Avonmouth House, London Borough of Southwark

Overheating Assessment

Version 01

25th October 2021

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Contents

1 Introduction

This report assesses the overheating potential of the proposed development of Avonmouth House in order to meet the sustainability requirements of the London Plan.

The site is situated in London Borough of Southwark. The proposed development consists of the demolition of existing building and structures and erection of a part 2, part 7, part 14, part 16 storey plus basement mixed-use development comprising 1733sqm (GIA) of space for Class E employment use and/or community health hub and/or Class F1(a) education use and 233 purpose-built student residential rooms with associated amenity space and public realm works, car and cycle parking, and ancillary infrastructure. The site area is shown in Figure 1-1 below.

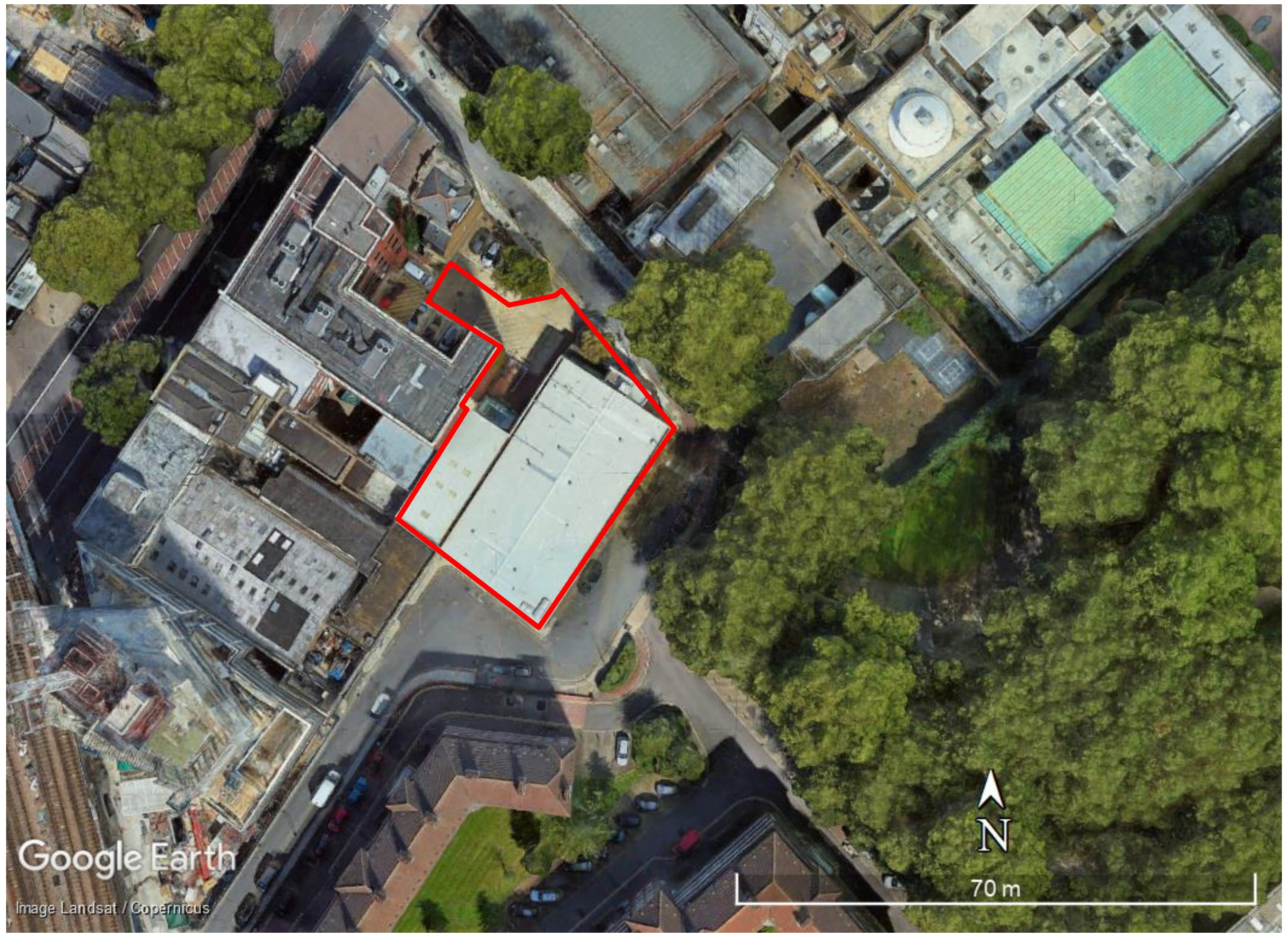

Figure 1-1 – Avonmouth House Site location

2 Guidance

2.1 The London Plan Policy SI 4 Managing heat risk

A. Development proposals should minimise adverse impacts on the urban heat island through design, layout, orientation, materials and the incorporation of green infrastructure.

B. Major development proposals should demonstrate through an energy strategy how they will reduce the potential for internal overheating and reliance on air conditioning systems in accordance with the following cooling hierarchy:

1) reduce the amount of heat entering a building through orientation, shading, high albedo materials, fenestration, insulation and the provision of green infrastructure
2) minimise internal heat generation through energy efficient design
3) manage the heat within the building through exposed internal thermal mass and high ceilings
4) provide passive ventilation
5) provide mechanical ventilation
6) provide active cooling systems.

2.2 CIBSE TM 59 - Design methodology for the assessment of overheating risk in homes

