows and Glazed Doors	0.80 (g=0.50)
Solid Doors	1.20

Table 3 - Construction details of the Proposed Development

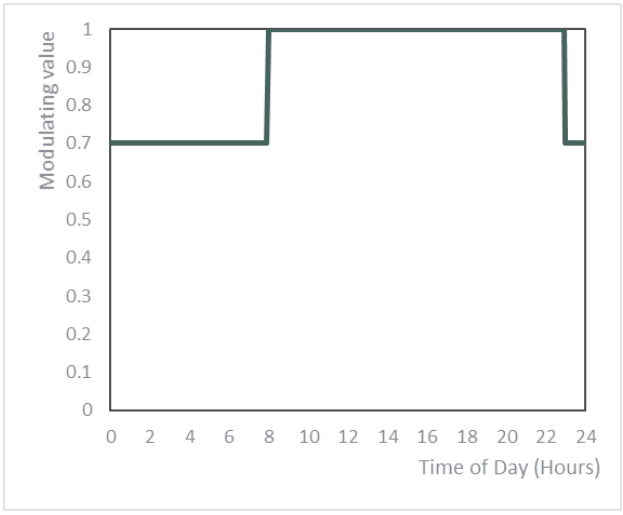
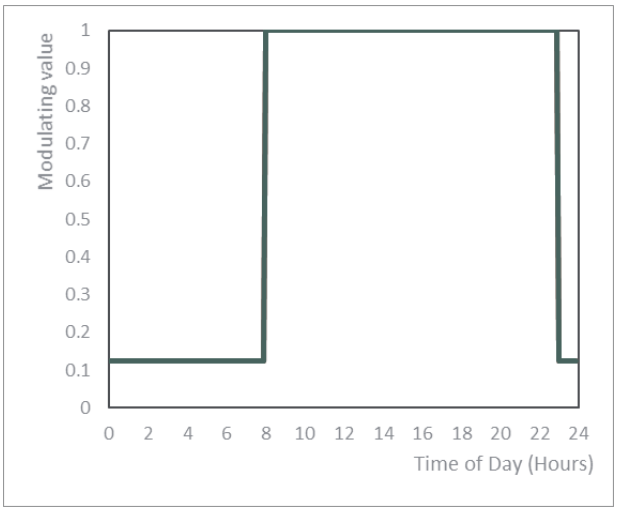
3.2 Occupancy and internal gain profiles

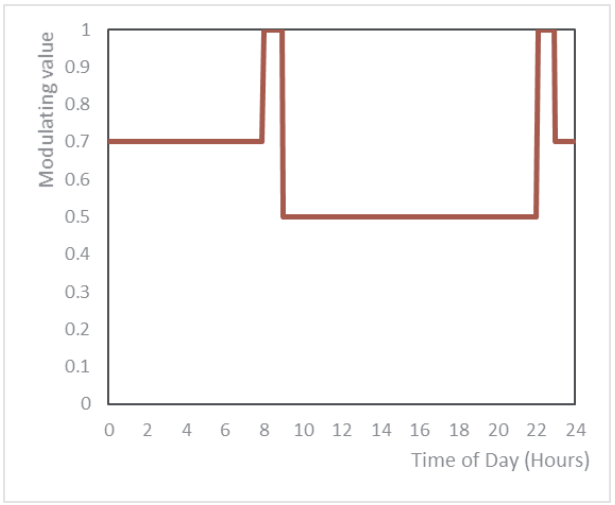
Based on CIBSE Guide A and TM59, a maximum sensible heat gain of 75W/person and a maximum latent heat gain of 55 W/person are assumed in occupied spaces in the assessment.

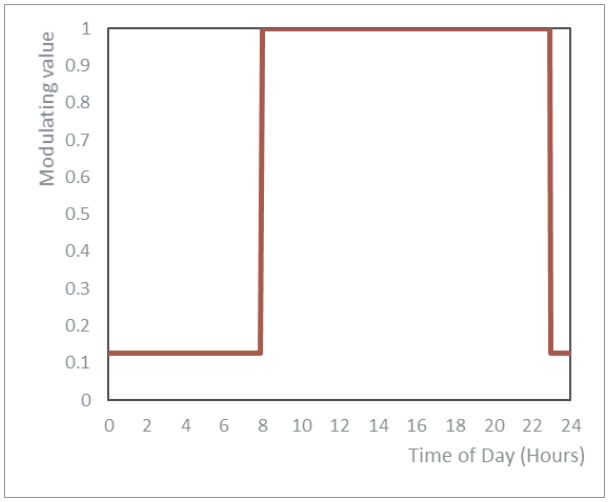
In addition, heat gains from lighting load and equipment are also included in the assessment, based on the methodology described in CIBSE TM59, which are summarised in Table 4.

