# ENERGY STATEMENT

## Ringers Road

Produced by XCO2 for Ringers Road Properties Ltd.

April 2023

**XCO2**
56 Kingsway Place, Sans Walk
London EC1R 0LU

+44 (0)20 7700 1000
mail@xco2.com
xco2.com

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# EXECUTIVE SUMMARY

The energy strategy for the Ringers Road development has been developed in line with the energy policies of the London Plan and of the London Borough of Bromley's Local Plan policies. A four-step Energy Hierarchy has been implemented in line with London Plan policy, and the estimated regulated $CO_2$ savings on site are 75% for the domestic part and 44% for the non-domestic part of the development, against a Part L 2021 compliant 'baseline' scheme, when using SAP10.2 carbon factors. Ringers Road is thus expected to meet the minimum 35% $CO_2$ reduction from on-site measures against Part L 2021 as required the London Plan policy. Remaining carbon emissions to reach the zero-carbon target will be offset by way of a carbon offset payment.

This report assesses the predicted energy performance and carbon dioxide emissions of the proposed development at Ringers Road, located in the London Borough of Bromley.

The proposed development includes the demolition of existing buildings and construction of a residential-led mixed-use development comprising residential units, ancillary residents' facilities (including co-working space) and commercial floor space (Use Class E) across two blocks, along with associated hard and soft landscaping, amenity spaces, cycle and refuse storage.

In line with London Plan policy SI2 and GLA energy assessment guidance the development will need to achieve a 'zero carbon' target for regulated $CO_2$ emissions; a minimum on-site reduction of at least 35% in regulated $CO_2$ emissions against a Building Regulations (Part L 2021) compliant scheme is required. Where the net zero carbon target cannot be fully achieved on-site, any shortfall should be offset.

The energy strategy outlined in this report has been developed using the SAP10.2 carbon emission factors in line with the GLA's energy assessment guidance 2022 in addition to Building Regulations Approved Document Part L 2021.

A centralised plant will supply the building with domestic hot water and space heating via a Low Temperature Hot Water (LTHW) communal heating circuit. Heat for the residential areas will be generated by central air source heat pumps and stored in thermal stores. Heat will be transferred from the LTHW circuit to individual dwellings via Heat Interface Units (HIUs). The communal LTHW will be operated at 55°C flow and 35°C return temperatures. An electric system with ASHP will also provide space heating, hot water and cooling to the commercial part of the development. The proposed strategy is in response to the update to carbon factors reflecting the cleaner electric grid.

The methodology used to determine the expected operational $CO_2$ emissions for the development is in accordance with the London Plan's four-step Energy Hierarchy (Policy SI2) and the $CO_2$ savings achieved for each step are outlined below:

### BE LEAN – USE LESS ENERGY

The first step addresses reduction in energy demand, through the adoption of passive and active design measures. The proposed energy efficiency measures include levels of insulation beyond Building Regulation requirements, low air tightness levels, efficient lighting as well as energy saving controls for space conditioning and lighting.

By means of energy efficiency measures alone, regulated $CO_2$ emissions are expected to reduce by:

| Regulated $CO_2$ Savings at Be Lean Stage (SAP10.2 carbon factors) | | |
|---|---|---|
| | % | t/yr |
| Domestic | 17% | 15.0 |

| | | |
|---|---|---|
| Non-domestic | 16% | 1.3 |
| Site wide | 17% | 16.3 |

At the ‘Be Lean’ stage, the proposed development exceeds the GLA target of 10% regulated $CO_2$ emission reductions for the residential portion of the scheme, and a 15% reduction for the non-domestic portion of the scheme using SAP10.2 carbon figures.

### BE CLEAN – SUPPLY ENERGY EFFICIENTLY

The application site is located in an area where a district heat network has not been found within a 1km radius of the site, and district heating is not expected to be implemented nearby in the near future.

A site wide heat network has been implemented for the Proposed Development, served solely by high efficiency Air Source Heat Pumps (ASHP). Based on the strategy proposed, no savings are achieved at the Be Clean stage.

### BE GREEN – USE RENEWABLE ENERGY

A renewable technologies feasibility study carried out for the development identified photovoltaics and air source heat pumps as suitable technologies for the development.

A fully electric communal ASHP system is proposed to serve the whole development. The system will provide heating and hot water to the residential portion; and heating, hot water and cooling to the commercial portion of the scheme. Photovoltaics will also provide electricity to the non-domestic parts of the development.

The incorporation of low and zero carbon technologies is expected to reduce $CO_2$ emissions further, as set out in the table below:

**Regulated $CO_2$ Savings at Be Green Stage (SAP10.2 carbon factors)**

| | % | t/yr |
|---|---|---|
| Domestic | 58% | 51.2 |
| Non-domestic | 28% | 2.3 |
| Site wide | 55% | 53.6 |

### CUMULATIVE ON-SITE SAVINGS

The overall regulated $CO_2$ savings on site against a Part L 2021 compliant scheme and using SAP10.2 carbon factors are therefore anticipated to be:

**Cumulative Regulated $CO_2$ Savings (SAP10.2 carbon factors)**

| | % | t/yr |
|---|---|---|
| Domestic | 75% | 66.2 |
| Non-domestic | 44% | 3.6 |
| Site wide | 72% | 69.8 |

### CARBON OFF-SETTING

The proposed development is expected to comply with the London Plan $CO_2$ savings target of 35% over Part L 2021 from on-site measures.

With the SAP10.2 carbon factors, to achieve ‘zero carbon’ for the residential portion of the scheme, 22.6 tonnes per annum of regulated $CO_2$, equivalent to 678 tonnes over 30 years, from the new-build domestic portion should be offset, which is estimated to equate to a one-off payment of £64,398. The shortfall to a zero-carbon reduction from baseline for the new build non-domestic portion of the scheme are estimated to be 4.6 tonnes per annum of regulated $CO_2$, equivalent to 138 tonnes over 30 years, to be offset, which would equate to a one-off payment of £13,095.

Any carbon offset contributions will be subject to viability discussions and detailed design stage calculations.

### BE SEEN

Following the implementation of the three previous stages of the hierarchy, a monitoring strategy will be put in place to ensure that the actual energy performance of the development can be monitored and reported post-occupation.

The relevant parties will also be made aware of their responsibilities at subsequent reporting stages.

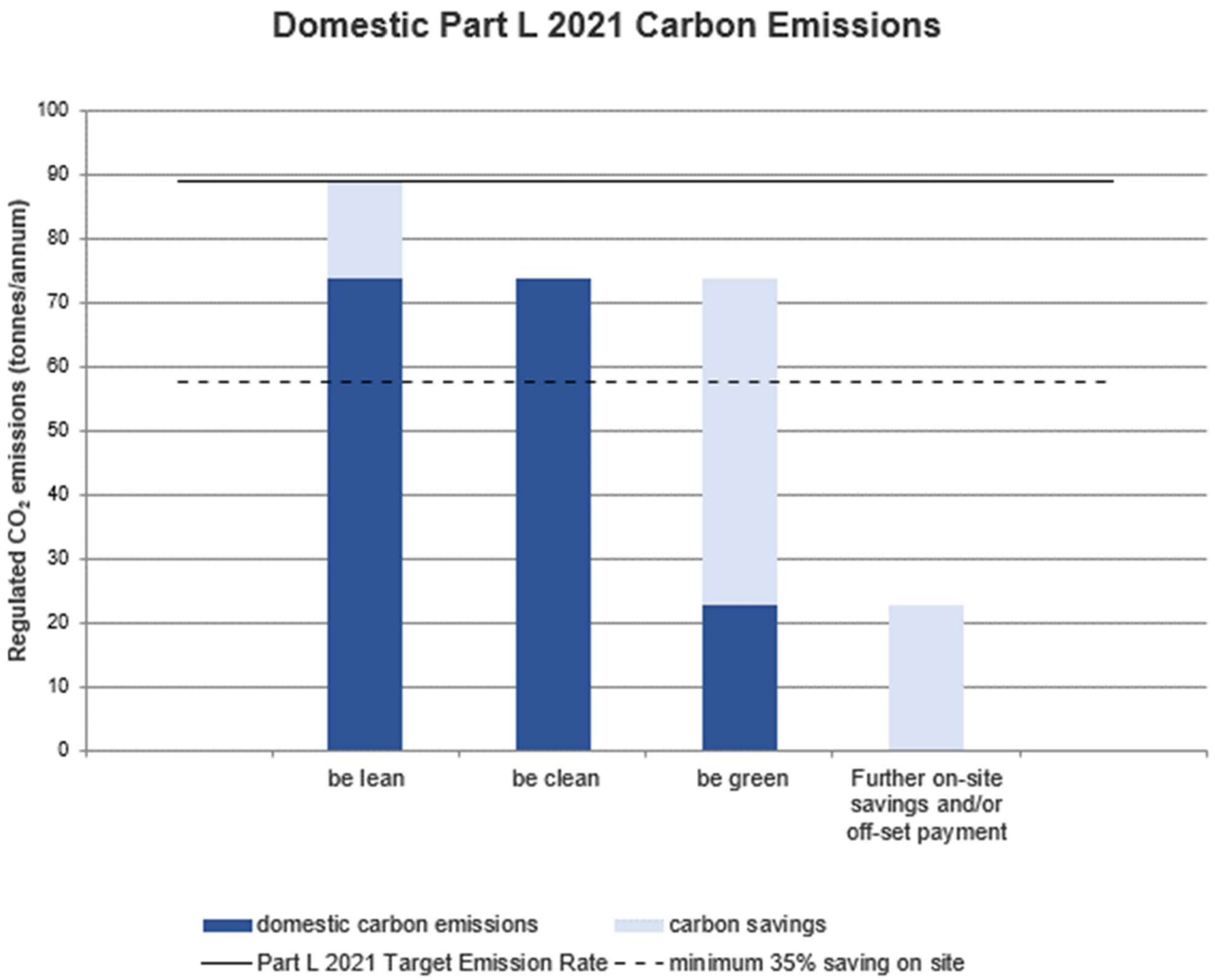


Figure 1: The Domestic Energy Hierarchy (SAP10.2 carbon factors)

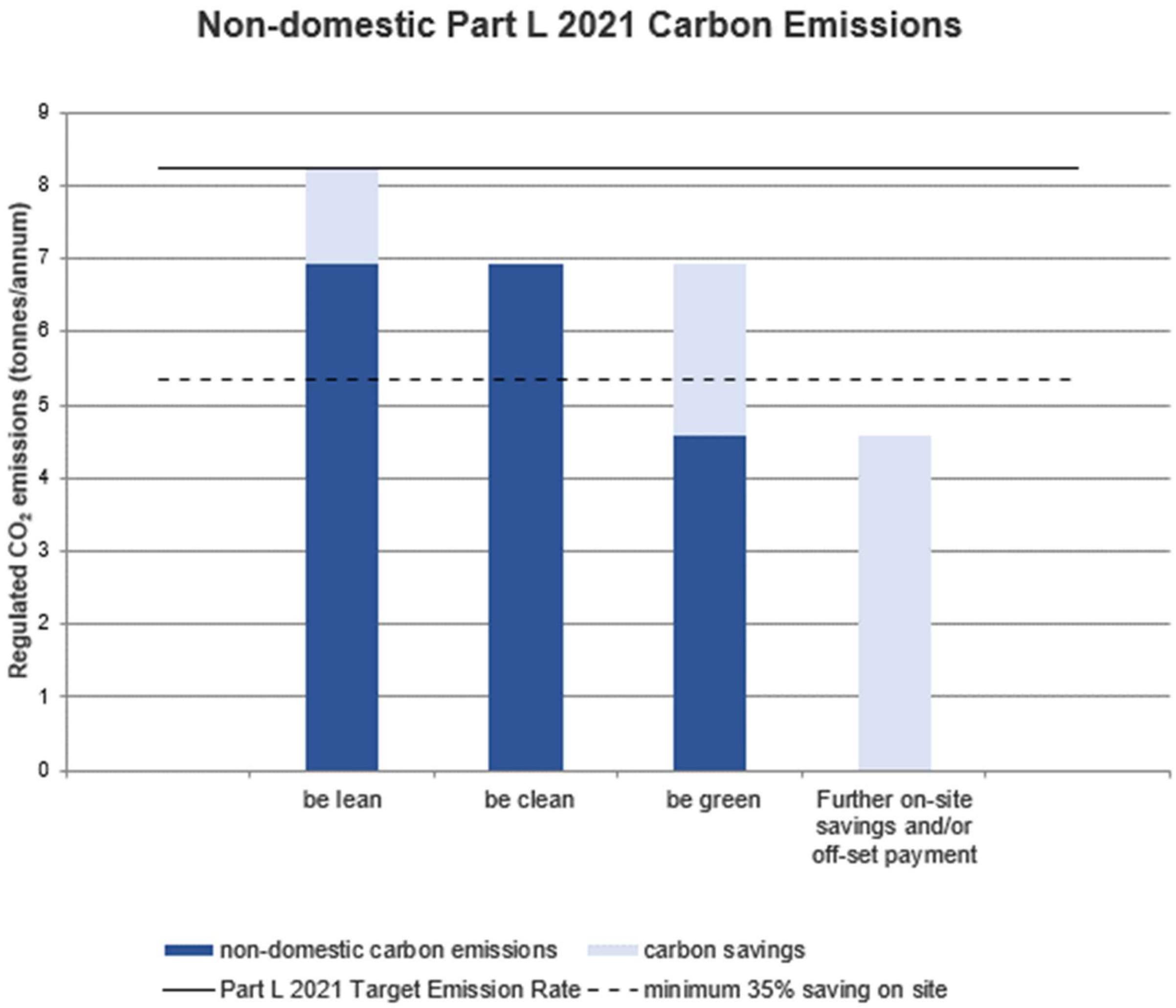


Figure 2: The Non-Domestic Energy Hierarchy (SAP10.2 carbon factors)

# INTRODUCTION

This chapter presents the description of the site and of the development proposal, the energy policy framework and the methodology employed for the energy assessment.

## SITE & PROPOSAL

The site is located between Ringers Road and Ethelbert Road in Bromley and includes the demolition of existing buildings and construction of a mixed-use development comprising residential units, ancillary residents' facilities (including co-working space) and commercial floor space (Use Class E) across two blocks, along with associated hard and soft landscaping, amenity spaces, cycle and refuse storage.

The location of the development site is shown in the figure below.

Figure 3: Approximate location of the application site.

## POLICY FRAMEWORK

This proposal responds to the energy policies of the London Plan and of the policies within the London Borough of Bromley Local Plan.

The most relevant applicable energy policies in the context of the proposed development are presented below.

### *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 sustainability focus with many new policies addressing the concern to deliver a sustainable and zero carbon London, particularly addressed in chapter 9 Sustainable Infrastructure.

The following policies, related to Energy, are of relevance for the proposed development:

#### POLICY SI2 MINIMISING GREENHOUSE GAS EMISSIONS

This policy sets the requirements for all major developments to follow the energy hierarchy and achieve net-zero-carbon for both residential and non-residential schemes (via a combination of on-site carbon reductions and offset payments) and introduces new targets at the Be Lean stage:

> *"...*
> *This means reducing greenhouse gas emissions in operation and minimising both annual and peak energy demand in accordance with the following energy hierarchy:*
> *1) be lean: use less energy and manage demand during operation*
> *2) be clean: exploit local energy resources (such as secondary heat) and supply energy efficiently and cleanly*
> *3) be green: maximise opportunities for renewable energy by producing, storing and using renewable energy on-site*
> *4) be seen: monitor, verify and report on energy performance.*
> *..."*

> *"...*
> *A minimum on-site reduction of at least 35 per cent beyond Building Regulations is required for major development. Residential development should achieve 10 per cent, and non-residential development should achieve 15 per cent through energy efficiency measures. Where it is clearly demonstrated that the zero-carbon target cannot be fully achieved on-site, any shortfall should be provided, in agreement with the borough, either:*
> *1) through a cash in lieu contribution to the borough's carbon offset fund, or*
> *2) off-site provided that an alternative proposal is identified and delivery is certain.*
> *..."*

This policy also sets the requirements to consider whole-life carbon emissions, including embodied carbon and unregulated emissions:

> *"...*
> *Major development proposals should calculate and minimise carbon emissions from any other part of the development, including plant or equipment, that are not covered by Building Regulations, i.e. unregulated emissions.*
>
> *Development proposals referable to the Mayor should calculate whole lifecycle carbon emissions through a nationally recognised Whole Life-Cycle Carbon Assessment and demonstrate actions taken to reduce life-cycle carbon emissions.*
> *..."*

The policy supporting text provides additional clarifications on the requirements for major developments:

- Developments including major refurbishments should also aim to meet the net-zero carbon target.
- All developments should maximise opportunities for on-site electricity and heat production from solar technologies (photovoltaic and solar thermal), use innovative building materials and smart technologies.
- Recommendation to use SAP10 carbon factors as per GLA Energy Guidance.