TM 59 outlines specific criteria for assessing overheating in residential buildings. In the case of free running or natural ventilation, including homes that have mechanical ventilation with heat recovery (MVHR), both of the following criteria must be passed for all relevant rooms in order to ensure the building does not overheat.

1. For living rooms, kitchens and bedrooms: The number of hours during which temperature difference between the actual operative temperature in the room and the limiting maximum acceptable temperature (ΔT) is greater than or equal to one degree 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: 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. (Note: 1% of the annual hours between 22:00 and 07:00 for bedrooms is 32 hours, so 33 or more hours above 26 °C will be recorded as a fail).

3 Overheating

3.1 Overheating Checklist

Section 1 – Site features affecting vulnerability to overheating		Yes or No
Site location	Urban – within central London[29] or in a high density conurbation	Yes
	Peri-urban - on the suburban fringes of London[30]	No
Air quality and/or Noise sensitivity - are any of the following in the vicinity of buildings?	Busy roads / A roads	Yes
	Railways / Overground / DLR	Yes
	Airport / Flight path	No
	Industrial uses / waste facility	No
Proposed building use	Will any buildings be occupied by vulnerable people (e.g. elderly, disabled, young children)?	No
	Are residents likely to be at home during the day (e.g. students)?	Yes
Dwelling aspect	Are there any single aspect units?	Yes
Glazing ratio	Is the glazing ratio (glazing: internal floor area) greater than 25%?	No
	If yes, is this to allow acceptable levels of daylighting?	-
Security - Are there any security issues that could limit opening of windows for ventilation?	Single storey ground floor units	No
	Vulnerable areas identified by the Police Architectural Liaison Officer	-
	Other	N/A