Usage	Equipment Peak Load (W)	Lighting Load (W/m^2)
Living Rooms	150	2
Single Bedroom	80	2
Double Bedroom	80	2
Kitchen/Living/Dining	450	2

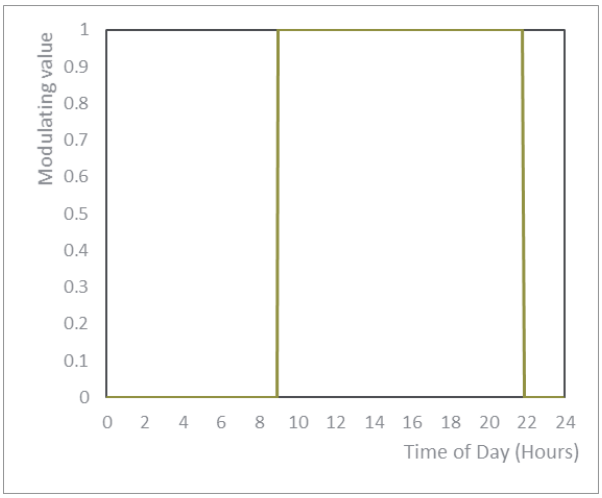
Table 4 - Equipment peak load for different usages

Single Bedroom Occupancy	Single Bedroom Equipment
	
Double Bedroom Occupancy	Double Bedroom Equipment





Living/Kitchen Occupancy	Living/Kitchen Equipment



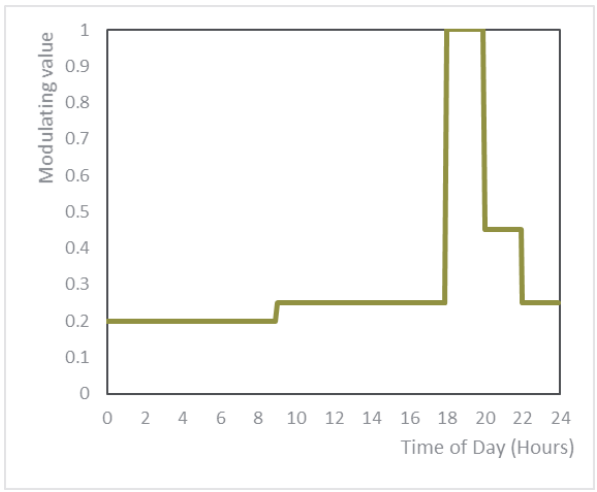


Table 5 - Occupancy and equipment profiles for the occupied space

These profiles represent a robust test that ensures the key aspects of overheating are captured, which include the following characteristics:

- Bedrooms are set with a 24-hour occupancy profile: one person is always considered in each bedroom during the daytime and two people in each double bedroom at night.
- Kitchens/living rooms are unoccupied during the sleeping hours and occupied during the rest of the day.
- No differences between weekdays and weekends are considered and the dwelling is modelled as occupied for 24 hours.

3.3 Air Exchange

Ventilation in all units will be provided through a mixed-mode strategy via a whole house MVHR system with purge ventilation along with natural ventilation through openable windows and doors.

The MVHR system has been modelled with purge ventilation to provide ventilation at a flow rate of 60 l/s when the air temperature of the space exceeds 24^{0}C within the occupied hours (08:00-23:00), and at 30 l/s at all other times for the following spaces:

- Guest room

- Reception
- Office
- Single bedrooms
- Double bedroom

A constant airflow of 30 l/s is provided for the Kitchen/Living/Dining, Drawing room and Family room.

A design air tightness of 4 $m^3/hr/m^2$ @50 Pa with 0.25ach infiltration rate has been applied in all areas.

3.4 Window Openings

Based on the information supplied by the Client Agent, the specification for the opening areas and angle are summarised in Table 6. Figures 5 and 6 shows the opening types applied within the thermal comfort model. External doors are modelled as fixed shut.

The free area and glazing area are explained in Appendix B.

Opening type	Opening category	Openable area (%)	Max. opening angle
Side Hung Window/Door	Side Hung	95	90
Fixed Window	Fixed	0	-
Casement Window	Sash	95	-
Openable Skylights	Top Hung	95	15