- Recommended carbon offset price of £95 per tonne $CO_2$.
- Requirement for major developments to monitor and report operational energy performance to the GLA.

### POLICY SI 3 ENERGY INFRASTRUCTURE

This policy requires all major developments within Heat Network Priority Areas to utilise a communal low-temperature heating system and follow the energy hierarchy to determine the most suitable system. Where developments are utilising CHP this policy also requires them to demonstrate that ‘the emissions relating to energy generation will be equivalent or lower than those of an ultra-low NOx gas boiler’. Any combustion on site should meet the requirements of part B of Policy SI1.

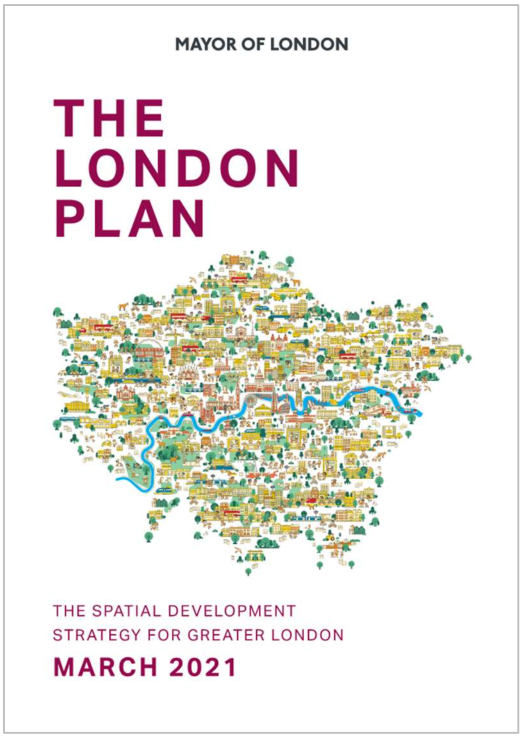
### POLICY SI 4 MANAGING HEAT RISK

This policy requires:

255. *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.*

The London Plan also consists of a suite of guidance documents, such as the Energy Assessment Guidance: Greater London Authority guidance on preparing energy assessments as part of planning applications (April 2020)



MAYOR OF LONDON

THE LONDON PLAN

THE SPATIAL DEVELOPMENT
STRATEGY FOR GREATER LONDON

MARCH 2021

## *GLA GUIDANCE ON PREPARING ENERGY ASSESSMENTS*

This document (last updated in June 2022) provides guidance on preparing energy assessments to accompany strategic planning applications; it contains clarifications on Policy SI2, of the new London Plan, carbon reduction targets in the context of zero carbon policy, as well as detailed guidelines on the content of the Energy Assessments undertaken for planning.

The guidance document specifies the emission reduction targets the GLA will apply to applications as follows:

*Major developments are required to* achieve *net zero-carbon by following the energy hierarchy (Policy SI 2). This means that regulated carbon emissions should be reduced so they are as close as possible to zero. Once on-site reductions have been maximised, the residual emissions should be offset via a payment into the relevant borough's carbon offset fund.*

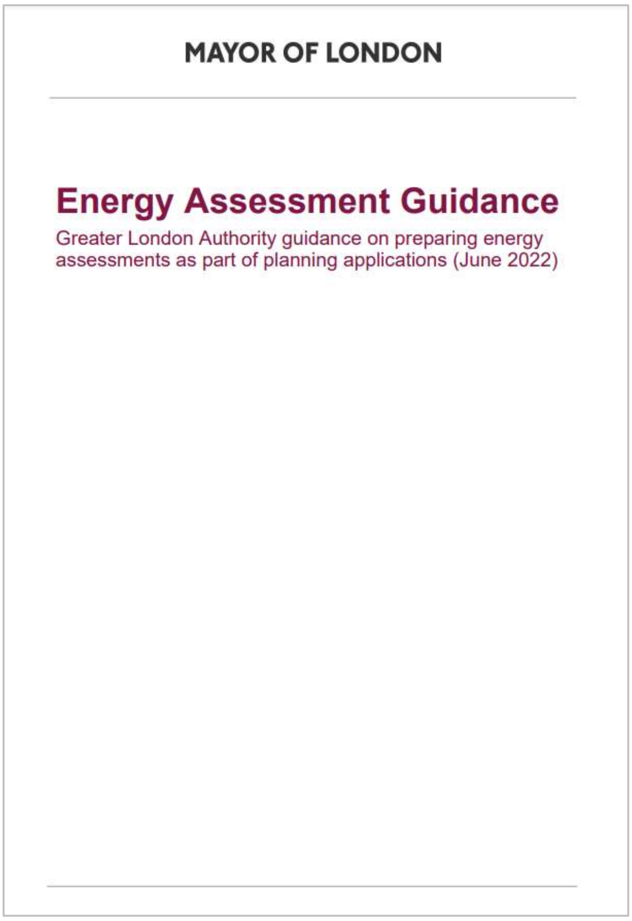
*Major developments are required to achieve a minimum 35 per cent on-site carbon reduction over Part L 2021. Residential developments are expected to be able to exceed this, and so an additional benchmark has been set that residential developments should be aiming to achieve. See Table below. The benchmarks may be updated periodically to include additional building types and to reflect improvements in performance over time.*

| Building type | Minimum on-site improvement over Part L 2021(per cent) | Benchmark improvement over Part L 2021 (per cent) |
|---|---|---|
| Residential | 35 per cent | 50 per cent+ |

*Energy efficiency is the first stage of the energy hierarchy. Energy demand should be reduced as far as possible before the heating strategy and installation of low carbon and renewable technologies is considered. This is important in protecting consumers from high prices. Developments are expected to achieve carbon reductions beyond Part L 2021 of 10 per cent for residential developments and 15 per cent for non-residential developments through energy efficiency measures alone, before other measures are applied.*

The definition of zero carbon homes is provided on Page 54 of the guidance:

Zero carbon homes - homes forming part of major development applications (i.e. those with 10 or more units) where the residential element of the application achieves at least a 35 per cent reduction in regulated carbon dioxide emissions (beyond Part L 2021) on-site. The remaining regulated carbon dioxide emissions, to 100 per cent, are to be offset through a cash in lieu contribution to the relevant borough to be ring fenced to secure delivery of carbon dioxide savings elsewhere.



MAYOR OF LONDON

Energy Assessment Guidance

Greater London Authority guidance on preparing energy assessments as part of planning applications (June 2022)

## *BROMLEY LOCAL PLAN (2019)*

**Policy 112 Planning for Sustainable Waste Management**

The Council will support sustainable waste management by:

- Implementing the waste hierarchy in its approach to future waste management
- Allocating the strategic waste management sites of Waldo Road, Churchfields and Cookham Road and safeguarding them for waste uses only.
- Working in collaboration with the London Boroughs of Bexley, Greenwich, Southwark, Lewisham and City of London to make optimum use of waste management capacity in the south east London sub region.
- Meeting the London Plan waste apportionment targets.

**Policy 115 Reducing Flood Risk**

In order to address existing flood risk and to reduce the impact of new development, the Council will:

- Work with the Environment Agency, landowners and developers, based on the findings of the most recent SFRA and other Plans, to manage and reduce flood risk from all sources of flooding.
- Apply the sequential and exception tests to avoid inappropriate development in relation to flood risk. Implement sustainable drainage system (SUDs) across the borough and work towards effective management of surface water flooding.
- Fully engage in flood risk emergency planning including the pre, during and post phases of flooding event.
- Propose ensure the implementation of measures to mitigate flood risk across the borough that are effective, viable, attractive and enhance the public realm and ensure that any residual risk can be safely managed.

To minimise river flooding risk, development in Flood Risk Areas (Environment Agency Flood Zones 2 and 3 and surface water flood risk hotspots) will be required to seek opportunities to deliver a reduction in flood risk compared with the existing situation.

In Flood Risk Areas the sequential test and exception test as set out in the NPPF and associated technical guidance should be applied.

Flood Risk Assessments should be submitted in support of all planning applications in these areas and for major development proposals across the Borough.

All development proposals should reduce surface water run-off entering the sewerage network reduce rainwater run-off through the use of suitable Sustainable Drainage Systems (SUDS) as far as possible.

**Policy 116 Sustainable Urban Drainage Systems (SUDS)**

All developments should seek to incorporate Sustainable Urban Drainage Systems (SUDS) or demonstrate alternative sustainable approaches to the management of surface water as far as possible. Applications for developments located within Flood Zones 2, 3a and 3b and in Flood Zone 1 for areas identified as hot spots in Bromley's Surface water Management Plan (SWAMP), Preliminary Flood Risk Assessment (PFRA) and in the Strategic Flood Risk Assessment must be accompanied by a site-specific Flood Risk Assessment (FRA).

**Policy 118 Contaminated Land**

Where the development of contaminated land, or land suspected of being contaminated, is proposed, details of site investigations and remedial action should be submitted.

- Applicants are required to submit, for approval:
- A desk study before starting investigations on site
- A full site investigation including relevant sampling and analysis to identify pollutants, risks and a remediation strategy
- A remediation strategy
- A closure report on completion of works
- Land should be remediated to a standard such that there is no appreciable risk to end users or other receptors once the development is complete.

**Policy 119 Noise Pollution**

In order to minimise adverse impacts on noise sensitive receptors, proposed developments likely to generate noise and or vibration will require a full noise/ vibration assessment to identify issues and appropriate mitigation measures.

In most cases where there is a risk of cumulative impact on background level over time or where an area is already subject to an unsatisfactory noise environment, applicants will be required to ensure that the absolute measured or predicted level of any new noise source is 10dB below the existing typical background LA90 noise level when measured at any sensitive receptor.

New noise sensitive development should be located away from existing noise emitting uses unless it can be demonstrated that satisfactory living and working standards can be achieved and that there will be no adverse impacts on the continued operation of the existing use.

The design and layout of new development should ensure that noise sensitive areas and rooms are located away from parts of the site most exposed to noise wherever practicable.

External amenity areas should incorporate acoustic mitigation measures such as barriers and sound absorption where this is necessary and will assist in achieving a reasonable external noise environment. In mixed use buildings, conversions and changes of use which increase internal noise should incorporate measures to minimise the transfer of noise between different parts of the building.

An airborne sound insulation of at least 55dB D'nT,w + Ctr will usually be expected in separating partitions between residential dwellings and non-residential noise generating uses. A higher standard may sometimes be necessary depending on the nature of the development.

**Policy 120 Air Quality**

Developments which are likely to have an impact on air quality or which are located in an area which will expose future occupiers to pollutant concentrations above air quality objective levels will be required to submit an Air Quality Assessment.

Developments should aim to meet "air quality neutral" benchmarks in the GLA's Air Quality Neutral report.

In the designated Air Quality Management Area:

- Developments should incorporate Ultra Low Nox boilers
- Biomass boilers should be avoided unless emission standards can be met.

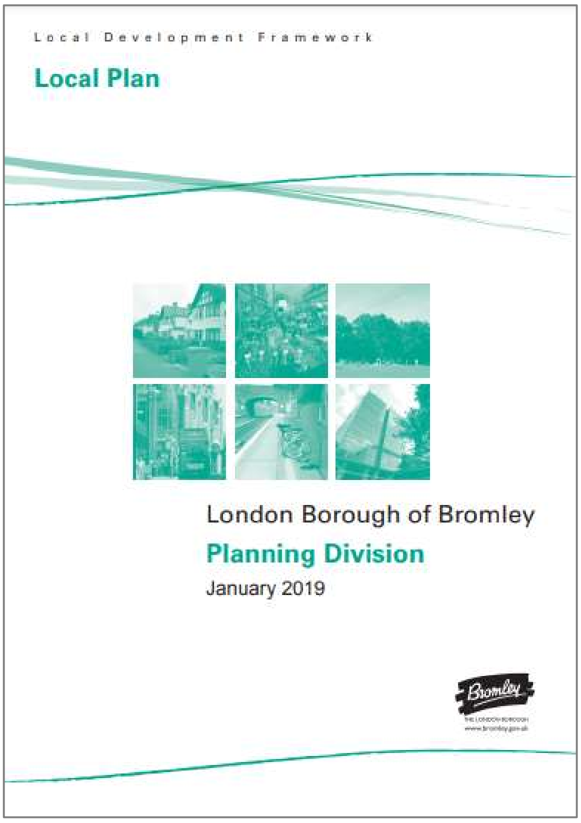
**Policy 124 Carbon Dioxide Reduction, Decentralised Energy Networks and Renewable Energy**

Major developments should aim to reduce their carbon dioxide emissions in accordance with the levels set out in the London Plan. Planning applications for major development should include evidence of how the energy requirements and carbon dioxide emissions of proposed developments have been assessed and propose a clear reduction strategy in line with the energy hierarchy.

Information submitted should be sufficient to demonstrate how the relevant London Plan policies have been addressed and how the strategy can be fully implemented without additional permissions.

Major development proposals should investigate the potential for connecting to an existing decentralised heat or energy network or developing a new site-wide network and the potential for renewable energy should be assessed as part of the design of the development to ensure successful integration.

The carbon dioxide reduction target should be met on site unless it can be demonstrated that it is not feasible. Any shortfall may be met through an identified project off-site or through a payment in lieu to a local carbon off-setting scheme.



Local Development Framework

Local Plan

London Borough of Bromley

Planning Division

January 2019

## METHODOLOGY

The sections below present the methodology followed in determining the on-site and off-site carbon savings for the proposed scheme.

### *ON-SITE CARBON SAVINGS – THE ENERGY HIERARCHY*

The methodology employed to develop the energy strategy for the scheme and achieve on-site carbon savings is in line with the GLA's *Guidance on preparing energy assessments* and is as follows:

The software used to model and calculate the energy performance and carbon emissions of the domestic elements is Elmhurst Design SAP10 and SBEM (IES VE) for the non-domestic elements.

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.

The emissions of the domestic areas are established by modelling representative dwelling types and multiplying the Target Emission Rate (TER) of each type with the cumulative floor area for that type to establish the total emissions for the domestic element of the proposal. Similarly, the TER for each non-domestic element is multiplied by its 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) and SBEM Building Emission Rate (BER) figures for the domestic and non-domestic elements respectively. The Energy Hierarchy aims at delivering significant carbon savings on-site.

The three key consecutive steps of the Energy Hierarchy prior to the development being built are:

- **Be Lean** whereby the demand for energy is reduced through a range of passive and active energy efficiency measures; as part of this step the Cooling Hierarchy (see Policy SI4) is implemented and measures are proposed to reduce the demand for active cooling;
- **Be Clean** whereby as much of the remaining energy demand is supplied as efficiently as possible (e.g., by connecting to a district energy network or developing a site-wide energy network), and,
- **Be Green** whereby renewable technologies are incorporated 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 implementation of the Energy Hierarchy determines the total regulated carbon savings that can be feasibly and viably achieved on site.

The % improvement against the baseline emissions is compared to the relevant targets for each element and in case of a shortfall, savings through off-site measures should be achieved.

### *OFF-SITE CARBON SAVINGS – CARBON OFFSETTING*

The GLA has an established provision to ensure that the shortfall in carbon savings is met off-site; this comprises a carbon offset payment with a figure of £95/tonne for a period of 30 years.

The cash in lieu contribution for the domestic and non-domestic elements of the proposal is calculated to provide the total carbon offset payment to be made to the Council.

The structure of the main body of the assessment follows the methodology presented above and comprises the sections:

- Be Lean;
- Be Clean;
- Be Green.

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

### *OPERATIONAL ENERGY MONITORING*

Following the implementation of the three previous stages of the hierarchy, a monitoring strategy will be put in place to ensure that the actual energy performance of the development can be monitored and reported post-occupation. The relevant parties will also be made aware of their responsibilities at subsequent reporting stages.

# BE LEAN – USE LESS ENERGY

The proposals incorporate a range of passive and active design measures that will reduce the energy demand for space conditioning, hot water, and lighting. Measures will also be put in place to reduce the risk of overheating. The regulated carbon saving achieved in this step of the Energy Hierarchy is 17% over the site wide baseline level when using SAP10.2 emission factors.

In line with GLA guidance, gas boilers with gross efficiency of 89.5% have been included for space heating and hot water for all residential spaces within the scheme in the SAP calculations in the Be Lean case. Also in line with GLA guidance, ASHP with a gross efficiency of 264% have been included for space heating within the SBEM modelling (non-residential areas) for the Be Lean test.

## 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 development will incorporate high levels of insulation and high-performance glazing beyond Part L 2021 targets, in order to reduce the demand for space conditioning (heating and/or cooling).

The adjacent tables demonstrate the proposed improved performance of the building fabric beyond the Building Regulations requirements for both domestic and non-domestic uses.