Section 2 – Design features implemented to mitigate overheating risk		Please Respond
Landscaping	Will deciduous trees be provided for summer shading (to windows and pedestrian routes)?	N/A
	Will green roofs be provided?	Yes
	Will other green or blue infrastructure be provided around buildings for evaporative cooling?	No
Materials	Have high albedo (light colour) materials been specified?	TBC
Dwelling aspect	% of total units that are single aspect	100%
	% single aspect with NE orientation	28%
	% single aspect with SE orientation	34%
	% single aspect with SW orientation	8%
	% single aspect with NW orientation	30%
Glazing ratio - What is the glazing ratio (glazing; internal floor area) on each facade?	NE	2.6%
	SE	4.2%
	SW	2.4%
	NW	2.2%
Daylighting	What is the average daylight factor range?	-
Window opening	Are windows openable?	Yes
Window opening	What is the average percentage of openable area for the windows?	50% in bedrooms, 100% in living areas
Window opening - What is the extent of the opening?	Fully openable	Yes
	Limited (e.g. for security, safety, wind loading reasons)	No
Security	Where there are security issues (e.g. ground floor flats) has an alternative night time natural ventilation method been provided (e.g. ventilation grates)?	N/A
Shading	Is there any external shading?	Surrounding proposed developments
	Is there any internal shading?	-
Glazing specification	Is there any solar control glazing?	Yes, low emissivity glazing is specified
Ventilation - What is the ventilation strategy?	Natural – background	Yes
	Natural – purge	Yes
	Mechanical – background (e.g. MVHR)	Yes
	Mechanical – purge	Yes
	What is the average design air change rate	-
Heating system	Is communal heating present?	Yes
	What is the flow/return temperature?	TBC
	Have horizontal pipe runs been minimised?	Yes
	Do the specifications include insulation levels in line with the London Heat Network Manual[31]	TBC

3.2 Cooling Hierarchy

3.2.1 Minimise internal heat generation

Internal heat generation will be minimised throughout the development. Highly efficient LED lighting will be required as part of the energy strategy, which minimises internal heat generation.

A communal heating system is currently being proposed. These pipes should be fully insulated to minimise any heat loss from the LTHW and prevent heat build-up in corridors & risers.

3.2.2 Reduce the amount of heat entering a building

There are a number of proposed developments nearby, which are significantly taller than the proposed building, although they are primarily to the west so are only likely to provide some shading to the lower floors in the evening.

The development will have highly insulated external walls, which minimise any heat gain through conduction. The development has been proposed with solar control glazing to minimise solar gain.

3.2.3 Manage the heat within the building

The development is likely to be constructed out of a reinforced concrete frame and brickwork and steel framing system external walls, which provide a significant amount for thermal mass. This provides a damping effect, allowing the development to buffer itself from extremely high temperatures outside. However, it can also cause heat accumulation.

3.2.4 Passive ventilation

All bedrooms are provided with operable windows. These allow the occupants to use natural ventilation to control their indoor temperature. Living kitchens are also provided with operable windows to allow natural ventilation. A noise assessment conducted by Ardent identified that the windows can be openable during overheating conditions. Units most likely to experience overheating, such as those on the upper floors, are less likely to experience high noise levels from the road and occupants will be more willing to leave windows open to ensure passive ventilation.

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[29] Urban - as defined in CIBSE Guide TM49. Broadly equivalent to Central Activities Zone and Inner London areas in Map 2.2 of the London Plan

[30] Peri-urban – as defined in CIBSE Guise TM49. Broadly equivalent to Outer London areas in Map 2.2 of the London Plan

[31] http://www.londonheatmap.org.uk/Content/uploaded/documents/LHNM_Manual2014Low.pdf

Units on the lower floors, closer to sources of noise, are less likely to experience overheating, due to reduce solar gain.

3.2.5 Mechanical ventilation

Ardent noise assessment identified that an alternative means of ventilation should be provided in normal operating conditions. The development has been specified with MVHR, which can be used to provide background ventilation rates to the development. This means ventilation is possible even in situations when occupants do not want to leave windows open due to noise and/or safety considerations. It also allows ventilation to rooms that do not have external windows, such as bathrooms.

3.2.6 Active cooling systems

No mechanical cooling systems were deemed necessary for the student sections of the development.

3.3 Circulation Areas

Assessment of overheating in circulation areas requires an understanding of the internal gains from pipework, which requires more detailed design then is feasible at this stage.