Table 6 - Glazing specification - openable areas

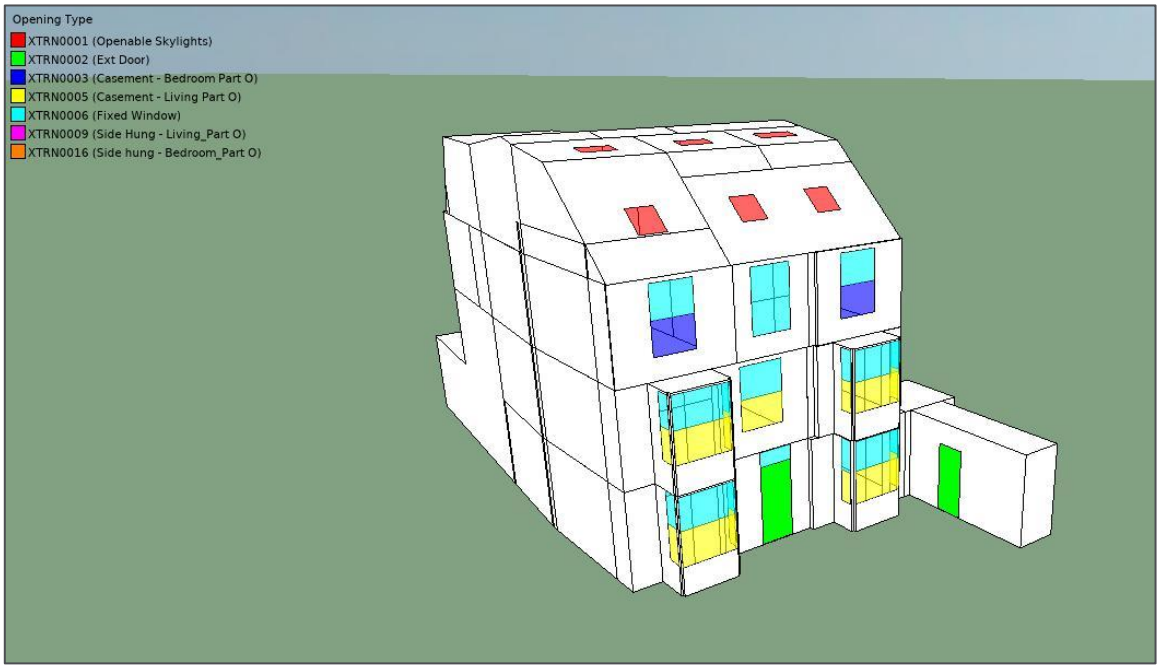


Figure 5 – Opening Types applied within the model (view from Southwest Elevation)

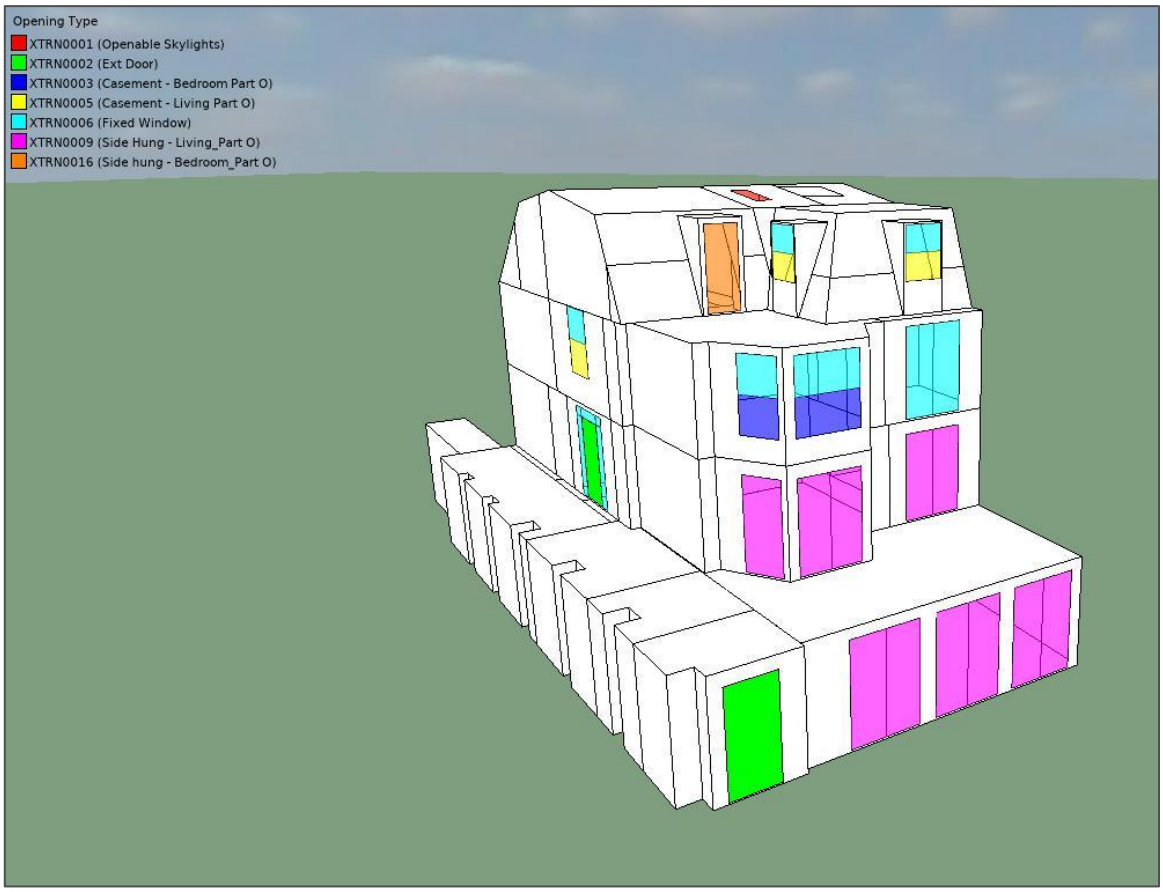


Figure 6 - Opening Types applied within the model (view from Northeast Elevation)