### *AIR TIGHTNESS IMPROVEMENT*

Heat loss may also occur due to air infiltration. Although this cannot be eliminated altogether, good construction detailing and the use of best practice construction techniques can minimise the amount of air infiltration.

The proposed development will aim to improve upon the Part L 2021 minimum standards for air tightness by targeting air permeability rates of $3m^3/m^2.h$ at 50Pa for all new build residential units and non-domestic areas.

Table 1: Thermal Envelope U-values.

| **Domestic (U-values in W/m².K)** | | | |
|---|---|---|---|
| **Element** | **Building Regulations** | **Proposed** | **Improvement** |
| Walls | 0.26 | 0.15 | 42% |
| Floor | 0.18 | 0.10 | 44% |
| Roof | 0.16 | 0.10 | 38% |
| Windows | 1.60 | 1.20 | 25% |
| Doors | 1.60 | 1.00 | 38% |

| **Non-domestic (U-values in W/m².K)** | | | |
|---|---|---|---|
| **Element** | **Building Regulations** | **Proposed** | **Improvement** |
| Walls | 0.26 | 0.15 | 42% |
| Floor | 0.18 | 0.10 | 44% |
| Roof | 0.18 | 0.10 | 44% |
| Windows | 1.60 | 1.20 | 25% |
| Doors | 1.60 | 1.00 | 38% |

### *THERMAL BRIDGING*

Thermal bridging can cause significant heat loss within buildings, whereby junctions between insulated building fabric elements provide less thermal resistance than the surrounding envelope. While repeating thermal bridges such as timber studs, rafters and wall ties are accounted for within U-value calculations, linear thermal bridges such as floor junctions, corners, roof junctions and window reveals must be included separately within the SAP calculations.

Heat loss from linear thermal bridges is known as the Psi-value (Ψ). Psi-values can be obtained through the modelling of specific junctions based on the proposed construction details, and is measured in W/mK. The cumulative impact of the total heat loss expected from all the thermal bridges combined is known as the y-value. The Building Regulations Part L 2021 uses a reference y-value of 0.08 W/m$^2$K for the notional building.

The proposed development will aim to meet the Part L 2021 target by targeting the psi values shown in Appendix E, with resultant y-values of 0.06 or below for the dwellings on average.

Further consideration will be given to thermal bridges, and detailed modelling of the junctions will be carried out in the next stages to ensure that these targets can be achieved.

### 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 of the 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.

### FABRIC ENERGY EFFICIENCY

The predicted performance of the dwellings was also assessed based on fabric efficiency alone. The energy demand of the dwelling per square metre is represented by the Dwelling Fabric Energy Efficiency (DFEE) and in order to reach Part L1 compliance this must not exceed the Target Fabric Energy Efficiency (TFEE). In Table 2 below, a summary of the findings from the assessment is presented and it demonstrates that the DFEE does not exceed the TFEE.

Table 2: Area Averaged Target and Dwelling Fabric Energy Efficiency for the residential portion of the scheme.

| Fabric Energy Efficiency | | |
|---|---|---|
| **TFEE (kWh/m$^2$.yr)** | **DFEE (kWh/m$^2$.yr)** | **Improvement** |
| 35.87 | 35.30 | 2% |

## ACTIVE DESIGN MEASURES

### HIGH EFFICACY LIGHTING

The development intends to incorporate low energy lighting throughout the residential and non-residential spaces. All light fittings will be specified as low energy lighting, and will accommodate LED luminaires only. The non-residential areas will incorporate lighting with efficacy of 120 lumens/Watt.

### HEAT RECOVERY VENTILATION

Mechanical ventilation with heat recovery (MVHR) is proposed for both the residential and non-residential portions of the development. The mechanical ventilation system will include heat recovery in order to achieve ventilation in the most energy-efficient way. High performance MVHR, such as Nuaire MRXBOX ECO2/ECO3 or similar with heat recovery efficiency of ~90% is recommended, with intake and exhaust louvre to be provided on the external wall.

### COMFORT COOLING

Air source heat pumps with high energy efficiency ratios will be proposed for both heating and cooling in the non-residential portions of the development, therefore the impact of active cooling in terms of energy use and carbon emissions will be minimised.

### CONTROLS

Advanced lighting and space conditioning controls will be incorporated, specifically:

- For non-residential areas of infrequent use, occupant sensors will be fitted for lighting, whereas day lit areas will incorporate daylight sensors where appropriate;
- Heating controls in dwellings will comprise time and temperature zone control, programmers and room thermostats; and,
- Space conditioning in the non-domestic areas will be controlled by local time and temperature on a room-by-room basis.

### MONITORING

In addition to the above design measures, the development will incorporate monitoring equipment and systems to enable occupiers to monitor and reduce their energy use.

Smart meters will be installed to monitor the heat and electricity consumption of each dwelling and the communal non-residential areas; the display board will demonstrate real-time and historical energy use data and will be installed at an accessible location within the dwellings and the communal non-residential area.

### *WASTE-WATER HEAT RECOVERY*

WWHR systems are not proposed for the apartments, as this would impact the space required under bathtubs and shower trays and result in increased heights for each floor and subsequently for the whole building.

## MINIMISING OVERHEATING

The potential risk of overheating will be mitigated by incorporating passive and active design measures, in line with the London Plan Policy SI4 and the Cooling Hierarchy, as follows.

### *THE COOLING HIERARCHY*

#### REDUCING THE AMOUNT OF HEAT ENTERING THE BUILDING IN SUMMER

The openings across the development have been appropriately designed to offer satisfactory daylight and views to occupied spaces, without disproportionately increasing solar gains and overheating risks.

The development also incorporates balconies, which apart from offering private amenity space for occupants, will also serve as shading elements for the openings of the floors below, obstructing direct solar gains during peak hours of the summer.

Different solar control glazing with low g-values of 0.5 and 0.40 for the residential and the commercial elements respectively, will also be proposed to reduce the overheating risk for the development.

#### MINIMISING INTERNAL HEAT GENERATION THROUGH ENERGY EFFICIENT DESIGN

The residential development will be served by a communal heating plant room, and heat sources and pipework will be sufficiently insulated to reduce heat dissipation in occupied spaces.

Efficient lighting will be used to further minimise internal heat gains and reduce energy expenditure. Heat sources and pipework will be sufficiently insulated (following CIBSE CoP1 guidelines).

#### USE OF THERMAL MASS AND HIGH CEILINGS TO MANAGE THE HEAT WITHIN THE BUILDING

During peak summer periods the thermal mass of the building will absorb and store excess heat. The building will release its heat in the cooler evenings to allow for cooler internal spaces dampening the peak diurnal weather conditions.

Due to the need to conceal services in suspended ceilings (for aesthetic reasons) and to limit noise impact between flats, there are limited opportunities of utilising exposed high thermal mass to manage the heat within the building.

In addition, thermal mass is mostly beneficial to reducing heat gains during the daytime (as it is chilled down by use of ventilation, such as open windows overnight, to then dissipate coolth into rooms during the following day), whereas the main issue with overheating risk is mostly experienced overnight in bedrooms, where thermal mass would not be of similar benefit.

#### PASSIVE VENTILATION

The dwellings have allowed for passive ventilation as a secondary strategy for fresh air supply and as a primary strategy for dissipating excess heat during peak summer conditions. The passive ventilation strategy includes single-sided ventilation and/or cross ventilation and night purge ventilation through openable windows and doors, operated by the occupants.

Openable windows will be implemented regardless of any overheating risk mitigation strategy, in order to give occupants the opportunity to open the windows to their dwellings as and when they so choose.

### MECHANICAL VENTILATION

The primary strategy for fresh air supply will be through a mechanical ventilation system with heat recovery for both the residential and non-residential spaces of the development. The MVHR will be capable of operating in summer bypass mode allowing for the dissipation of any heat build-up during peak summer conditions.

### COOLING SYSTEMS

Cooling coils are proposed to be installed in the MVHR units. Cooling coils are considered a ‘trim cooling’ option, as they pre-temper the incoming air and reduce its temperature by 4-8°C and they do not allow the occupants to set a fixed desired temperature, which could result in increased energy consumption.

As per SAP conventions, cooling coils are not modelled within the Part L calculations.

Active cooling is only proposed for the non-domestic areas, i.e. the communal lounges, gym and reception areas, with an expected efficiency of 6.0 (SEER). The cooling demand of the non-domestic spaces is expected to be lower than the cooling demand of the notional building, as shown in the table below:

Table 3: Non-residential areas cooling demand based on SBEM calculations.

| Area weighted average non-domestic cooling demand ($MJ/m^2$) | |
|---|---|
| Actual | 113.8 |
| Notional | 181.0 |

### *OVERHEATING RISK ASSESSMENT*

An overheating assessment was undertaken for representative ‘worst case’ dwellings in line with CIBSE TM59 and Part O of the Building Regulations. Dynamic thermal modelling was conducted using three design weather years, thus also accounting for climate change scenarios.

The results show that all flats are expected to comply with the Part O overheating risk criteria for the London Weather Centre DSY1 2020’s weather data, following the implementation of adequate design considerations.

Due to exceedance of acoustic levels, as per Part O guidance, the assessment concluded that a hybrid strategy of passive and active measures will be required to comply with Part O of the Building Regulations.

The passive measures to be incorporated into the design include solar control glazing, external shading, and efficient lighting.

The active measure involves the incorporation of trim cooling in the form of cooling coils within the MVHR systems. This is due to noise restrictions, highlighted within the acoustic report in accordance with the Part O methodology, meaning there could not be a reliance on openable windows as the sole option for mitigating overheating risk to bedrooms overnight.

The Overheating Assessment can be seen in full in Appendix A –Overheating Risk Assessment.

## BE LEAN $CO_2$ EMISSIONS

At the ‘Be Lean’ stage, the proposed development meets the GLA target of 10% regulated $CO_2$ emission reductions for the residential portion of the scheme, and a 15% reduction for the non-domestic portion of the scheme, when using SAP10.2 carbon factors.

Energy cost to residents is also reduced through the implementation of energy efficiency measures outlined within this section.

| Regulated $CO_2$ Savings at Be Lean Stage (SAP10.2) | | |
|---|---|---|
| | % | t/yr |
| Residential | 17% | 15.0 |
| Non-Residential | 16% | 1.3 |
| Site Wide | 17% | 16.3 |

# BE CLEAN – SUPPLY ENERGY EFFICIENTLY

A review of the London Heat Map shows that there are no nearby existing or proposed energy networks, and it is therefore not feasible or viable for the proposed development to incorporate the supply of low carbon heating or cooling from an offsite network. Therefore, no carbon savings are achieved for this step of the Energy Hierarchy.

## ENERGY SYSTEM HIERARCHY

The energy system for the development has been selected in accordance with the London Plan decentralised energy hierarchy. The hierarchy listed in Policy SI3 states that energy systems should consider:

1. Connection to existing heating and cooling networks;
2. Site wide CHP network; and,
3. Communal heating and cooling.

Local heat and power sources minimise distribution losses and achieve greater efficiencies when compared to separate energy systems, thus reducing $CO_2$ emissions.

In a communal energy system, energy in the form of heat, cooling, and/or electricity is generated from a central source and distributed via a network of insulated pipes to surrounding residences.

## CONNECTION TO AN EXISTING OR PROPOSED NETWORK

The London Heat Map identifies existing and potential opportunities for decentralised energy projects in London. It builds on the 2005 London Community Heating Development Study.

An excerpt from the London Heat Map can be seen on the following page which shows the energy demand for different areas. Darker shades of red signify areas where energy demand is high. The map also highlights any existing and proposed district heating networks within the vicinity of the development.

A review of the map shows that there are no existing or proposed networks in the vicinity of the site for current or future connection.

In addition, Bromley Council have confirmed that there are no planned network opportunities within suitable proximity to the site. This correspondence can be found in Appendix H.

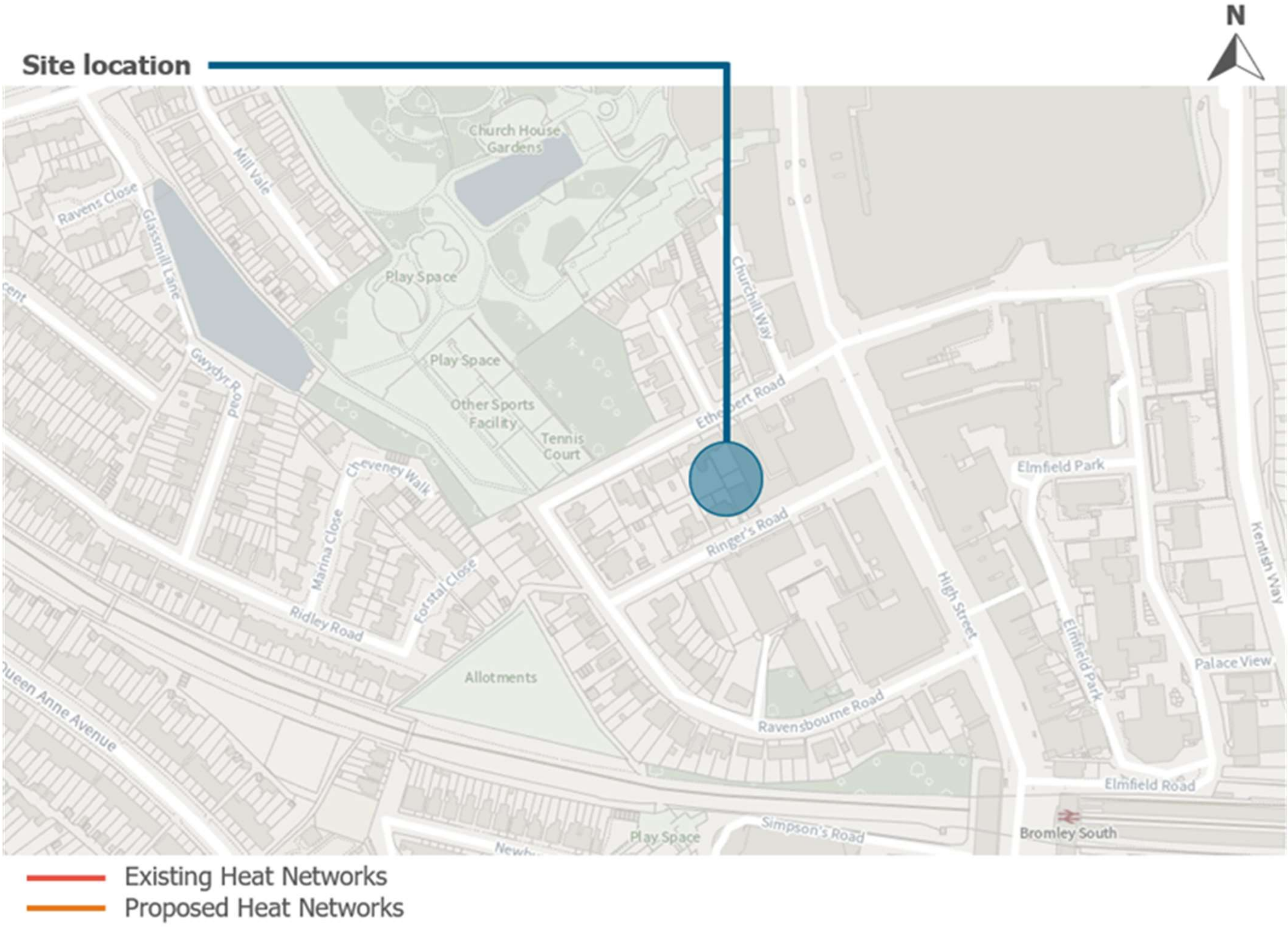


Figure 4: Excerpt from the London Heat Map. Existing district networks outlined in yellow, proposed networks in red.

## COMMUNAL HEATING

A central plant room will supply the building with hot water and space heating via a Low Temperature Hot Water (LTHW) communal heating circuit. Heat will be generated by 100% central air source heat pumps and stored in thermal stores. Heat will be transferred from the communal LTHW circuit to individual dwellings via Heat Interface Units (HIUs). The communal LTHW will be operated at 55°C flow and 35°C return temperatures. The estimated associated carbon savings from this strategy are further elaborated in the Be Green section.

## BE CLEAN $CO_2$ EMISSIONS

Given that it has not been found feasible or viable for the proposed development to incorporate the supply of low carbon heating or cooling form an off-site network, no carbon savings are achieved for this step of the Energy Hierarchy.

# BE GREEN – USE RENEWABLE ENERGY

A feasibility study of low and zero carbon technologies carried out for the development identified photovoltaics and air source heat pumps as suitable technologies for the development. The regulated carbon saving achieved in this step of the Energy Hierarchy is 55% over the site wide baseline level (Part L 2021) when using SAP10.2 emission factors. This is in addition to the savings achieved at the Be Lean stage of the Energy Hierarchy.