However, the design of the system will ensure that all lateral pipework runs are minimised and will be fully insulated in line with design guidelines, to minimise heat gains. The pipework distribution will be designed and assessed to generally meet the best practice recommendations of CIBSE CP1 with distribution losses of 10% or less. Pipework insulation will be assessed accordingly against the requirements of BS5422:2009 and are expected to exceed normal installations with pipe insulation thicknesses of between 35mm and 45mm to keep losses below 25W/m (dependant on pipe size and conductivity of insulation selected).

3.4 Non-residential Spaces

As well as residential spaces, the development will include a number of non-residential spaces. Assessment of overheating within these spaces is not feasible at this point, as it requires a detailed understanding of internal gains from proposed use of the space, as well as a detailed design of HVAC equipment.

However the spaces will follow the cooling hierarchy in order to minimise overheating and cooling demand. The development will comply with criterion 3 of ADL2A with regards to solar gains, and will ensure that the cooling demand for the actual building is lower than that of the notional building.

Highly efficient LED lighting will be specified, with daylight dimming to minimise internal heat gain. Solar control glazing has been specified to minimise solar gain. Mechanical ventilation will be used to provide fresh air and will have a summer bypass mode to prevent heat build-up. Highly efficient VRF cooling is expected to be provided to ensure thermal comfort within the spaces, while minimising energy use.

4 Assessment Methodology

The assessment was undertaken using IES Virtual Environment software. A model of the proposed development was created in the IES ModelIt module using drawings provided by the architect. The surrounding buildings have been modelled based on satellite imagery and information provided in the drawings. An indicative model of the proposed adjacent developments has also been included. An image of part of the model used within the assessment is shown in Figure 4-1.