3.5 Shading devices

Although internal blinds can be applied to all non-openable windows to reduce solar gains during the daytime, this has not been modelled as per Part O1 guidance. Overhangs have been modelled as proposed. External shutters are modelled for the Living/Kitchen/Dining space in the lower ground floor as a means of solar gain control. The external shutters are modelled to coincide with the window opening profile, therefore modelled to be fully open when the internal temperature exceeds 24°C.

3.6 Space Heating and Cooling

In order to ensure the operative temperature in the occupied areas are achieving the CIBSE Guide A comfort criteria (Table 1), space heating which operates on a variable refrigerant volume (VRF) principle, has been provided to all the occupied rooms with a heating set point of 16°C based on standard TM59 profiles. Active cooling is also provided to spaces where passive strategies alone are not sufficient to remove excess heat from the indoor environment, the spaces with proposed active cooling are as below:

- Reception
- Office
- Drawing room
- Flexi room
- Guest room

Majority of these spaces are bounded by the existing front façade, which has been retained due to the Proposed Development's location within a conservation area. As there are limitations to the interventions which can be proposed for the existing façade, passive measures have been maximised as far as reasonably practicable. These have been discussed within the sections above, and include reduced glazing g-values and use of

shading/shutters to limit solar gain, as well as maximising openable windows for natural ventilation and the incorporation of purge mechanical ventilation to remove excess heat.

The thermal comfort analysis is conducted under both current and projected future climate conditions in accordance with CIBSE TM59 requirements, based on the below weather files:

Current condition:

- London LHR DSY1 2020s high emissions 50th percentile

Future condition:

- London LHR DSY1 2050s high emissions 50th percentile

The solar gains are calculated from the IES software based on the weather file, the building's geometry and orientation of its facades, surrounding obstacles, transmission coefficients of the glazing and the solar angles.

Results

4.0 Results

According to CIBSE TM59, the overheating assessment has been undertaken for the summer period, from 1st May to 30th September. The air speed is set at 0.1 m/s to generate operative temperature, and the thermal comfort category is assumed to be Category II (new building) in the assessment. Dynamic thermal simulation has been conducted with the settings described in Section 3.0. Results for both the current and future weather conditions are presented in this section.

4.1 Current Weather File – DSY1 2020

Results for current weather conditions using London Heathrow DSY1 2020 are presented in this section.

Results for the assessed occupied spaces under the current weather file with mixed-mode ventilation (openable windows and MVHR) and active cooling are tabulated in the table below.

Space	Criterion 1 (% hours top-max>=1K)	Criterion 2 (hours operative temp. >26°C)	Pass / Fail (without active cooling	Pass / Fail (with active cooling
LGF Family Room	2.8	-	Pass	Pass
LGF Flexi Room	2.1	72	Fail	Pass
LGF Kitchen/Living/Dining	2.2	-	Pass	Pass
GF Reception Room	3.5	-	Fail	Pass
GF Office	3.7	-	Fail	Pass
GF Drawing Room	3.1	-	Fail	Pass
FF Kids Bedroom 1	0.9	28	Pass	Pass
FF Kids Bedroom 2	1.2	29	Pass	Pass
FF Main Bedroom	1.4	21	Pass	Pass
SF Accessible Bedroom	1.0	22	Pass	Pass
SF Guest Room	3.9	-	Fail	Pass

Table 7 – Simulation results summary for occupied spaces – using the DSY1 2020 current weather file [1]

As demonstrated in the table above, all of occupied rooms of the Proposed Development pass the assessment under the current weather condition using a combination of passive and active design measures and mechanical cooling, thus satisfying TM59 requirements and complying with Part O Requirement O1.

4.2 Future Weather File – DSY1 2050

Results for future weather conditions using London Heathrow DSY1 2050 are presented in this section.

Results for the assessed occupied spaces under the future weather file with mixed-mode ventilation (openable windows and MVHR) and active cooling are tabulated in the table below.