## RENEWABLE TECHNOLOGIES FEASIBILITY STUDY

Methods of generating on-site renewable energy (Be Green) were assessed, once Lean and Clean measures were considered.

The development of Ringers Road will benefit from an energy efficient building fabric and efficient systems which will reduce the energy consumption of the proposed development in the first instance. A range of renewable technologies were subsequently considered including:

- Biomass boiler;
- Ground/water source heat pumps;
- Air source heat pumps;
- Wind energy;
- Photovoltaic panels, and,
- Solar thermal panels.

In determining the appropriate renewable technology for the site, the following factors were considered:

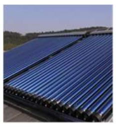
- $CO_2$ savings achieved;
- Site constraints;
- Any potential visual impacts, and,
- Compatibility with the ‘Clean’ stage proposals where applicable.

### *RENEWABLE ENERGY APPRAISAL SUMMARY*

The table overleaf summarises the factors taken into account in determining the appropriate renewable technologies for this project. This includes estimated capital cost, lifetime, level of maintenance and level of impact on external appearance. The final column indicates the feasibility of the technology in relation to the site conditions (10 being the most feasible and 0 being infeasible). It is important to note that the information provided is indicative and based upon early project stage estimates.

The feasibility study demonstrates that photovoltaics and ASHP would be the most feasible renewable technologies for the proposed development. Detailed assessments for the proposed technologies can be found in the following sections; site specific analysis data for the technologies not adopted can be found in Appendix B –Detailed Renewables Appraisal.

Table 3. Summary of renewable technologies feasibility study

| | | Comments | Lifetime | Maintenance | Impact on external appearance | Site feasibility |
|---|---|---|---|---|---|---|
| Biomass |  | Not adopted – burning of wood pellets releases high NOx emissions and other particulates, and in addition there are limitations for their storage and delivery within an urban location. | 20 yrs. | High | High | 2 |
| PV |  | Adopted – located on the southern end of the roof of Block A (where roof areas is not taken up by ASHP plant), and on all available space of Block B. | 25 yrs. | Low | Med | 10 |
| Solar thermal |  | Not adopted – PV has been preferred its lower maintenance and ease of integrating with other site systems. The two technologies compete for roof space availability, and therefore PV has been chosen over solar thermal. | 25 yrs. | Low | Med | 4 |
| GSHP |  | Not adopted – the installation of ground loops requires significant space, additional time at the beginning of the construction process and very high capital costs. | 20 yrs. | Med | Low | 3 |
| ASHP |  | Adopted – to supply all space heating and DHW to the scheme, as well as cooling to non-residential areas. | 20 yrs. | Med | Med | 10 |
| Wind |  | Not adopted – Wind turbines located at the site would have a significant visual impact on the site and surroundings. There are also issues with implementing wind turbines in urban environments where laminar air flow is less like to be achieved. | 25 yrs. | Med | High | 1 |

## DETAILED ASSESSMENT OF PHOTOVOLTAIC PANELS

Four types of solar cells are available on the market at present: mono-crystalline, poly-crystalline, thin film, and hybrid panels. Although mono-crystalline and hybrid cells are the most expensive, they are also the most efficient with a gross efficiency rate of 12-20%. Poly-crystalline cells are cheaper but they are less efficient (9-15%). Thin film cells are only 5-8% efficient but can be produced as thin and flexible sheets, and are therefore sometimes applicable depending on the design and location of the array.

Photovoltaics are considered a suitable technology for this development for the following reasons:

- The development provides an extent of suitable roof space for the installation of rooftop renewables;
- PV arrays are relatively easy to install when compared to other renewable systems; and
- PV panels provide a significant amount of $CO_2$ savings.

The PV shall comprise 24.1kWp (127m$^2$ panel area) of horizontal roof mounted arrays. For the current analysis, PV arrays have been allocated to the non-residential areas of the development. An option to further optimise the onsite savings achieved from PV would be to install panels above the rooftop amenity spaces, however due to a building of this height it would be entirely subject to a detailed wind analysis that can be carried out during the detailed design stage.

The adjacent table summarises the technical data for the proposed PV array and estimated $CO_2$ savings from the application of this technology. In total the PV installation is expected to result in regulated $CO_2$ savings of 2.4% for the development.

An indicative area for the installation of the PV panels on the roof can be found in the following page.

The performance and output of the PV system will be monitored, in line with the Be Seen policy.

Table 4: Summary of technical/operational data and estimated $CO_2$ savings for PVs

| **Photovoltaics** | | |
|---|---|---|
| Module efficiency (before losses) | 19 | % |
| Orientation | South-east | |
| Tilt of Collector | 30° | |
| Predicted site solar energy | 914 | kWh/m$^2$.yr |
| System losses | 20 | % |
| System peak power | 24.1 | kWp |
| Array area | 127 | m$^2$ |
| Primary energy offset by PV | 17,650 | kWh/yr. |
| Total $CO_2$ savings | 2.3 | t/yr. |
| Regulated baseline $CO_2$ emissions | 97.0 | t/yr. |
| % Regulated $CO_2$ reduction* | 2.4 | % |

* % reduction from site baseline

Figure 5: Monocrystalline PV arrays

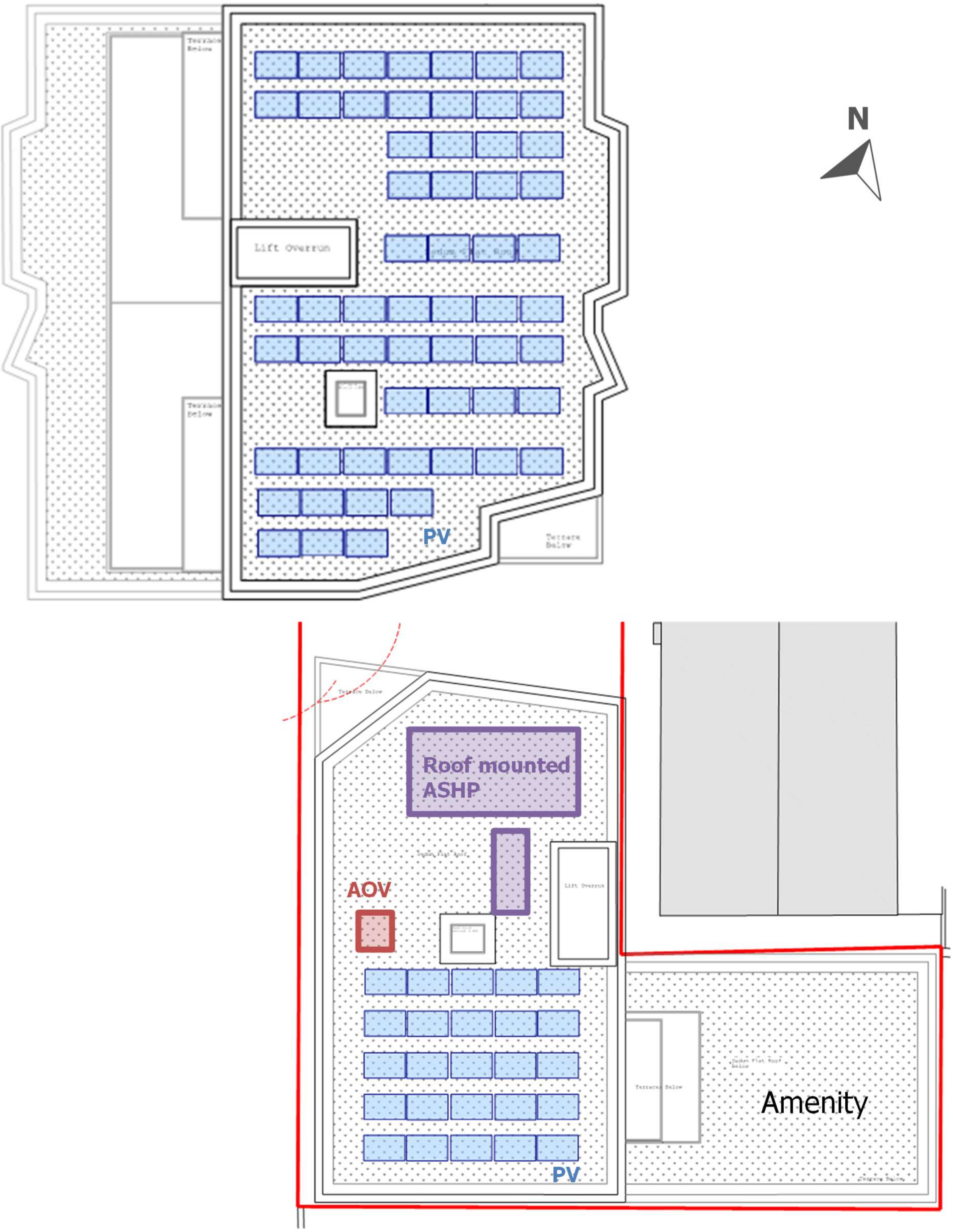


Figure 6. Proposed PV layout for Ringers Road.

## DETAILED ASSESSMENT OF AIR SOURCE HEAT PUMPS

Air source heat pumps (ASHPs) extract heat from the external ambient air.

The efficiency of heat pumps is very much dependent on the temperature difference between the heat source and the space required to be heated. As a result, ASHPs tend to have a lower COP than GSHPs. This is due to the varying levels of air temperature throughout the year when compared to the relatively stable ground temperature. The lower the difference between internal and external air temperature, the more efficient the system.

ASHP is considered a suitable technology for the development for the following reasons:

- It is a high efficiency system that can cater for the space heating and cooling of the most energy-intensive areas of the proposed development;
- Requires less capital cost and less site disruption than GSHP;
- It can be integrated with the proposed ventilation strategy; and,
- It is simple to install when compared to other renewable technologies and will work well alongside the proposed PV array.

A central plant room will supply both the residential and commercial areas of the building with hot water and space heating via a Low Temperature Hot Water (LTHW) communal heating circuit. Heat will be generated by air source heat pumps and stored in thermal stores. Heat will then be transferred from the communal LTHW circuit to individual dwellings via Heat Interface Units (HIUs). The communal LTHW will be operated at 55°C flow and 35°C return temperatures. ASHP efficiencies and the design supply temperatures align with the stipulate in BS EN 14825. At this stage a conservative seasonal efficiency (SCOP) of the air source heat pump is anticipated to be 2.98 based on manufacturer's information. This communal ASHP will also be capable of providing cooling to the commercial spaces.

End-users will be supplied with regular information to control and operate the system e.g., at point of occupancy and maintenance visits.

The performance of the heat pump system post construction will be monitored and reported to ensure it is achieving the expected performance, in line with the Be Seen policy.

The table on the following page summarises the technical data for the proposed ASHP and the estimated $CO_2$ savings from the application of this technology. In total the ASHP technology is expected to result in regulated $CO_2$ savings of 52.8% for the residential part of the development and 0.5% for the commercial portion of the scheme over the side-wide baseline emissions (Part L 2021), when calculated using SAP10.2 carbon factors.

Table 5: Summary of technical/operational data and estimated $CO_2$ savings for ASHP

| **ASHP for domestic spaces** | | |
|---|---|---|
| SCOP heating | 2.98 | |
| Carbon intensity of electricity | 0.136 | $kgCO_2/kWh$ |
| Proportion of domestic space heating and hot water met by ASHP | 100 | % |
| Energy met by ASHP | 301,400 | kWh/yr. |
| Energy used by ASHP | 110,700 | kWh/yr. |
| Total $CO_2$ savings | 51.2 | t/yr. |
| Regulated baseline $CO_2$ emissions | 97.0 | t/yr. |
| % Regulated $CO_2$ reduction* | 52.8 | % |
| **ASHP for non-domestic spaces** | | |
| SCOP heating | 2.98 | |
| SEER cooling | 6.0 | |
| Carbon intensity of electricity | 0.136 | $kgCO_2/kWh$ |
| Proportion of non-domestic space heating and hot water met by ASHP | 100 | % |
| Proportion of non-domestic space cooling met by ASHP | 100 | % |
| Energy met by ASHP | 31,300 | kWh/yr. |
| Energy used by ASHP | 23,500 | kWh/yr. |
| Total $CO_2$ savings | 0.5 | t/yr. |
| Regulated baseline $CO_2$ emissions | 97.0 | t/yr. |
| % Regulated $CO_2$ reduction* | 0.5 | % |

* % reduction from site baseline

Figure 7: Outdoor units of ASHP – at Ringer's Road it is expected these will be surrounded by an acoustic enclosure.

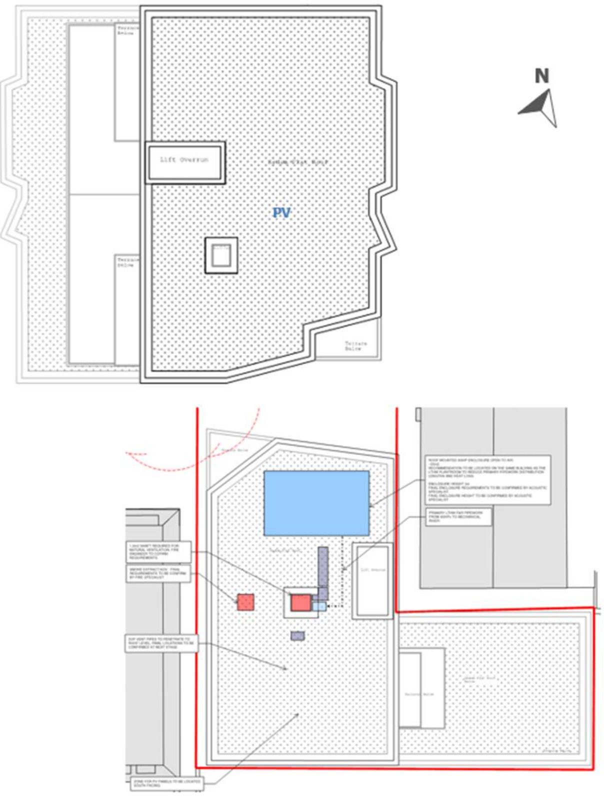


Figure 8. Proposed ASHP location for Ringers Road (shown in blue)

## BE GREEN $CO_2$ EMISSIONS

Following the measures adopted at the Be Lean stage, further savings can be obtained through the incorporation of the proposed PV panels and ASHP. Through the integrated performance of the proposed measures at each step in the Energy Hierarchy, the development meets the relevant London Plan and London Borough of Bromley policies.

# BE SEEN – ENERGY MONITORING

The proposed development will allow for separate metering and submetering in order to facilitate reporting on energy consumption of the development in-use.

The new London Plan has introduced a fourth step into the Energy Hierarchy named "Be Seen" in Policy SI 2 (Minimising greenhouse gas emissions). This is a requirement for all major development to monitor and report its energy performance post-construction to ensure that the actual energy consumption of the development is aligned with the energy strategy, and to ultimately reduce the performance gap.

A 'Be Seen' energy monitoring guidance was released September 2021, detailing the GLA approach to be met by new developments.

Reporting to the GLA is required at planning stage, as-built stage and for the following 5 years of occupation through a reporting spreadsheet sent to the GLA. An online portal/webform has also been made available.

The Be Seen spreadsheet for the planning stage has been completed and a copy can be found in Appendix G – Be Seen Spreadsheet

The proposed development has been designed to meet high operational performance targets beyond the requirements of Building Regulations.

Furthermore, a monitoring strategy will be put in place to ensure that the actual energy performance of the development can be monitored and reported post-occupation, in line with GLA guidance.

The proposed development incorporates solar PV which will have their own energy meter to help identify how much renewable energy is generated on site.

The relevant parties will also be made aware of their responsibilities at subsequent reporting stages.

# ESTIMATION OF OPERATIONAL FUEL COSTS

This section provides an early-stage estimation of the operational costs of the development from an energy perspective.

The annual estimated operational fuel cost predictions associated with the development using SAP and SBEM methodologies are outlined in the table below.

It should be appreciated that the operational fuel costs presented in this report are solely based on Building Regulations Part L compliance calculations carried out at early design stage. These estimations do not necessarily reflect the actual operational costs, and do not take into consideration occupant behaviour and account for costs associated with un-regulated energy use.

Annual administration costs of the communal system should be confirmed by a management company who would have a more accurate understanding of these associated costs closer to completion of the development. However, as a generic estimate, a figure of £200-400/year per dwelling could be used.

In order to ensure that running/operational costs to occupants are kept low once the development is built, developments can utilise quality assurance mechanisms and commitments by ensuring that adequate post construction monitoring and practices are adhered too. Therefore, the following mechanisms will be adopted:

- Provision of transparent billing;
- Liaising with the contractor to follow CIBSE CP1 as far as feasible;
- Exploring quality assurance accreditation post-planning (e.g. Heat Trust); and,
- Provision of heat tariff options (depending on who is operating the billing system).