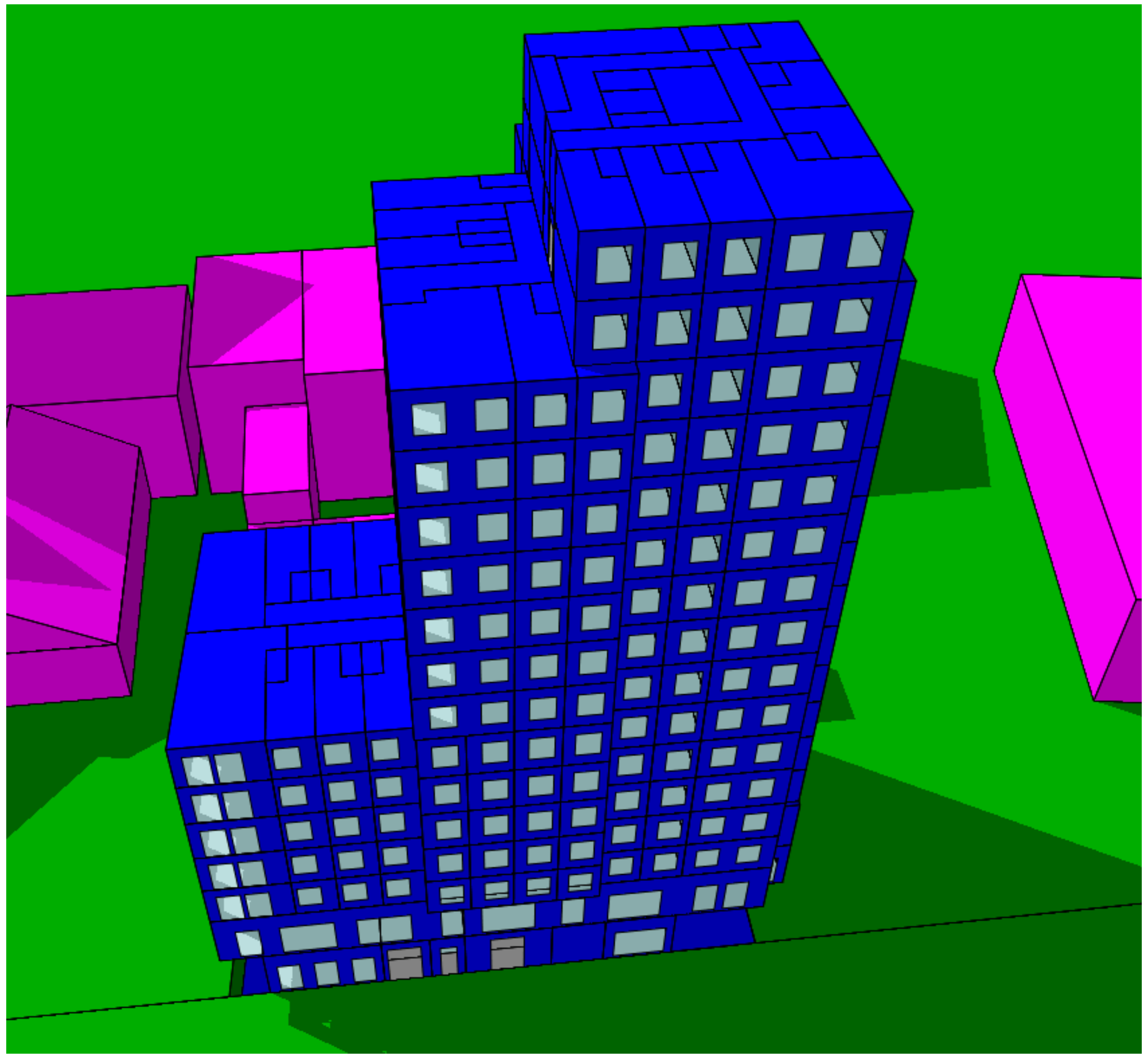

Figure 4-1 – IES model for Avonmouth House

A dynamic thermal assessment was conducted using the IES Apache module, which is a CIBSE AM11 compliant thermal modelling software.

All bedrooms and living/kitchen rooms have been assessed on the top 4 storeys of the development. The 6th floor has also been included to ensure all room types have been assessed.

The Design Summer Year 1 (DSY1), Design Summer Year 2 (DSY2) and Design Summer Year 3 (DSY3), London Weather Centre, high emission, 50% percentile weather files have been used from 2020 for the current scenarios.

The three DSY scenarios represent different types of hot summers:

- DSY1 – moderately warm summer, with a return period of seven years
- DSY2 – short, intense warm spell, about the same length as the moderate summer year but with a higher intensity
- DSY3 – long, less intense warm spell, which is less intense than the high-intensity year, but longer and more intense than the moderate summer year

5 Results

The results for the overheating assessment using 2020 weather data is outlined in Table 5-1 below.