[1] The Active cooling is only applied in spaces specified in Section 3.6

Space	Criterion 1 (% hours top-max>=1K)	Criterion 2 (hours operative temp. >26°C)	Pass / Fail (without active cooling	Pass / Fail (with active cooling
LGF Family Room	5.8	-	Fail	Fail
LGF Flexi Room	4.2	170	Fail	Pass
LGF Kitchen/Living/Dining	4.9	-	Fail	Fail
GF Reception Room	6.6	-	Fail	Pass
GF Office	7	-	Fail	Pass
GF Drawing Room	6.1	-	Fail	Pass
FF Kids Bedroom 1	2.6	81	Fail	Fail
FF Kids Bedroom 2	2.9	88	Fail	Fail
FF Main Bedroom	2.9	49	Fail	Fail
SF Accessible Bedroom	2.5	56	Fail	Fail
SF Guest Room	7.4	-	Fail	Pass

Table 8 - Simulation results summary for occupied spaces – using the DSY1 2050 future weather file

As demonstrated in the table above, the rooms with mechanical cooling pass the assessment under the future weather condition, whilst rooms without mechanical cooling fail to meet the assessment criteria. This indicates that appropriate mitigation measures would be needed to be fitted to these spaces in order for comfortable thermal conditions to be achieved. It should be noted that a pass under the future weather conditions is not compulsory.

Conclusions

5.0 Conclusions

This Thermal Comfort Report has been undertaken by SRE for the proposed development at 26 Rosslyn Hill, London in order to assess the risks of overheating and the thermal comfort conditions in the occupied areas.

The following passive and active design measures to address summertime overheating have been incorporated into the design of all occupied rooms.

- Solar Control Glass with low g-value of 0.50
- External shutter and shades
- Mixed mode ventilation via openable windows and MVHR
- Active cooling to selected occupied spaces where required

The results of the simulations indicate that under current climate conditions (London Heathrow DSY1 2020s high emissions, 50th percentile), the Proposed Development passes the assessment criteria using a combination of passive strategies and active cooling (to selected spaces), indicating a good level of thermal comfort during summer periods.

An additional simulation was carried out using a future weather file (London Heathrow DSY1 2050s high emissions, 50th percentile) to further test the robustness of the design. The results of the simulation indicate that all the spaces with active cooling pass the assessment, while measures will need to be taken to mitigate overheating of all the other spaces. It should be noted that a pass is not mandatory under the future weather file scenario.

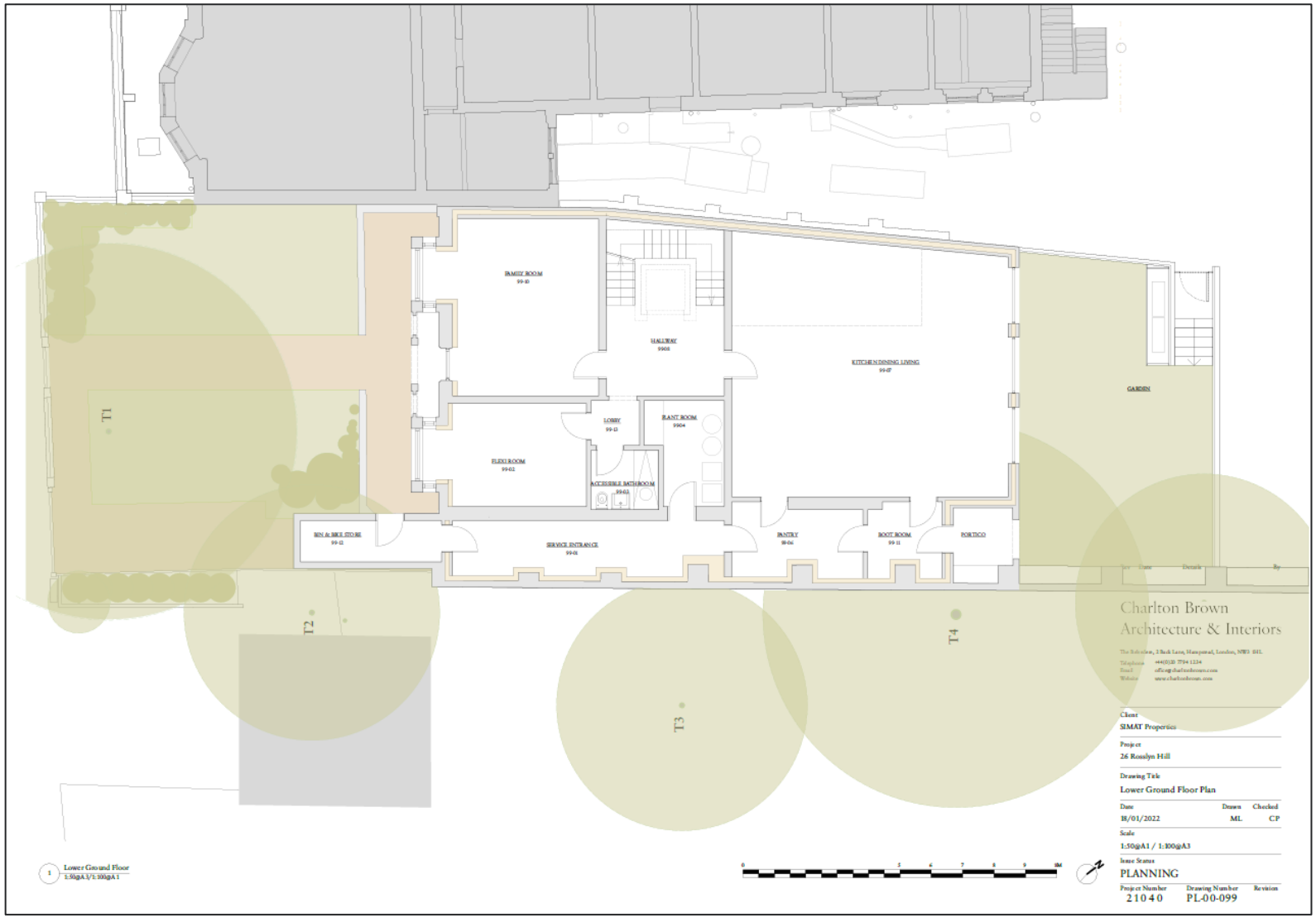
Results from the simulation results indicate that a thermally comfortable environment can be expected within the Proposed Development with the proposed design considerations.