Table 6. Estimated operational fuel cost for Ringers Road

| | | Unit |
|---|---:|---|
| Space heating energy demand | **97,020** | kWh/year |
| Hot water energy demand | 306,776 | kWh/year |
| Other regulated electricity consumption | 34,744 | kWh/year |
| Per unit cost – electricity (2023) | 0.34 | £/kWh |
| **Total regulated annual operational energy fuel cost (electricity)** | **149,104** | **£/year** |

# CONCLUSIONS

Following the implementation of the four-step Energy Hierarchy, the cumulative $CO_2$ savings on site are estimated at 75% for the domestic part and 44% for the non-domestic part of the development, against a Part L 2021 compliant scheme with SAP10.2 emission factors. The regulated $CO_2$ savings for the site as a whole are 72%. The development is therefore expected to meet the 35% $CO_2$ reduction on Part L 2021 from on-site measures. as required by policies.

## ON SITE $CO_2$ SAVINGS

The energy strategy for the scheme focuses on the efficiency of the fabric and building services, so that the energy demand is reduced to the extent feasible. Energy efficiency is primarily achieved through a highly insulated building envelope and a good air permeability rate. Highly efficient lighting, space conditioning and hot water systems, as well as appropriate controls further reduce the regulated energy demand and consumption of the development. The proposals also incorporate the usage of air source heat pumps (ASHP) which will further reduce $CO_2$ emissions on-site. An energy centre will supply the building with hot water and space heating via a Low Temperature Hot Water (LTHW) communal heating circuit. Heat will be generated by 100% central air source heat pumps and stored in thermal stores. Heat will be transferred from the LTHW circuit to individual dwellings via Heat Interface Units (HIUs). The communal LTHW will be operated at 55°C flow and 35°C return temperatures.

By implementing the four step Energy Hierarchy as detailed in the previous sections, the Regulated $CO_2$ emissions for the development have been reduced against a Part L 2021 compliant scheme through onsite measures alone by:

| **Cumulative Regulated $CO_2$ Savings (with SAP10.2 carbon factors)** | | |
|---|---|---|
| | % | t/yr |
| Domestic | 75% | 66.2 |
| Non-domestic | 44% | 3.6 |
| Site wide | 72% | 69.8 |

## OFF SITE $CO_2$ SAVINGS: CARBON OFFSET PAYMENT

The proposed development complies with the London Plan $CO_2$ savings target of 35% from on-site measures.

With the SAP10.2 carbon factors, to achieve ‘zero carbon’ for the residential portion of the scheme, 22.6 tonnes per annum of regulated $CO_2$, equivalent to 678 tonnes over 30 years, from the new-build domestic portion should be offset, which is estimated to a one-off payment of £64,398. The shortfall to a zero-carbon reduction from baseline for the new build non-domestic portion of the scheme are estimated tobe 4.6 tonnes per annum of regulated $CO_2$, equivalent to 138 tonnes over 30 years, to be offset, which would equate to a one-off payment of £13,095.

Any carbon offset contributions will be subject to viability discussions.

The tables in the following pages summarise the implementation of the Energy Hierarchy for the proposed scheme and detail the $CO_2$ emissions and savings against the baseline scheme for each step of the Energy Hierarchy; as well as the savings achieved through carbon offset.

Separate tables are presented for the domestic and non-domestic parts of the development; as well as for the site as a whole.

Overall, the proposed development has been designed to meet energy policies set out by the GLA and the London Borough of Bromley, which demonstrates the client and the design team's commitment to enhancing sustainability of the scheme.

## BE SEEN

Following the implementation of the three previous stages of the hierarchy, a monitoring strategy will be put in place to ensure that the actual energy performance of the development can be monitored and reported post-occupation. The relevant parties will also be made aware of their responsibilities at subsequent reporting stages.

## CUMULATIVE SAVINGS – DOMESTIC AREAS

Table 7: $CO_2$ emissions after each step of the Energy Hierarchy for the domestic part of the development

| | **Carbon dioxide emissions for domestic buildings (tonnes $CO_2$ per annum - with SAP10.2 carbon factors)** | |
|---|---|---|
| | **Regulated** | **Unregulated** |
| Baseline | 88.8 | 54.1 |
| After energy demand reduction | 73.8 | 54.1 |
| After heat network/CHP | 73.8 | 54.1 |
| After renewable energy | 22.6 | 54.1 |

Table 8: Regulated $CO_2$ savings from each stage of the Energy Hierarchy for the domestic part of the development

| | **Regulated domestic carbon dioxide savings (with SAP10.2 carbon factors)** | |
|---|---|---|
| | **Tonnes $CO_2$ per annum** | **% Over baseline** |
| Savings from energy demand reduction | 15.0 | 17% |
| Savings from heat network/CHP | 0.0 | 0% |
| Savings from renewable energy | 51.2 | 58% |
| Cumulative on-site savings | 66.2 | 75% |
| Shortfall from zero carbon, to be offset by cash-in-lieu payment | 678 tonnes over 30 years | |

## CUMULATIVE SAVINGS - NON-DOMESTIC AREAS

Table 9: $CO_2$ emissions after each step of the Energy Hierarchy for the non-domestic part of the development

| | Carbon dioxide emissions for non-domestic buildings (tonnes $CO_2$ per annum - with SAP10.2 carbon factors) | |
|---|---|---|
| | Regulated | Unregulated |
| Baseline | 8.2 | 6.1 |
| After energy demand reduction | 6.9 | 6.1 |
| After heat network/CHP | 6.9 | 6.1 |
| After renewable energy | 4.6 | 6.1 |

Table 10: Regulated $CO_2$ savings from each stage of the Energy Hierarchy for the non-domestic part of the development

| | Regulated non-domestic carbon dioxide savings (with SAP10.2 carbon factors) | |
|---|---|---|
| | Tonnes $CO_2$ per annum | % Over baseline |
| Savings from energy demand reduction | 1.3 | 16% |
| Savings from heat network/CHP | 0.0 | 0% |
| Savings from renewable energy | 2.3 | 28% |
| Cumulative on-site savings | 3.6 | 44% |
| Shortfall from zero carbon, to be offset by cash-in-lieu payment | 138 tonnes over 30 years | |

## SITE-WIDE CUMULATIVE SAVINGS

Table 11: Site wide regulated $CO_2$ emissions and savings (with SAP10.2 carbon factors)

| | Total regulated emissions (tonnes $CO_2$/year) | Regulated $CO_2$ savings (tonnes $CO_2$/year) | Percentage saving (%) |
|---|---|---|---|
| Baseline | 97.0 | | |
| Be Lean | 80.8 | 16.3 | 17% |
| Be Clean | 80.8 | 0.0 | 0% |
| Be Green | 27.2 | 53.6 | 55% |
| Total | | 69.8 | 72% |
| Offset to zero carbon for domestic | | 678 tonnes over 30 years | |
| Offset to zero carbon for non-domestic | | 138 tonnes over 30 years | |

# APPENDIX A –OVERHEATING RISK ASSESSMENT

www.xco2.com
mail@xco2.com
+44 (0)20 7700 1000
56 Kingsway Place, Sans Walk
London, EC1R 0LU

# OVERHEATING RISK ASSESSMENT

## 9.604 – RINGER'S ROAD

20/04/2023 *by NH, reviewed by LW*

## EXECUTIVE SUMMARY

An overheating risk analysis has been conducted for the proposed development at Ringer's Road, located in the London Borough of Bromley. The purpose of this analysis is to test the design of the proposed scheme and ensure the compliance with Part O – Overheating of the Building Regulations 2021 for the occupied zones across the development. This will minimise the risk of high temperatures being experienced by the occupants, as well as future-proof the scheme by taking into account projected increased ambient air temperatures resulting from climate change.

In order to assess the thermal performance of the development, a model was constructed using full dynamic thermal simulation software. The internal lighting and ventilation conditions were set in line with Part O Methodology (Approved Document O or AD O) for all tested habitable internal spaces.

With the aim of giving the most robust consideration, performance of the various occupied rooms was compared with AD O of the Building Regulations, which relies partly on CIBSE Technical Memorandum 59 [1] performance recommendations. These are rigorous targets that determine the acceptability of overheating risk either based on the temperature differential between the internal and the external environment (ΔT), or on a set temperature threshold, considering the frequency of temperature difference beyond which the level of overheating risk is considered unacceptable. Specifically, for bedrooms, the methodology aims to evaluate comfort during the sleeping hours by setting a maximum number of hours for which the operative temperature can exceed 26°C.

### RESIDENTIAL AREAS

Part O is part of the Building Regulations 2021 and is currently the most appropriate assessment methodology for assessing overheating risk in residential properties in the UK.

Compliance with Part O has been demonstrated through dynamic thermal modelling. The thermal simulations indicate the following:

- The proposed dwellings are predicted to satisfy the overheating risk criteria for the probabilistic Design Summer Year (DSY1) weather data for London Weather Centre, through a combination of natural ventilation and solar control strategies:
  - As a result of design iterations, the facade has been optimised to balance the daylight ingress with the risk of overheating, and the facade now presented for the planning application is the end result of this process.
  - To achieve the required levels of natural ventilation, all residential windows will be fully openable (side hung by 90 degrees, or bottom hung to 30 degrees in accordance with opening styles indicated on the architectural elevations). In order to comply with requirements of this test, these must provide minimum equivalent free areas as described in the 'Ventilation' section within this report.

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[1] CIBSE TM59:2017 – Design Methodology for the assessment of overheating risk in homes

  - For solar control, glass of low g-value (0.50) for all windows and glazed doors will be specified to avoid excessive solar transmittance during summer but allow for a suitable amount of passive heating in winter and reduced reliance on artificial lighting. Local external shading in the form of inset balconies has also been provided.
- Based on the Noise Assessment Report produced by Lustre Consulting completed on 22nd December 2022, all dwellings across all facades are expected to experience increased risk of noise, dictating that windows would be required to remain shut overnight. The proposed solution is to restrict the opening of the windows overnight for all facades and incorporate cooling coils within the MVHR system to provide trim cooling. This does not amount to full comfort cooling, rather it is a 'trim cooling' provision, expected to be capable of reducing the incoming air temperature by approx. 8-10°C. All occupied spaces are expected to meet the Part O criteria after the MVHR system with incorporated cooling coils is applied, and after all proposed passive actions have been incorporated.
- Use of internal shading devices, e.g. curtains or blinds of low shading coefficient, will be recommended to the future occupant for controlling solar gains. It should be noted here however that the impact of internal shading devices is not accepted by the Part O methodology for compliance testing, thus, is not included in this assessment, however, blinds should be designed to function effectively whilst windows are both closed and open, and not substantially reduce air flow.
- Energy efficient light fittings that emit less heat than standard types will also be specified to further reduce overheating risk.
- For communal corridors, the inclusion of solar control strategies has also been implemented to allow for compliance with the overheating risk criteria and generally improve the resilience of the building to overheating risk. The corridors were modelled with continuous mechanical ventilation (10 l/s) which was found to be sufficient in allowing them to meet the Part O criteria and therefore they are not considered to be at risk of overheating. Windows in corridors were modelled with 60% free openable area (through the combination of side (90 degree) and bottom hung (10 degrees) openings) and able to open all day.
- In case of overheating risk during extreme weather conditions, residents are encouraged to make use of their private amenities, in the form of balconies provided to all flats across the scheme.

Based on the method of assessment adopted, XCO2 recommend the incorporation of the above features that allow compliance with the Part O (CIBSE TM59) criteria for the London weather file, DSY1 for the 2020s, high emissions, 50th percentile scenario.

**NON-RESIDENTIAL AREAS**

Guidance set out in CIBSE Technical Memorandum (TM52) was used in the analysis of the communal working and Class E spaces, as this is the recommended methodology for assessing overheating risk in non-domestic developments.

The four communal spaces, including the communal working space at the ground floor of Block A, and Class E spaces (C.00.01, C.00.02, and C.01.01) located at ground and first floors of Block B were tested against the TM52 risk criteria. The thermal simulations indicate the following:

- Due to the expected high internal gains caused by the use of the spaces themselves the non-domestic spaces are designed to provide an element of comfort cooling. All spaces were found to satisfy the overheating risk criteria using the weather data DSY1 (2020s, high emissions, 50% percentile scenario) for the London Weather Centre in combination with energy efficient lighting and solar control strategies (g-value of 0.50).

It should be noted that the findings of this assessment are related to planning stage design only and are based on a sample of units in line with the methodology requirements. Any changes to the ventilation strategy, façade opening areas, window operation and shading elements would impact the performance of the building and may void the results of the current assessment.

# METHODOLOGY

3D thermal models of the proposed scheme, which comprises a mix of residential units in two blocks and non-domestic space at ground and part of first-floor levels, have been developed based on the planning architectural drawings received from Hollaway Studio; draft dated February 2023.

The assessment has identified those dwellings that are at higher risk of overheating and a sample of units representing these dwellings have been assessed against the Part O overheating criteria. To give a fair representation of the residential development, 21 residential units (including their 28 Double bedrooms, 3 Single bedrooms and 21 Kitchen/Living/Dining areas (KLD)) were analysed to provide a representative sample of the space and dwelling typologies within the development. These include units with larger glazing area, units with windows facing all directions, top floor units that will receive higher solar gains, and units where cross ventilation is not possible across low, middle, and top floors.

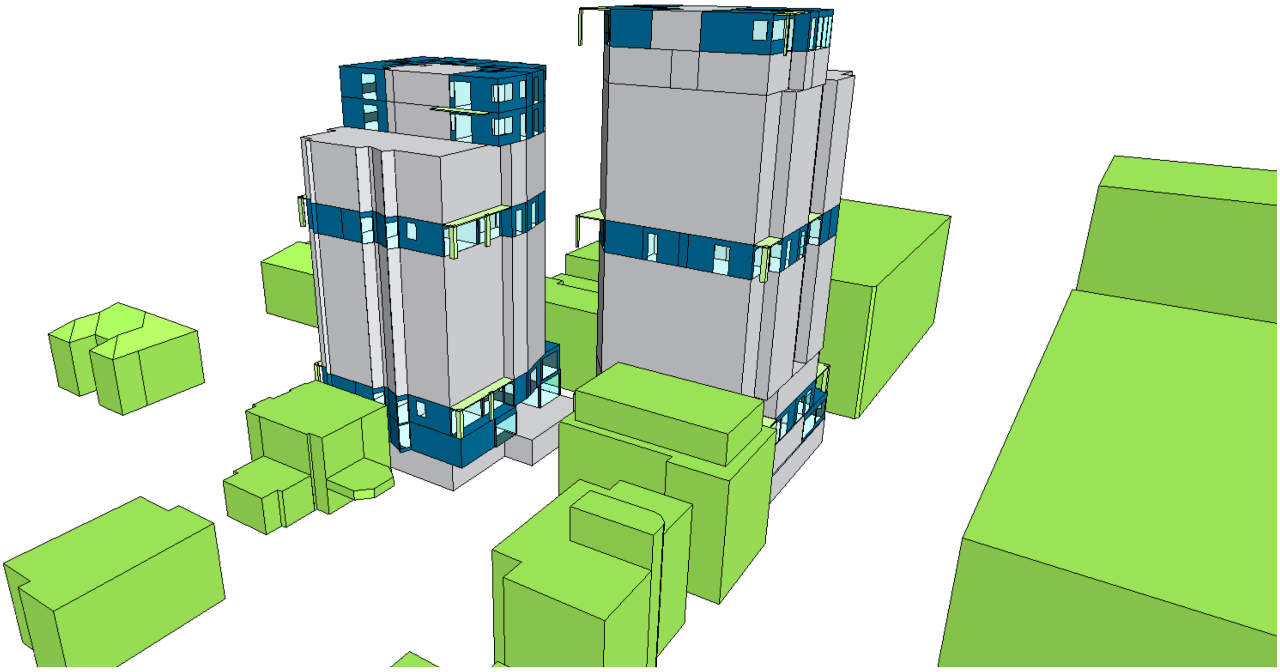

Figure 1: An axonometric view of the proposed development at Ringer's Road.

The overheating risk of the spaces was assessed for current and future climate scenarios. Following the methodology set out in CIBSE TM59 and TM49 *Design Summer Years for London*, the following three years were selected to form the set of probabilistic design summer years for the 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 entered. The 50% percentile scenario 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 design with the CIBSE TM52, TM59 and Part O criteria has been sought.

The acoustic assessment has highlighted that there may be a risk of excessive noise overnight. As a result, the dwellings cannot rely solely on openable windows as a means of mitigating overheating risk overnight; cooling coils placed atop the MVHR units has been adopted to mitigate the risk of overheating when the external noise levels are in excess of acceptable levels.

# ASSESSMENT CRITERIA

## *RESIDENTIAL AREAS*

The performance standards set out within Part O of Building Regulations (which reference CIBSE TM59) have been used to assess the overheating risk within the proposed development.