Room	DSY1		DSY2		DSY3	
	Criteria 1	Criteria 2	Criteria 1	Criteria 2	Criteria 1	Criteria 2
Requirement	=<3.0	=<32	=<3.0	=<32	=<3.0	=<32
L06.A LKD	0.1		1		1.8	
L06.A.01 Bed	0	11	0	37	0	38
L06.A.02 Bed	0	11	0.1	37	0	38
L06.A.03 Bed	0	11	0	38	0	36
L06.A.04 Bed	0	11	0	36	0	36
L06.A.05 Bed	0	11	0	36	0	36
L06.A.06 Bed	0	11	0	36	0	36
L06.A.07 Bed	0	14	0.2	43	0.1	40
L06.A.08 Bed	0	13	0.1	43	0	37
L06.B LKD	0.5		2.1		2.3	
L06.B.01 Bed	0	15	0.3	46	0.2	40
L06.B.02 Bed	0	14	0.2	45	0.2	40
L06.B.03 Bed	0	14	0.2	45	0.2	39
L06.B.04 Bed	0	17	0.3	50	0.5	46
L06.B.05 Bed	0	17	0.3	50	0.5	46
L06.B.06 Bed	0	14	0.3	45	0.2	39
L06.B.07 Bed	0	14	0.3	45	0.2	39
L06.B.08 Bed	0	14	0.3	46	0.4	39
L06.C LKD	1.1		3		3.4	
L06.C.01 Bed	0	15	0.1	41	0.7	40
L06.C.02 Bed	0	14	0.1	39	0.6	40
L06.C.03 Bed	0	14	0.1	39	0.6	40
L06.C.04 Bed	0	14	0.1	40	0.6	40
L06.C.05 Bed	0	14	0.1	41	0.6	40
L06.C.06 Bed	0	18	0.1	44	0.6	44
L06.D.01 Studio	0	22	0	51	0.1	50
L12.A LKD	0.1		1.1		1.8	
L12.A.01 Bed	0	11	0	37	0	38
L12.A.02 Bed	0	11	0.1	37	0.1	38
L12.A.03 Bed	0	11	0	38	0	35
L12.A.04 Bed	0	11	0	37	0	33
L12.A.05 Bed	0	11	0	37	0	33
L12.A.06 Bed	0	11	0	37	0	35
L12.A.07 Bed	0	14	0.2	43	0.1	40
L12.B. LKD	0.7		2.5		2.7	
L12.B.01 Bed	0	14	0.2	45	0.3	39
L12.B.02 Bed	0	11	0.2	44	0.3	37
L12.B.03 Bed	0	12	0.2	44	0.1	38
L12.B.04 Bed	0	13	0.2	45	0.2	38
L12.B.05 Bed	0	11	0.5	44	0.6	39
L12.B.06 Bed	0	11	0.5	44	0.5	39
L12.B.07 Bed	0	14	0.2	48	0	40
L12.C.01 Studio	0	23	0	52	0.1	50
L13.A LKD	0.1		1		1.7	
L13.A.01 Bed	0	11	0	37	0	38
L13.A.02 Bed	0	11	0	37	0	38
L13.A.03 Bed	0	11	0	38	0	35
L13.A.04 Bed	0	11	0	36	0	33
L13.A.05 Bed	0	11	0	36	0	35
L13.A.06 Bed	0	11	0	37	0	35
L13.A.07 Bed	0	13	0.1	41	0.1	40
L13.B. LKD	0.4		2.2		2.5	
L13.B.01 Bed	0	14	0.2	45	0.2	39
L13.B.02 Bed	0	11	0.2	42	0.2	37
L13.B.03 Bed	0	11	0.2	44	0.1	36
L13.B.04 Bed	0	12	0.2	45	0.1	36
L13.B.05 Bed	0	11	0.5	44	0.4	39
L13.B.06 Bed	0	11	0.4	44	0.4	39
L13.B.07 Bed	0	14	0.2	46	0	38

L13.C.01 Studio	0	21	0	51	0	50
L14.A LKD	0.1		1.2		1.9	
L14.A.01 Bed	0	11	0	38	0	36
L14.A.02 Bed	0	11	0	37	0	36
L14.A.03 Bed	0	11	0	38	0	36
L14.A.04 Bed	0	13	0.2	44	0.1	37
L14.A.05 Bed	0	12	0.2	40	0	36
L14.A.06 Bed	0	14	0.2	44	0	38
L14.B.01 Studio	0.2	18	0.4	45	0.8	42
L15.A LKD	0		0.9		1.5	
L15.A.01 Bed	0	11	0	38	0	36
L15.A.02 Bed	0	11	0	38	0	36
L15.A.03 Bed	0	11	0	38	0	36
L15.A.04 Bed	0	13	0	40	0	35
L15.A.05 Bed	0	12	0	39	0	35
L15.A.06 Bed	0	14	0	44	0	37
L15.B.01 Studio	0.2	18	0.4	46	0.8	42
Pass	76/76	67/67	76/76	0/67	75/76	0/67
	100%	100%	100%	0%	99%	0%

Table 5-1 – Overheating results for 2020 weather files

6 Discussion

The results show that all assessed units within the development pass the overheating assessment for the DSY1, 2020, High emission 50th percentile scenario, which is the weather file recommended to be used in TM59.