In relation to CIBSE TM59 requirements and Building Regulations Part O Requirement O1, the Proposed Development meets the assessment criteria.

Appendices

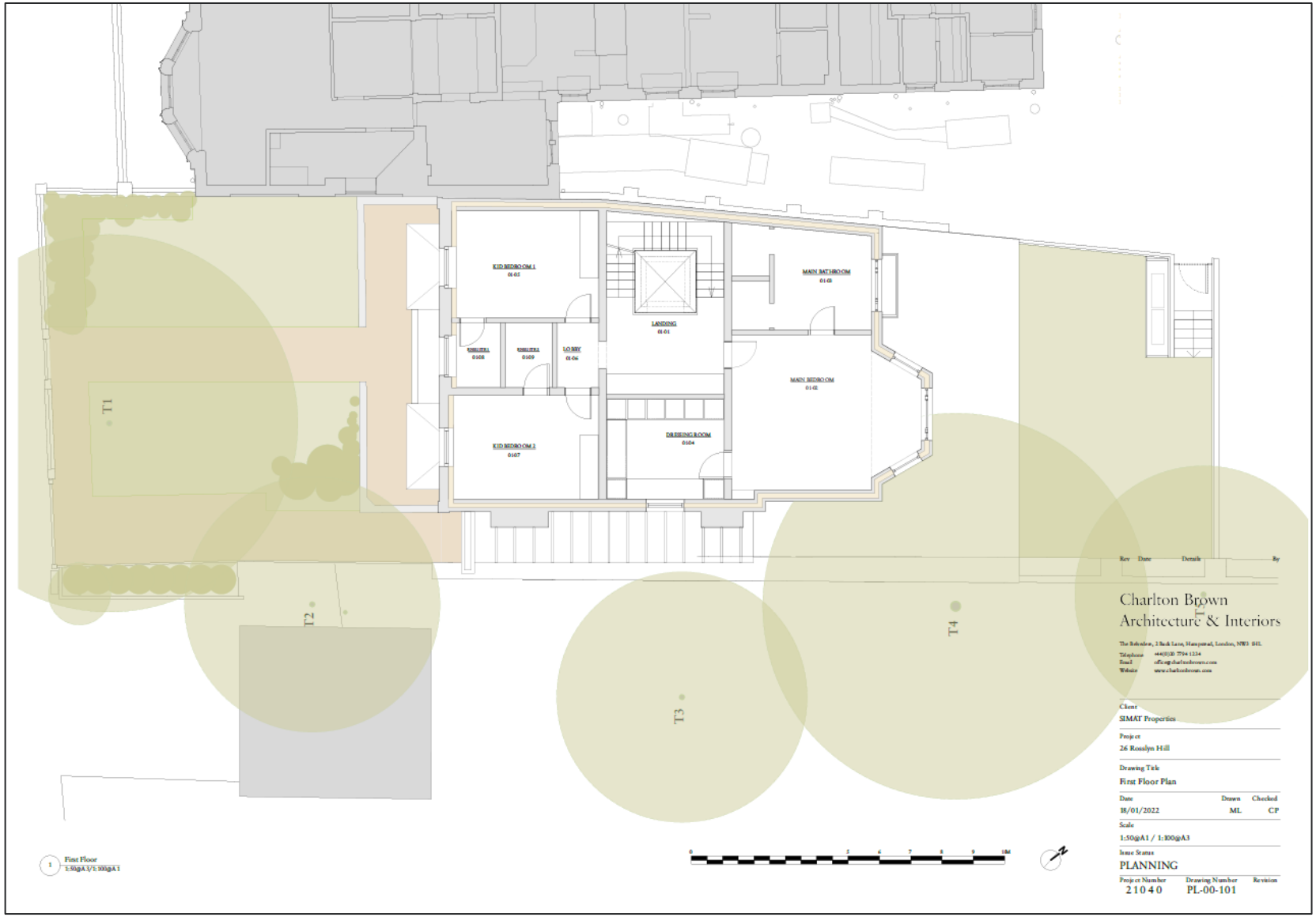
Appendix A – Floor Plans

Lower Ground Floor Plan

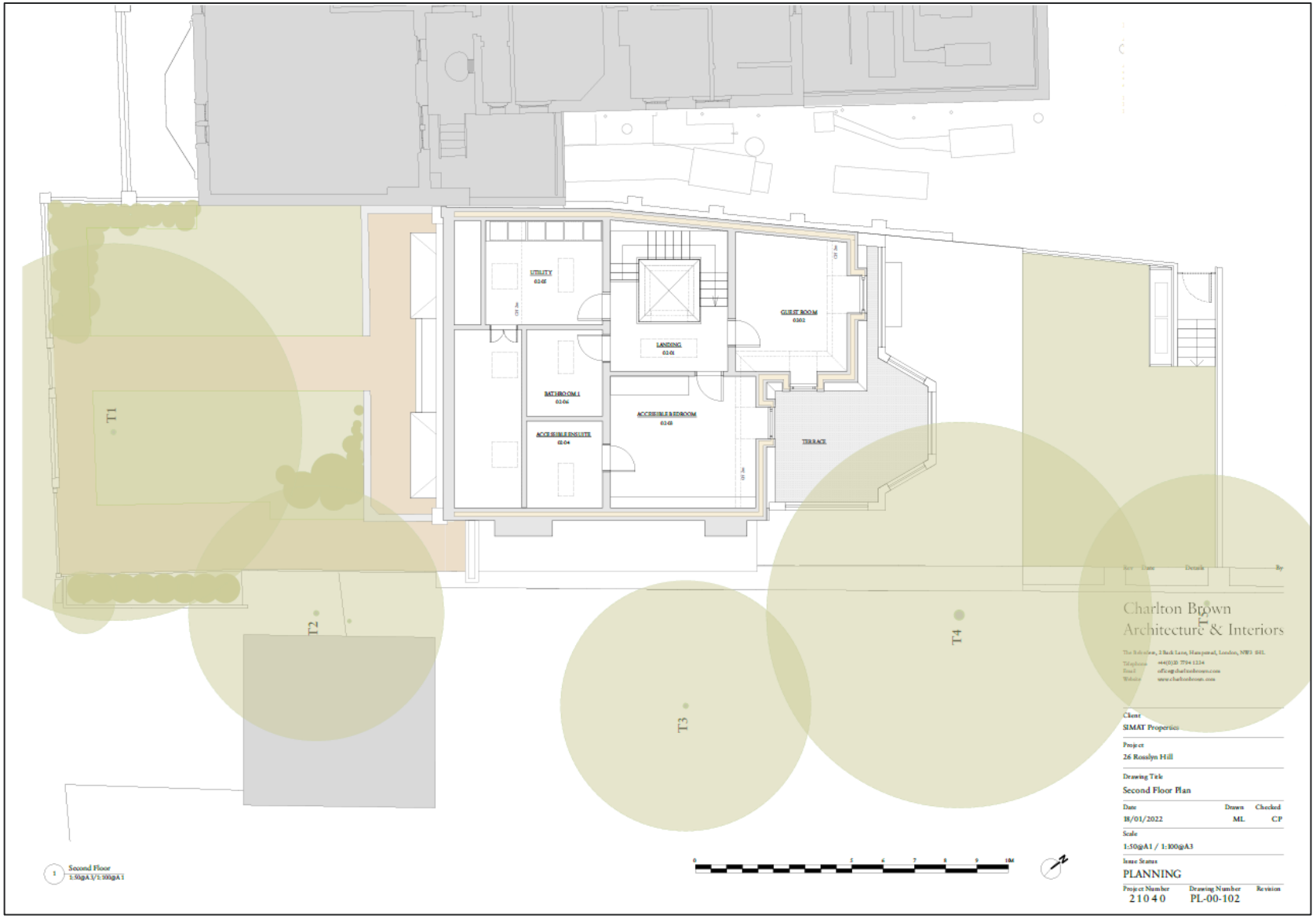


Upper Ground Floor Plan

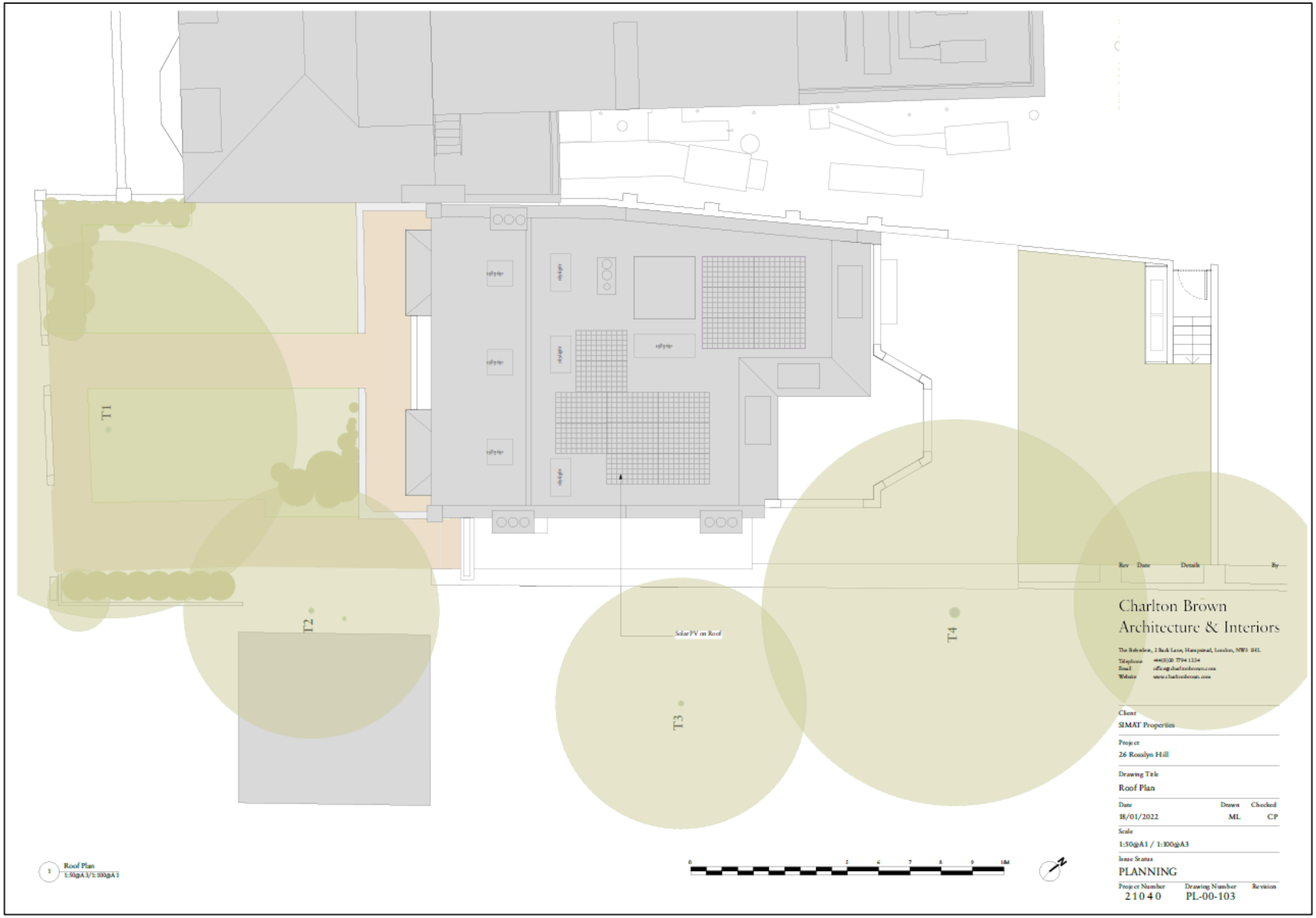
First Floor Plan



Second Floor Plan



Roof Plan


T1
T2
T3
T4
Solar PV on Roof
Roof Plan
1:50@A1/1:100@A1