Considering the dwellings within the development will use natural ventilation as the primary mechanism to mitigate overheating risk, the following two criteria must be met:

1) **For living rooms, kitchens and bedrooms:** The number of hours during which ΔT (the difference between operative and threshold comfort temperatures) is greater than or equal to one degree (K), during the period of May to September inclusive, shall not be more than 3 per cent of occupied hours. (CIBSE TM52 Criterion 1: Hours of exceedance).
2) **For bedrooms only:** To evaluate 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).

The first criterion is evaluated in terms of the ΔT, which is the difference between the operative temperature $T_{op}$ and the limiting maximum temperature $T_{max}$, $\Delta T = T_{op}$[2] $- T_{max}$[3]. In order to estimate $T_{op}$, dynamic thermal modelling is carried out to compute the predicted temperature distribution in the different thermal zones of the building. The maximum acceptable temperature is a function of the outdoor temperature and the design limits, which are shown below. The table details the suggested acceptability in terms of the temperature range of naturally ventilated buildings. For the purpose of the assessment, we have used Category II limits, as recommended within CIBSE TM52.

Table 1: CIBSE TM52 – Suggested applicability of the category and the associated acceptable temperature range for a free running building

| Category | Description | Acceptable Range (°C) |
|---|---|---|
| II | Normal expectation (for new buildings and renovations) | ±3 |

CIBSE TM59 also recommends testing of overheating risk in corridors based on exceeding an operative temperature of 28°C. Whilst there is no mandatory target, corridors should aim to comply with the following criterion:

1) **For corridors:** If an operative temperature of 28°C is exceeded for more than 3% of total annual hours, this should be flagged as a significant risk within the report.

## *NON-RESIDENTIAL AREAS*

The performance standards set out within CIBSE TM52 have been used to assess the overheating risk within the communal elements of the scheme. At least two of the following must be met:

1) **Hours of exceedance ($H_e$): $H_e < 3\%$ of occupied hours:** As per criterion 1 above.
2) **Daily weighted exceedance ($W_e$): $W_e < 6$:** The second criterion deals with the severity of overheating within any one day, which can be as important as its frequency, the level of which is a function of both temperature rise and duration. This criterion sets a daily limit for acceptability.
3) **Upper limit temperature ($T_{upp}$): $T_{op} - T_{max} < 4$°C:** The third criterion sets an absolute maximum daily temperature for a room, beyond which the level of overheating is unacceptable.

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[2] Operative temperature models the combined effect of convective and radiant heat transfer. It accounts for the combined of the temperature of the air, of the surfaces and air speed.

[3] $T_{max}$ is the maximum acceptable temperature and is dependent on the outdoor running mean temperature and the building category with each associated acceptability range.

# MODELLING INPUTS

## *FABRIC PERFORMANCE*

The proposed specification of the fabric is aligned with the planning stage design as outlined in the Energy Statement for the scheme, and summarised in Table 2:

Table 2: Building fabric assumptions.

| Element | Specification | |
|---|---|---|
| | **U-value [W/m².K]** | |
| External Walls | 0.15 | |
| Ground Floor | 0.10 | |
| Roof | 0.10 | |
| | **U-value [W/m².K]** | **g-value** |
| Window | 1.00 | 0.50 |
| | **Air permeability (@50Pa)** | |
| | 3 m³/m².h | |

## *OCCUPANCY*

### RESIDENTIAL AREAS

The TM59 methodology, which Part O refers to, specifies the hours during which spaces are anticipated to be occupied and these have been used within the overheating risk assessment calculations. Table 3 sets out the predicted occupancy patterns for the assessed rooms within the dwellings in line with the TM59 requirements; these are programmed into the dynamic software model to calculate the relative occupancy gains for the designated spaces.

Table 3: Occupancy inputs for a 2-bedroom dwelling room type assessed.

| Area | TM59 Predicted occupation pattern |
|---|---|
| Bedrooms | 24 hours a day |
| Open plan Kitchen/Living/Dining (KLD) | 09:00 – 22:00 |

### NON-RESIDENTIAL AREAS

CIBSE TM52 does not specify the exact hours the non-residential spaces are expected to be occupied, and as a result BRE estimates, inherited from the National Calculation Methodology (NCM), are often used as a basis for a prediction of the occupied hours of different areas. The table below sets out the occupancy times included within the model.

Table 4: Occupancy inputs for each non-domestic room type assessed.

| Area | NCM Predicted Occupation Pattern |
|---|---|
| Non-domestic spaces (Class E and Communal Working) | 06:30 – 18:00 |

## 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 5 sets out the various internal gains for the assessed rooms within the dwellings. Non-occupied spaces such as circulation, bathrooms and storage were modelled based on the typical internal gains specified within the TM59 methodology.

Table 5: Internal gains modelled for each room type assessed.

| Area | Predicted Internal Gains | | |
|---|---|---|---|
| | Lighting [W/m²] | People [peak W] | Equipment [peak W] |
| Double Bedroom | 2.0 W/m² | 150 W sensible, 110 W latent | 80 W |
| Single Bedroom | 2.0 W/m² | 75 W sensible, 55 W latent | 80 W |
| 1Bed Kitchen/Living area | 2.0 W/m² | 75 W sensible, 55 W latent | 450 W |
| 2Bed Kitchen/Living area | 2.0 W/m² | 150 W sensible, 110 W latent | 450 W |
| HIU cupboards | - | - | 31 W |
| Bathroom | 2.0 W/m² | - | - |
| Circulation in flats | 2.0 W/m² | - | - |

Part O requires the inclusion of corridors in the overheating risk analysis where community heating pipework runs through them. The circulation areas have been included in the assessment to verify the compliance with Part O guidance, to ensure the design is robust and overheating risk can be mitigated in all areas of the building. The assessment takes into account heating pipework distribution gains on communal corridors in accordance with CIBSE Guide C. The model accounts for 12.19 W/m heat loss per metre run of pipe.

Table 6: Internal Gains modelled for corridor areas.

| Area | Predicted Internal Gains | | |
|---|---|---|---|
| | Lighting [W/m²] | People [peak W] | Equipment [peak W] |
| Typical floor: Corridor circulation on Level 7 Block A | 2.0 W/m² | - | 400 W |

## VENTILATION

### RESIDENTIAL AREAS

The proposed background ventilation strategy for the development will be led by mechanical ventilation to all residential units. The mechanical ventilation system will include heat recovery to achieve ventilation in the most energy efficient way. Therefore, the estimated auxiliary ventilation flow rates have been included in the model in line with Part F requirements for background ventilation. The MVHR will automatically divert outgoing air around the heat recovery cell by a summer bypass in warm weather conditions.

For the purpose of this assessment natural ventilation was modelled as a baseline using equivalent free areas calculated from the elevations in the architectural drawings received from Hollaway Studios, dated February 2023. Detailed description of the modelled window types, and their equivalent free areas, can be seen below.

In line with the Part O methodology, it is assumed that windows:

- will start to open when internal dry bulb temperature exceeds 22 °C for occupied hours (08:00 to 23:00);
- be fully open when the internal dry bulb temperature exceeds 26 °C;
- start to close when the internal dry bulb temperature falls below 26 °C;
- be fully closed when the internal dry bulb temperature falls below 22 °C.

- For the baseline case, at night (23:00 to 08:00), bedroom openings are assumed fully open if the openings are on the first floor or above and the internal dry bulb temperature exceeds 23 °C. KLD windows are assumed closed overnight.

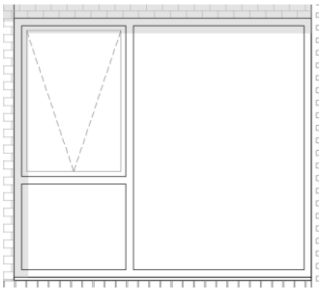
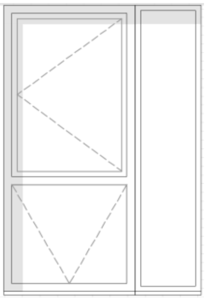
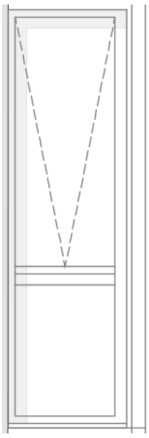
The methodology outlined in Appendix D of Approved Document O was used to calculate the equivalent area of each window type proposed across the scheme. The level of exposure and associated coefficients of discharge are set up in accordance with the relative position of each window in relation to building massing. The table below shows the detail of the minimum equivalent free area and the openable pattern of the windows to comply with Part O. Please refer to Appendix A for window type locations.

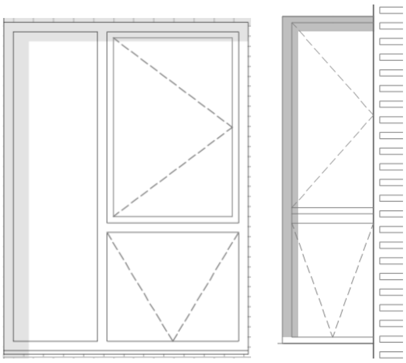
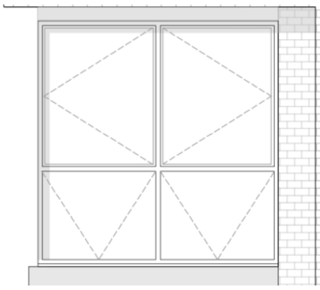
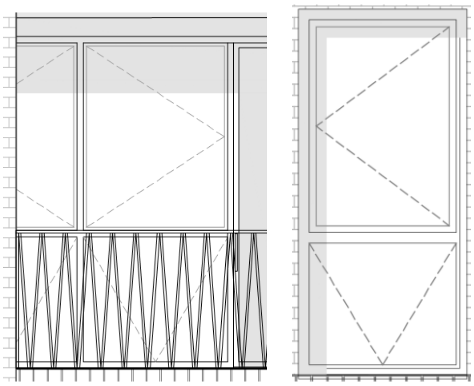
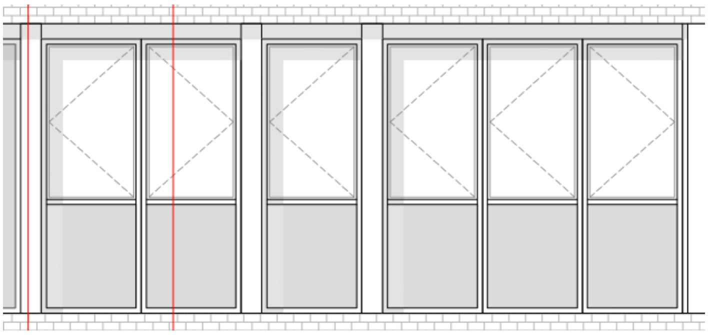
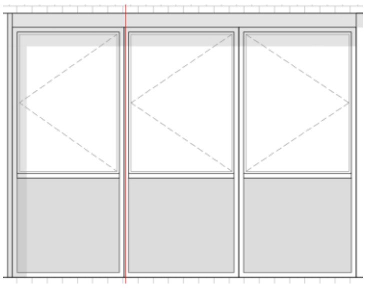
Internal doors in bedrooms and KLD areas have been included and assumed to be open during daytime but closed overnight. Location of the selected unit types can be found in the Appendix A.

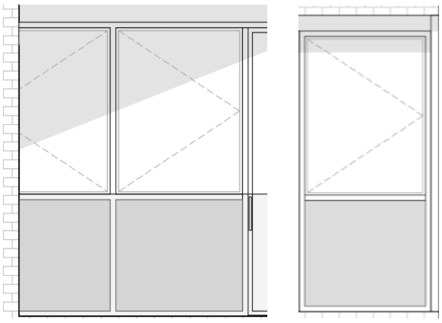
In case of overheating during extreme weather conditions, residents will also be encouraged to make use of their private amenities, in the form of balconies, provided to all flats across the scheme, as well as the communal spaces at ground and first floors.

The following table describes the final window opening types as modelled in IES VE with a description for the baseline (naturally ventilated scenario) and XCO2 recommendations, now incorporated in the design, for Part O and TM52 compliance. Location of the selected window types can be found in **Error! Reference source not found.**. The presented equivalent free area (EFA) figures are the minimum required ventilated free areas to meet Part O compliance. Note, any increase in EFA values will benefit the overheating results and are welcomed.

Table 7: Opening types as modelled in IES VE.

| Window Reference | Recommended openable area for Part O compliance (as indicated on architectural elevations) | Minimum openable area in terms of Equivalent Free Area (EFA) |
|---|---|---|
| **WT1** |  | 19% |
| **WT2** |  | 40% |
| **WT3** |  | 51% |

| Window Reference | Recommended openable area for Part O compliance (as indicated on architectural elevations) | Minimum openable area in terms of Equivalent Free Area (EFA) |
|---|---|---|
| **WT4** |  | 59% |
| **WT5** |  | 65% |
| **WT6** |  | 78% |
| **WT7** |  | 86% |
| **WT8** |  | 89% |

| Window Reference | Recommended openable area for Part O compliance (as indicated on architectural elevations) | Minimum openable area in terms of Equivalent Free Area (EFA) |
|---|---|---|
| **WT9** |  | 95% |

The design recommendations set out in the above table have been discussed with the design team, and have been implemented in the current proposals.

The impact of using internal shading devices on reducing the risk of overheating has not been assessed, in line with Part O guidance. Tenants will be advised to install curtains or blinds of low shading coefficient to allow for manual control of solar gains during summer, thus reducing the risk of overheating further. Venetian blinds in particular are highly recommended as they provide internal shading while interfering less with natural ventilation.

## *NOISE*

Part O notes that in locations where external noise may be an issue in accordance with the noise limits specified, the overheating mitigation strategy should take account of the likelihood that windows will be closed during sleeping hours (11pm to 7am). Due to the high noise levels expected on the site and confirmed by the acoustic report, additional modelling was completed where passive ventilation through windows is not suitable.

Therefore, MVHRs with incorporated cooling coils have been included in the design for all apartments. For the purpose of this analysis, the cooling system has been modelled during night-time when the windows are expected to be closed. This does not amount to full comfort cooling, rather it is a 'trim cooling' provision, expected to be capable of reducing the incoming air temperature by approx. 8-10°C. The proposed system is expected to provide a cooling capacity of 1.8kW for the largest 2-bed flats and be able to provide constant air at 17.4°C with a flow rate of 65 and 90 l/s for the 1 and 2 Bed units, respectively, for the whole flat. Note the system is included after all proposed passive actions have been incorporated.

## *THERMAL MASS*

Note, we have not tested thermal mass, part of the cooling hierarchy, as thermal mass provides benefits for cooling purposes in rooms occupied during the day, whereas the acoustic restrictions to Ringer's Road predominantly increase the overheating risk in bedrooms overnight.

## *POLLUTION*

Buildings located near to significant local pollution sources should be designed to minimise the intake of air pollutants. All mechanical ventilation units at Ringers Road will incorporate filters which will help to reduce the intake of polluted air into the building.

## *PROTECTION FROM FALLING*

Part O outlines specific requirements to minimise the risk of falling associated with the use of a natural ventilation strategy. Requirements are based on the degree of opening possible and guarding heights when windows open outwards. Windows above ground floor level with a change in floor level between inside and outside of more than 600 mm should have a guarding height of 1.1 m or greater, if the respective window is to be open outwards.

All external openings across the residential development are therefore proposed to open inwards.

## SECURITY

AD O further outlines requirements related to security. During sleeping hours, AD O notes that only the proportion of windows that can be opened securely should be considered to provide useful ventilation. Rooms unoccupied during sleeping hours (e.g. KLDs) that are at ground floor or are easily accessible, windows and patio doors should be modelled as closed at night. For rooms occupied during sleeping hours (e.g. bedrooms), ground floor windows and easily accessible windows should only be used for ventilation during sleeping hours where they have been made secure, specifically via the use of fixed or lockable louvred shutters or fixed or lockable window grilles or railings.

The Proposed Development does not include any residential habitable rooms at ground floor, therefore these particular security restrictions are not applicable to Ringer’s Road.

# RESULTS

## RESIDENTIAL AREAS

This section presents the results summary for each of the tests carried out for the proposed development. In total 52no. habitable spaces were included in the assessment (28no. double bedrooms, 3no. single bedrooms, 9no. 1-bed KLDs, and 12no. 2-bed KLDs). Non-habitable spaces such as bathrooms, storage rooms and circulation areas have also been included in the assessment; and their internal gains have been accounted for in the model.

Table 8 shows the modelling undertaken for London Weather Centre DSY1 2020s weather data and the number of rooms that were not found to meet the Part O criteria for each of the modelling iterations. Refer to Appendix B – Detailed Results: CIBSE 2020s DSY1 Weather File for detailed results.

A sample access corridor was also tested for overheating risk and passed with < 3% of annual hours found to be above 28°C.