When assessed under more extreme weather scenarios such as DSY2 and DSY3, the building struggles to meet the requirements of Criteria 2, which assesses the number of night-time hours bedrooms spend above 26 degrees. These criteria are hard to pass, especially using the central London weather file, as these weather simulations have outside air temperature above 26 degrees during the night (22:00-07:00) for a significant number of hours during the year. The results show that due to the thermal mass of the building, it does not cool down instantly on warm summer evenings. However, the thermal mass of the building helps improve the performance of the development against Criteria 1, by providing a buffer against extreme temperatures during the day, so lowering the thermal mass is not recommended. All design steps have been taken to minimise overheating, such as minimising solar gain and providing large openable windows have been provided to allow purge ventilation. Further measures, such as mechanical cooling, would be excessive given the performance of the development against the current recommended weather scenarios.

DSY2 and DSY3 represent rare weather events that are not representative of a typical or common summer and are unlikely to occur regularly. Following the results of the overheating assessment, some guidance has been provided to help occupants prevent overheating:

- Ensure internal gains are minimised, by turning off lighting and appliances that may generate heat and use blinds to minimise solar gain.
- Leaving windows partially open can lead to effective ventilation and prevent the build-up of heat. When this is not possible, the MVHR can be used to provide ventilation.
- When heat builds up, open the windows to purge the room of heat. When possible, open internal doors and windows to allow cross ventilation throughout the unit.

7 Conclusion

This report assessed the overheating potential of the proposed development at Avonmouth House in order to meet the sustainability requirements of the London Plan. Action was taken at each stage of the cooling hierarchy in order to minimise overheating.

A TM 59 assessment was undertaken using IES Virtual Environment software, which is a CIBSE AM11 compliant thermal modelling software. The DSY1, DSY2 and DSY3, London Heathrow, high emission, 50% percentile weather files were used to assess the overheating potential.

The results show that all of the assessed units within the development pass the overheating assessment for the current DSY1 scenario, which is the weather file recommended to be used in TM59. Measures were implemented to combat overheating. In more extreme heat, the building struggles to meet the requirements of Criteria 2. Guidance was provided to help occupants prevent overheating.

8 Appendix

8.1 Model Assumptions

The building and modelling assumptions used in the assessment are outlined below. The building fabric used are outlined in Table 8-1.

Building Element	U – Value (W/m²K)	G - Value
External Walls	0.15	
Roof	0.14	
External Glazing	1.2	0.40

Table 8-1 – Building fabric properties

All residential spaces were modelled in line with TM 59, with the exception of the studio rooms. These were modelled with just one occupant, rather than the two occupants recommended by TM 59, as they are single bedrooms.

Natural ventilation was modelled through operable windows using the IES MacroFlo Module.

Internal doors within each cluster were modelled as openable during the day when occupants are awake. Internal doors from the central hallway to studio and each cluster remained closed throughout.

Operable windows were set to open when the room is occupied and internal air temperatures is greater 22°C and greater than external air temperature, in line with the guidance in TM 59. Side hung windows have been set to open to 30 degrees, and bottom hung windows have been set to open to 10 degrees.

Auxiliary ventilation was modelled within the providing 0.5 ACH to bedrooms, kitchens, living room and bathrooms.

EARLY STAGE OVERHEATING RISK TOOL

Version 1.0, July 2019

This tool provides guidance on how to assess overheating risk in residential schemes at the early stages of design. It is specifically a pre-detail design assessment intended to help identify factors that could contribute to or mitigate the likelihood of overheating.

The questions can be answered for an overall scheme or for individual units. Score zero wherever the question does not apply. Additional information is provided in the accompanying guidance, with examples of scoring and advice on next steps.

Find out more information and download accompanying guidance at goodhomes.org.uk/overheating-in-new-homes.