Charlton Brown
Architecture & Interiors
Client
SIMAT Properties
Project
26 Rosslyn Hill
Drawing Title
Roof Plan
Date
18/01/2022
Drawn
ML
Checked
CP
Scale
1:50@A1 / 1:100@A3
Issue Status
PLANNING
Project Number
21040
Drawing Number
PL-00-103
Revision

Appendix B - Window Openings

Space	Glazing Area (m^2)	Free Area (m^2)
LGF Family Room	5.39	2.58
LGF Flexi Room	4.84	2.52
LGF Kitchen/Living/Dining	17.56	17.22
GF Reception Room	7.12	3.54
GF Office	4.62	2.30
GF Drawing Room	8.57	8.08
FF Kids Bedroom 1	2.25	1.12
FF Kids Bedroom 2	2.25	1.12
FF Main Bedroom	6.76	3.35
SF Accessible Bedroom	1.98	1.94
SF Guest Room	2.98	1.48

Table 9 - List of glazing area and free area

SRE Registered Office | Greenforde Farm
Stoner Hill Road | Froxfield
Petersfield | Hampshire | GU32 1DY
T: +44 (0)1730 710044
E: info@sre.co.uk

SRE London Office | Parkshot House
5 Kew Road | Richmond
Surrey | TW9 2PR

T: +44 (0)20 8332 6633
W: www.sre.co.uk