Table 8: Overheating assessment results London Centre Weather DSY1 2020s weather file.

| ID | Design change | Bedrooms and KLDs | Window g-value | Bedrooms TM59 night-time 26°C criterion | KLD/Bedrooms TM52 Criterion 1 | Total No. rooms not meeting Part O Criteria |
|---|---|---|---|---|---|---|
| | | Window opening area and profile | | No. of rooms not meeting criteria | | |
| **Naturally Ventilated Scenario** | | | | | | |
| N1 | Baseline case | Window opening free areas and opening pattern as proposed in original architectural design.<br>Bedrooms considered open 24 hours; KLDs open during daytime only, with exception of hotter periods where KLDs were considered open overnight where safe to do so. | 0.50 | 0/31 | 1/52 | 1/52 |
| N2 | 1 lower windowpane removed from B 11.03 KLD | | | 0/31 | 0/52 | 0/52 |

The iterations above are based on a naturally ventilated scenario with no restrictions on opening the windows due to noise. For this scenario has been assumed that bedroom windows are able to open all day, including ground floor bedrooms with provision of secured window grilles. Iteration N4 above presents the final and proposed scenario and includes all measures from previous iterations. The following observations can be made from the results:

- All of the assessed habitable rooms at the proposed development were found to meet the Part O overheating risk criteria when assessed with openable windows as the main means of mitigating high internal temperatures (iteration N2);
- It should be ensured that the minimum opening equivalent area of the windows is as described in Table 7. The location of all window types and modelled flats can be seen in **Error! Reference source not found.**;
- For all dwelling bedrooms, for this iteration it is expected that windows can be left fully open throughout the day to enhance the natural ventilation strategy;
- All Kitchen/Living/Dining (KLD) windows have been assumed closed at night, although these windows could be allowed open by occupants where it is safe to do so;
- For solar control, glass of low g-value (0.50) for all windows and glazed doors will be specified to avoid solar transmittance during summer but allow for passive heating in the winter;
- Provision of external shading in the form of balconies has been incorporated within the design, which will help to control solar gains;
- Energy efficient light fittings that emit less heat than standard types will also be specified to reduce overheating potential;
- For communal corridors, the inclusion of solar control strategies has also been implemented to allow for compliance with the overheating risk criteria and generally improve the resilience of the building to overheating risk. The corridors were modelled with continuous mechanical ventilation (10 l/s) which was found to be sufficient in allowing them to meet the Part O criteria and therefore they are not considered to be a risk for overheating. Windows in corridors were assumed with 60% free openable area and able to open all day.

As described in previous sections, bedrooms are expected to experience increased risk of noise overnight, and the proposed solution for this has been to test a scenario where windows closed, and the mechanical ventilation is applied.

Two options have been tested, with and without an additional cooling capacity incorporated. The first option assumes windows fully closed and no cooling capacity is provided, whereas the second incorporates the cooling capacity. This cooling capacity is available for the proposed MVHR in all apartments. This does not amount to full comfort cooling, rather it is a 'trim cooling' provision, expected to be capable of reducing the incoming air temperature by approx. 8-10°C. All tested flats against the 'predominantly mechanically ventilated' criterion confirms that all bedrooms are expected to meet Part O criteria with the MVHR running in trim cooling mode.

Table 9: Overheating risk assessment results for the mechanical ventilation scenario under DSY1.

| ID | Design change | Bedrooms | Kitchen / Living / Dining rooms | TM59 'predominantly mechanically ventilated' 26°C criterion |
|---|---|---|---|---|
| | | Ventilation profile | | No. of bedrooms not meeting criteria |
| **Mechanically Ventilated Scenario due to noise** | | | | |
| M1 | Frozen scheme design | All bedroom windows closed due to noise restrictions at night and as confirmed by acoustic report. No cooling capacity is provided. | | 31/31 |
| M2 | With cooling capacity | All bedroom windows closed due to noise restrictions.<br>Cooling capacity provided as part of the MVHR system with cooling coils. | | 0/31 |

For the purpose of this analysis the MVHR with integrated cooling coils system has been modelled during night-time when the windows are expected to be closed. MVHR with integrated cooling coil is required for the compliance of all bedrooms due to noise restrictions stated by the Part O methodology and confirmed by the acoustic analysis. Results show that all 31no. tested bedrooms are expected to comply with the Part O overheating risk criteria. Refer to Appendix B – Detailed Results: CIBSE 2020s DSY1 Weather File for detailed results.

Lastly, the combined naturally and mechanically ventilated iterations (N2 and M2 above) were applied with DSY2 and DSY3 weather files, which are more severe weather scenarios. The results for these years are shown in the table below.

Table 10: Overheating assessment results for the <specify whether London Weather Centre, London Heathrow, or London Gatwick> weather, 1976 and 2003 for 2020 weather.

| Future Weather File – London Weather Centre Weather Data | | | | |
|---|---|---|---|---|
| **Iteration** | **Glazing g-value** | **Glazing Percentage** | **No. of rooms not meeting criteria** | |
| | | | **2003 (DSY2)** | **1976 (DSY3)** |
| Based on iteration M2<br>(DSY2 & DSY3 weather files) | 0.5 | Bedroom and KLD windows closed at night and with provision of trim cooling. | 52/52 | 52/52 |

The nature of the DSY2 and DSY3 weather files is such that it becomes particularly difficult to fully mitigate overheating risk in accordance with Part O criteria owing to their onerous conditions. In essence, they are representative of a period where overheating is an intrinsic risk within the environment itself, rather than a risk imposed by inappropriate design.

Following assessment of the model with the DSY2 and DSY3 weather files, it can be observed that the criteria cannot be met, and the overheating risk cannot be fully mitigated through the currently implemented measures alone given the onerous nature of the more severe weather. Refer to APPENDIX C – Detailed Results: CIBSE 2020s DSY2 and DSY3 for detailed results.

Please note that the results for DSY2 and DSY3 for 2020's period are for informative purpose only. The scheme has sought to comply with DSY1 as per GLA's policy by including solar control glazing with g-value of 0.50 throughout all residential spaces as well as generous Free Areas and has sought to go as far as feasible in terms of performance with 2020's DSY2 and DSY3 weather files.

A future retrofit plan for overheating risk mitigation with more onerous weather files could include the increase of the cooling provision and capacity, currently assumed at 1.8kW for the largest 2-bed flats and be able to provide constant air at 17.4ºC with a flow rate of 65 and 90 l/s for the 1 and 2 Bed units, respectively, for the whole flat.

Note, provision of internal blinds would also give some protection for the most onerous weather scenarios even if Part O does not allow the incorporation of them to show compliance.

## NON-RESIDENTIAL AREAS

The four communal spaces, including the communal working space at the ground floor of Block A, and Class E spaces (C.00.01, C.00.02, and C.01.01) located at ground and first floors of Block B were tested against the TM52 risk criteria. The thermal simulations indicate the following:

- Due to the expected high internal gains caused by the use of the spaces themselves the non-domestic spaces are designed to provide an element of comfort cooling. All spaces were found to satisfy the overheating risk criteria using the weather data DSY1 (2020s, high emissions, 50% percentile scenario) for the London Weather Centre in combination with energy efficient lighting and solar control strategies (g-value of 0.50).

The non-domestic spaces were also tested against DSY2 and DSY3 weather types. The results for these weather files are presented in the table below for the London Centre DSY2 and DSY3 for 2020's period. This is for information purposes only for more onerous weather types as explained in the residential results section of the report.

Table 11: Overheating risk assessment results for dwellings for London Weather Centre DSY2 and DSY3 for the 2020's weather file.

| Future Weather File – London Weather Centre Data | | | | |
|---|---|---|---|---|
| Iteration | Glazing g-value | Glazing percentage | No. of rooms not meeting criteria | |
| | | | 2003 (DSY2) | 1976 (DSY3) |
| (DSY2 & DSY3 weather files) | 0.5 | Windows assumed closed and provision of cooling | 0/4 | 0/4 |

Due to the higher internal gains in the non-domestic spaces, it is deemed appropriate to keep the input for active cooling for the non-domestic spaces after the passive measures have been incorporated in order to prevent overheating under the more severe scenarios in the most effective way.

# CONCLUSIONS AND RECOMMENDATIONS

The results show that all modelled flats and communal spaces are expected to achieve compliance with Part O and TM52 overheating risk criteria for London Weather Centre DSY1 2020's weather data, when incorporating adequate design considerations.

The results detailed in the previous section demonstrate that a combination of window opening types for natural ventilation and solar control strategies are essential for compliance with the overheating risk criteria. Generally, a g-value of 0.50 is the preferred specification in order to not overly compromise the energy performance and compliance with $CO_2$ emissions targets (SAP), as well as daylight assessment results which are also inter-connected.

In addition to this, provision of trim cooling as part of the MVHR system with incorporated cooling coil has been included in the design for flats due to expected noise restrictions on opening of the windows overnight. The opening of windows is at the discretion of the occupant, but they cannot be relied upon as the sole measure to reduce high internal temperatures for the purpose of this overheating risk analysis.

Table 12 summarises the recommendations that have been implemented in the design to reduce overheating risk.

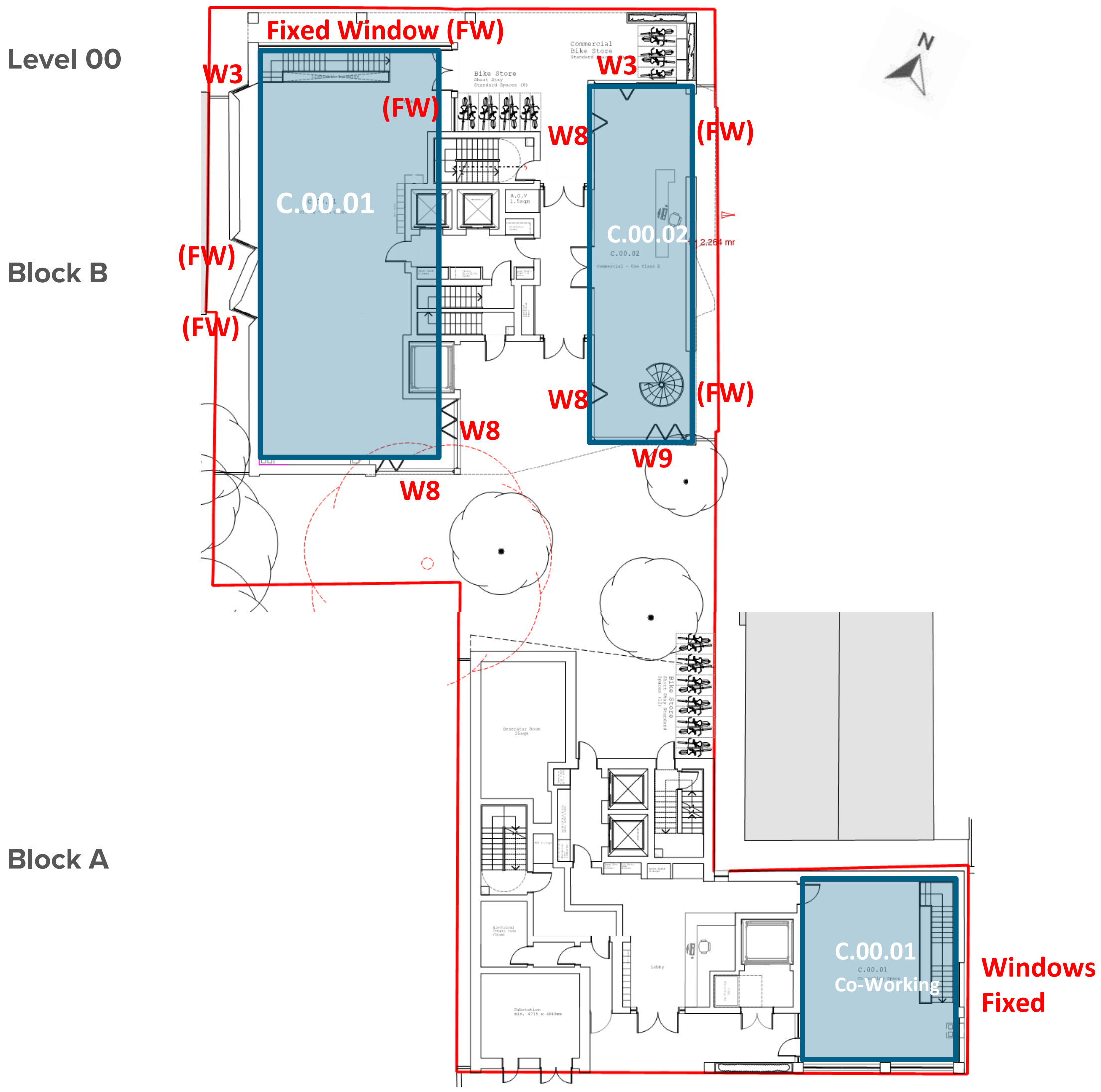
Table 12: Summary of recommendations for the proposed development.

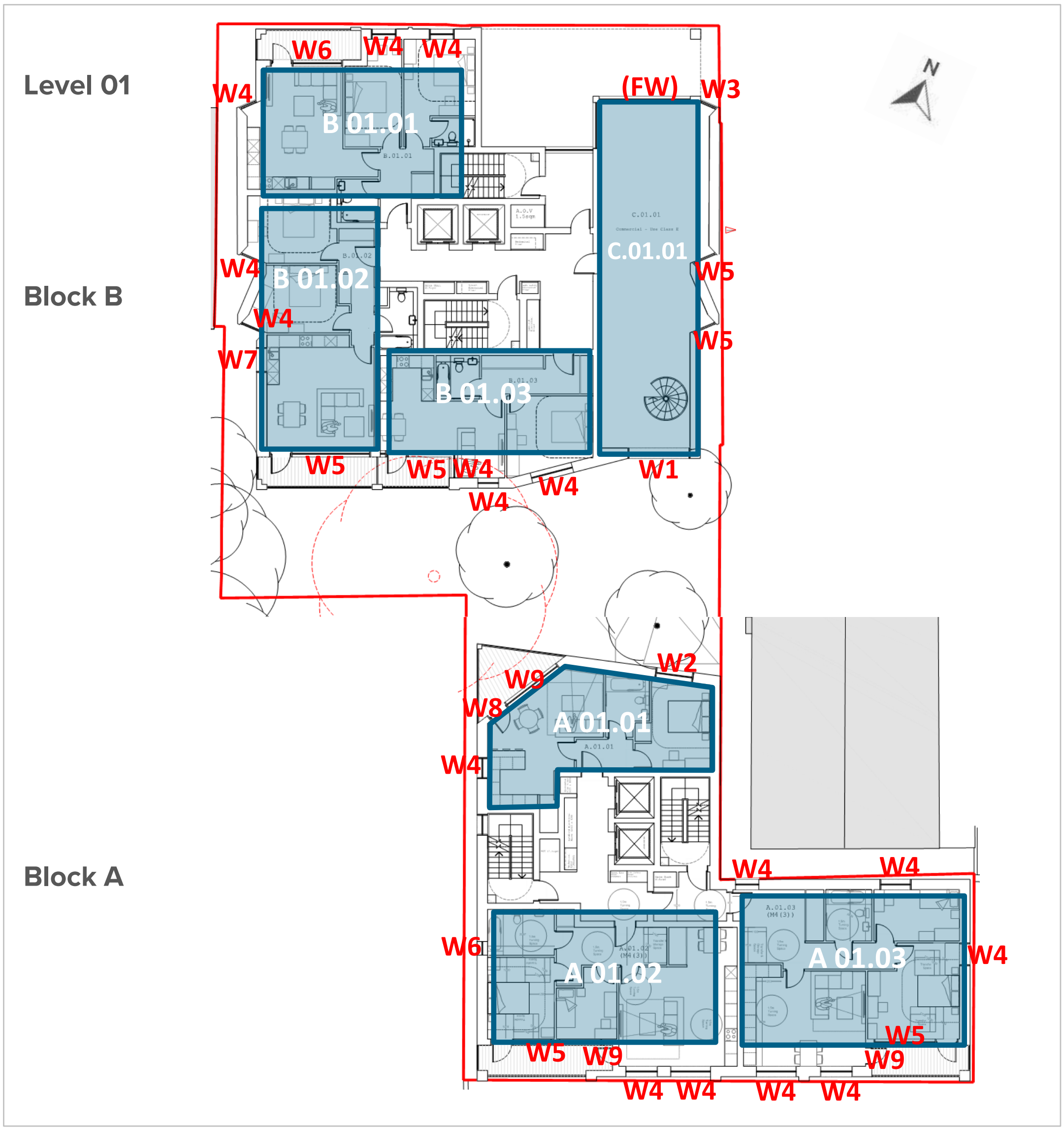
| Measure | Implementation |
|---|---|
| **Minimise internal heat generation through energy efficient design** | |
| High efficiency lighting installations (LED) | All spaces: All fixed building elements such as ceiling lights and white goods will be very energy efficient. It is recommended that the occupants also use energy efficient equipment, for example, energy efficient light fittings of LED types and A+ rated electrical appliances such as TVs that consume less energy and promote to reduce internal heat gains.<br>Occupants should also be advised against prolonged use of any appliances during hot summer days. |
| Low temperature hot water (LTHW) pipework design and installations (location, configuration and insulation) to minimise heat losses. | LTHW pipework running in corridors and circulation areas to be highly insulated across the whole length, including jackets for valves and junctions. Primary distribution within the building is recommended to be vertical rather than horizontal to reduce pipe lengths.<br>The design team have also worked to minimise pipe run lengths. |
| **Reduce the amount of heat entering the building** | |
| External shade from balconies | Balconies incorporated and modelled. |
| Internal shading via opaque blinds | The overheating risk strategy does not rely on blinds; however, the use of internal shading devices is recommended on sunny and warm days to prevent direct solar gains been transmitted into the rooms. These should be left closed when the rooms are not occupied. When using the curtains/blinds, occupants should make sure that these do not cover the openable area of the windows completely so that the air movement is not blocked. **Note the benefit of having internal shading devices is not included in this assessment, in accordance with Part O guidance**. |
| Solar control glazing | Solar control glazing on all windows to achieve g-value = 0.50. |
| **Use of thermal mass to manage heat within the building** | |
| Concrete slab providing thermal mass | Not offering a significant beneficial impact and incompatible with other required strategies (e.g. MVHR, which requires concealment of ductwork in suspended ceiling).<br>Further, thermal mass provides benefits for cooling purposes in rooms occupied during the day, whereas the acoustic restrictions to Ringer's Road predominantly increase the overheating risk in bedrooms overnight. |
| **Passive ventilation** | |
| Natural ventilation opening | Openable windows as per proposed equivalent free area for natural ventilation in all residential areas and communal corridors. |