Good Homes Alliance

KEY FACTORS INCREASING THE LIKELIHOOD OF OVERHEATING	KEY FACTORS REDUCING THE LIKELIHOOD OF OVERHEATING

Geographical and local context

#1 Where is the scheme in the UK? See guidance for map	South east	4	4
	Northern England, Scotland & NI	0	
	Rest of England and Wales	2	

#2 Is the site likely to see an Urban Heat Island effect? See guidance for details	Central London (see guidance)	3	2
	Grtr London, Manchester, B'ham	2	
	Other cities, towns & dense sub-urban areas	1	

#8 Do the site surroundings feature significant blue/green infrastructure? Proximity to green spaces and large water bodies has beneficial effects on local temperatures; as guidance, this would require at least 50% of surroundings within a 100m radius to be blue/green, or a rural context	1	0

Site characteristics

#3 Does the site have barriers to windows opening? - Noise/Acoustic risks - Poor air quality/smells e.g. near factory or car park or very busy road - Security risks/crime - Adjacent to heat rejection plant	**Day** - reasons to keep all windows closed	8	0
	Day - barriers some of the time, or for some windows e.g. on quiet side	4	
	Night - reasons to keep all windows closed	8	0
	Night - bedroom windows OK to open, but other windows are likely to stay closed	4	

#9 Are immediate surrounding surfaces in majority pale in colour, or blue/green? Lighter surfaces reflect more heat and absorb less so their temperatures remain lower; consider horizontal and vertical surfaces within 10m of the scheme	1	0
#10 Does the site have existing tall trees or buildings that will shade solar-exposed glazed areas? Shading onto east, south and west facing areas can reduce solar gains, but may also reduce daylight levels	1	1

Scheme characteristics and dwelling design

#4 Are the dwellings flats? Flats often combine a number of factors contributing to overheating risk e.g. dwelling size, heat gains from surrounding areas; other dense and enclosed dwellings may be similarly affected - see guidance for examples	3	3
#5 Does the scheme have community heating? i.e. with hot pipework operating during summer, especially in internal areas, leading to heat gains and higher temperatures	3	3

#11 Do dwellings have high exposed thermal mass AND a means for secure and quiet night ventilation? Thermal mass can help slow down temperature rises, but it can also cause properties to be slower to cool, so needs to be used with care - see guidance	1	1

#12 Do floor-to-ceiling heights allow ceiling fans, now or in the future? Higher ceilings increase stratification and air movement, and offer the potential for ceiling fans	>2.8m and fan installed	2	0
	> 2.8m	1	

Solar heat gains and ventilation

#6 What is the estimated average glazing ratio for the dwellings? (as a proportion of the facade on solar-exposed areas i.e. orientations facing east, south, west, and anything in between). Higher proportions of glazing allow higher heat gains into the space	>65%	12	0
	>50%	7	
	>35%	4	

#7 Are the dwellings single aspect? Single aspect dwellings have all openings on the same facade. This reduces the potential for ventilation	Single-aspect	3	3
	Dual aspect	0	

#13 Is there useful external shading? Shading should apply to solar exposed (E/S/W) glazing. It may include shading devices, balconies above, facade articulation etc. See guidance on "full" and "part". Scoring depends on glazing proportions as per **#6**		Full	Part	0
	>65%	6	3	
	>50%	4	2	
	>35%	2	1	

#14 Do windows & openings support effective ventilation? Larger, effective and secure openings will help dissipate heat - see guidance		Openings compared to Part F purge rates			0
		= Part F	+50%	+100%	
	Single-aspect	minimum required	3	4	
	Dual aspect		2	3	

TOTAL SCORE	13	=	Sum of contributing factors:	15	*minus*	Sum of mitigating factors: 2

High 12 **Medium** 8 **Low**

score >12:
Incorporate design changes to reduce risk factors and increase mitigation factors AND Carry out a detailed assessment (e.g. dynamic modelling against CIBSE TM59)

score between 8 and 12:
Seek design changes to reduce risk factors and/or increase mitigation factors AND Carry out a detailed assessment (e.g. dynamic modelling against CIBSE TM59)

score <8:
Ensure the mitigating measures are retained, and that risk factors do not increase (e.g. in planning conditions)