| | |
|---|---|
| | Due to noise restriction the opening of the windows is at the discretion of the tenant but not rely upon for the overheating design. |
| | Occupants should be advised to leave their windows securely open during the night on warm summer days to take advantage of the low external temperatures during the night for cooling down their rooms and remove the excessive heat that builds up throughout the day. |
| **Mechanical ventilation** | |
| Mechanical ventilation | MVHR with summer boost mode and cooling coils in all flats. Recommended for current weather file and with potential increase in flow rates for future retrofit.<br>Communal corridors will require continuous mechanical ventilation with a flow rate of 10 l/s per floor as a minimum to mitigate overheating risk with DSY1 2020’s weather. |
| **Comfort Cooling** | |
| Cooling capacity | Active mechanical cooling in the form of individual cooling systems to be specified in all non-domestic spaces after passive measures are in place. |

# APPENDIX A – WINDOW LAYOUT

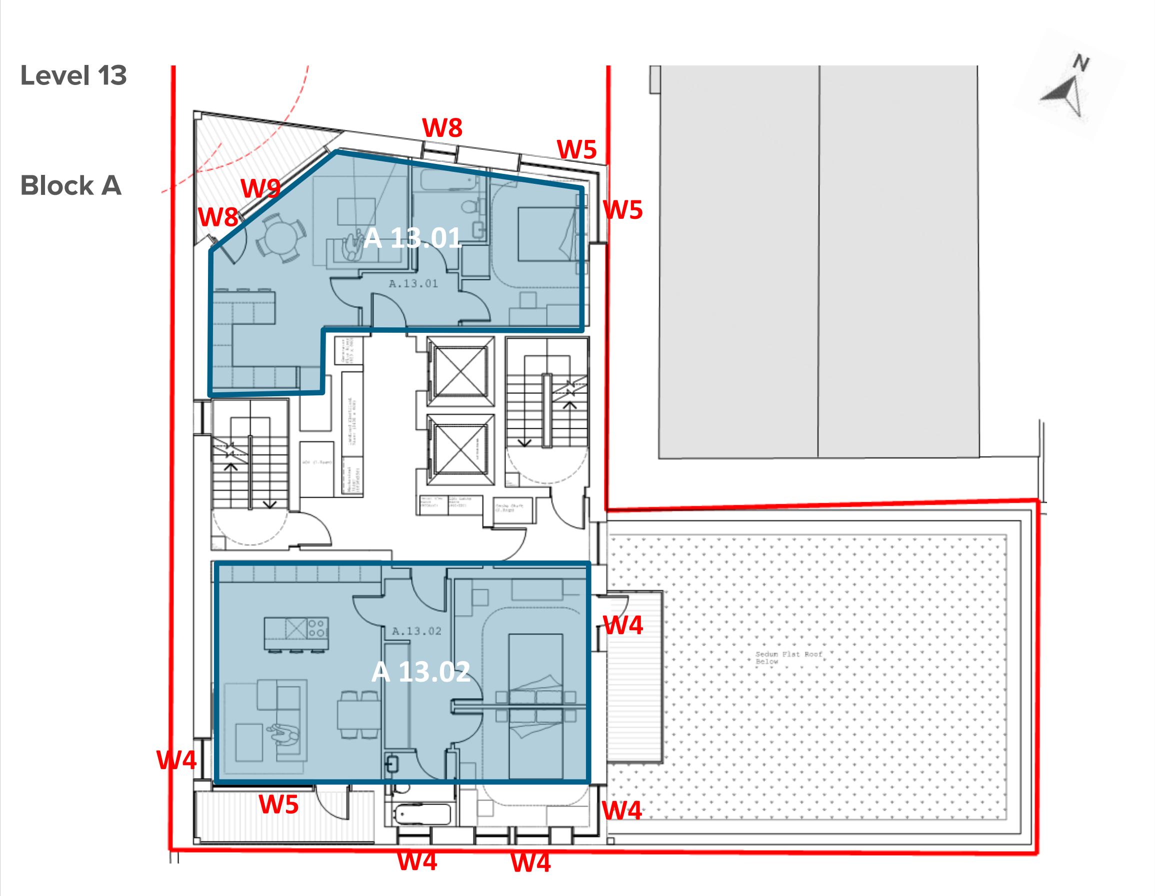
The following figure shows the window types (and their respective numbering that was assigned) throughout the scheme for the purposes of the preliminary overheating risk assessment.




Level 01
Block B
Block A
B 01.01
B 01.02
B 01.03
C.01.01
A 01.01
A 01.02
A 01.03
W1
W2
W3
W4
W5
W6
W7
W8
W9
(FW)
N


Level 07
Block B
Block A
N
W6
W4
B 07.02
W4
B 07.03
W4
W7
B 07.04
W5
W5
W4
W4
W4
W9
W8
A 07.01
W4
W4
A 07.02
W5
W4
W4


Level 10
Block B
W7
W8
W8
W4
W8
B 10.01
B 10.02
W4
W4
W6
W8
B 10.03
W6
W7
W8
W4
W4
N
W7
W8
W8
W4
B 11.01
W8
B 11.02
Level 11
Block B
W4
W4
W6
W8
B 11.03
W6
W7
W8
W4
W9


Level 13
Block A
N
W8
W5
W9
W8
W5
A 13.01
A.13.01
A 13.02
A.13.02
W4
W4
W5
W4
W4
W4
Sedum Flat Roof Below

## APPENDIX B – DETAILED RESULTS: CIBSE 2020S DSY1 WEATHER FILE

The following tables present results in detail for each of the residential assessed rooms under the naturally ventilated scenario (iteration N2) and the final scenario after the acoustic measures incorporated (iteration M2), and in terms of percentage of occupied hours when the internal operative resultant temperature is within the comfort range given by both Part O criteria. Compliance for bedrooms requires passing both of the following two criteria, whereas compliance for living rooms requires compliance with the first criterion.

### NATURALLY VENTILATED SCENARIO (Iteration N2)

| **Room** | **CIBSE 2020s DSY1** | | **Part O Compliance** |
|---|---|---|---|
| | Criterion 1 | Criterion 2 | |
| | ≤ 3% | ≤ 32hrs | |
| A_01.02_KLD (2 Bed) | 2 | N/A | Pass |
| A_01.02_Bedroom (Single) | 1 | 13 | Pass |
| A_01.02_Bedroom | 1.1 | 14 | Pass |
| A_01.03_KLD (2 Bed) | 2.1 | N/A | Pass |
| A_01.03_Bedroom | 1.2 | 13 | Pass |
| A_01.03_Bedroom (Single) | 1 | 16 | Pass |
| A_07.02_KLD (1 Bed) | 2.5 | N/A | Pass |
| A_07.02_Bedroom | 1.1 | 12 | Pass |
| A_07.03_KLD (1 Bed) | 1.4 | N/A | Pass |
| A_07.03_Bedroom | 1 | 13 | Pass |
| A_13.02_KLD (2 Bed) | 2.2 | N/A | Pass |
| B_01.02_KLD (2 Bed) | 2.2 | N/A | Pass |
| B_01.02_Bed 2 (SE) | 1.1 | 12 | Pass |
| B_01.03_Bedroom | 1 | 17 | Pass |
| B_01.03_KLD (1 Bed) | 1.9 | N/A | Pass |
| B_07.02_KLD (2 Bed) | 1.8 | N/A | Pass |
| B_07.02_Bed 1 | 0.8 | 15 | Pass |
| B_07.02_Bed 2 (Single) | 1.2 | 20 | Pass |
| B_07.03_Bedroom | 1 | 17 | Pass |
| B_07.03_KLD (1 Bed) | 1.9 | N/A | Pass |
| B_11.02_ Bed 1 (NW) | 0.8 | 15 | Pass |
| B_11.02_ KLD (2 Bed) | 2 | N/A | Pass |
| B_11.02_ Bed 2 (SE) | 1 | 16 | Pass |
| B_11.03_ Bedroom | 1.1 | 16 | Pass |
| B_07.01_KLD (2 Bed) | 2.2 | N/A | Pass |
| B_07.01_Bed 1 (N) | 0.9 | 15 | Pass |
| B_07.01_Bed 2 (S) | 1 | 21 | Pass |
| B_07.02_Bed 1 (NW) | 1 | 20 | Pass |
| B_07.02_Bed 2 (SE) | 1.1 | 17 | Pass |
| B_07.02_KLD (2 Bed) | 2.3 | N/A | Pass |
| B_11.01_ KLD (2 Bed) | 2.9 | N/A | Pass |
| B_01.02_Bed 1 (NW) | 1 | 17 | Pass |
| C.01.01 | 2.1 | N/A | Pass |
| A_01.01_KLD (1 Bed) | 2 | N/A | Pass |
| A_01.01_Bed 1 (N) | 0.7 | 17 | Pass |
| A_07.01_Bed 1 (N) | 1 | 17 | Pass |
| A_07.01_KLD (1 Bed) | 1.6 | N/A | Pass |
| A_13.02_Bed 1 (NW) | 1 | 13 | Pass |
| A_13.01_Double Bed | 1.5 | 12 | Pass |
| A_13.01_KLD 1bed | 2 | N/A | Pass |
| B_01.01_Double Bed 1 | 0.8 | 12 | Pass |

<table>
<tr><th colspan="2" rowspan="3">Room</th><th colspan="2">CIBSE 2020s DSY1</th><th rowspan="3">Part O Compliance</th></tr>
<tr><th>Criterion 1</th><th>Criterion 2</th></tr>
<tr><th>≤ 3%</th><th>≤ 32hrs</th></tr>
<tr><td colspan="2">B_01.01_Double Bed 2</td><td>1</td><td>21</td><td>Pass</td></tr>
<tr><td colspan="2">B_01.01_KLD (2 Bed)</td><td>2.1</td><td>N/A</td><td>Pass</td></tr>
<tr><td colspan="2">B_11.01_ Bed 2 (NE)</td><td>1.2</td><td>20</td><td>Pass</td></tr>
<tr><td colspan="2">C.00.01</td><td>2.5</td><td>N/A</td><td>Pass</td></tr>
<tr><td colspan="2">B_10.02_ Bed 1 (NW)</td><td>0.8</td><td>12</td><td>Pass</td></tr>
<tr><td colspan="2">B_10.02_ KLD (2 Bed)</td><td>2</td><td>N/A</td><td>Pass</td></tr>
<tr><td colspan="2">B_10.02_ Bed 2 (SE)</td><td>1</td><td>16</td><td>Pass</td></tr>
<tr><td colspan="2">B_10.03_ KLD (1 Bed)</td><td>2.6</td><td>N/A</td><td>Pass</td></tr>
<tr><td colspan="2">B_10.03_ Bedroom</td><td>1.1</td><td>16</td><td>Pass</td></tr>
<tr><td colspan="2">B_10.01_ Bed 2 (NE)</td><td>1.2</td><td>15</td><td>Pass</td></tr>
<tr><td colspan="2">A_13.02_Bed 2 (SE)</td><td>2.4</td><td>12</td><td>Pass</td></tr>
<tr><td colspan="2">B_11.03_ KLD (1 Bed)</td><td>3</td><td>N/A</td><td>Pass</td></tr>
<tr><td colspan="2">B_10.01_ KLD (2 Bed)</td><td>3</td><td>N/A</td><td>Pass</td></tr>
<tr><td rowspan="4">Total No. Pass</td><td>Bedrooms</td><td>31 / 31</td><td>31 / 31</td><td><b>31 / 31</b></td></tr>
<tr><td>Kitchen, Living, Dining (KLDs)</td><td>21 / 21</td><td>N/A</td><td><b>21 / 21</b></td></tr>
<tr><td colspan="3"><b>Overall compliance</b></td><td><b>52/ 52</b></td></tr>
<tr><td colspan="3"><b>% Pass</b></td><td><b>100%</b></td></tr>
</table>

## MECHANICALLY VENTILATED SCENARIO (Iteration M2)

| Room | CIBSE 2020s DSY1 | | Part O Compliance |
|---|---|---|---|
| | Criterion 1 | Criterion 2 | |
| | ≤ 3% | ≤ 32hrs | |
| A_01.02_KLD (2 Bed) | 1.8 | N/A | Pass |
| A_01.02_Bedroom (Single) | 0.8 | 10 | Pass |
| A_01.02_Bedroom | 0.9 | 16 | Pass |
| A_01.03_KLD (2 Bed) | 2.1 | N/A | Pass |
| A_01.03_Bedroom | 1.1 | 29 | Pass |
| A_01.03_Bedroom (Single) | 0.8 | 21 | Pass |
| A_07.02_KLD (1 Bed) | 2.4 | N/A | Pass |
| A_07.02_Bedroom | 1 | 18 | Pass |
| A_07.03_KLD (1 Bed) | 1.3 | N/A | Pass |
| A_07.03_Bedroom | 0.9 | 18 | Pass |
| A_13.02_KLD (2 Bed) | 2.1 | N/A | Pass |
| B_01.02_KLD (2 Bed) | 2 | N/A | Pass |
| B_01.02_Bed 2 (SE) | 0.7 | 20 | Pass |
| B_01.03_Bedroom | 0.7 | 17 | Pass |
| B_01.03_KLD (1 Bed) | 1.5 | N/A | Pass |
| B_07.02_KLD (2 Bed) | 1.8 | N/A | Pass |
| B_07.02_Bed 1 | 0.6 | 17 | Pass |
| B_07.02_Bed 2 (Single) | 0.7 | 16 | Pass |
| B_07.03_Bedroom | 0.7 | 12 | Pass |
| B_07.03_KLD (1 Bed) | 1.5 | N/A | Pass |
| B_11.02_ Bed 1 (NW) | 0.7 | 17 | Pass |
| B_11.02_ KLD (2 Bed) | 1.8 | N/A | Pass |

<table>
<tr><th colspan="2" rowspan="3">Room</th><th colspan="2">CIBSE 2020s DSY1</th><th rowspan="3">Part O Compliance</th></tr>
<tr><th>Criterion 1</th><th>Criterion 2</th></tr>
<tr><th>≤ 3%</th><th>≤ 32hrs</th></tr>
<tr><td colspan="2">B_11.02_ Bed 2 (SE)</td><td>0.7</td><td>20</td><td>Pass</td></tr>
<tr><td colspan="2">B_11.03_ Bedroom</td><td>2.8</td><td>17</td><td>Pass</td></tr>
<tr><td colspan="2">B_07.01_KLD (2 Bed)</td><td>0.8</td><td>N/A</td><td>Pass</td></tr>
<tr><td colspan="2">B_07.01_Bed 1 (N)</td><td>1.8</td><td>20</td><td>Pass</td></tr>
<tr><td colspan="2">B_07.01_Bed 2 (S)</td><td>0.6</td><td>16</td><td>Pass</td></tr>
<tr><td colspan="2">B_07.02_Bed 1 (NW)</td><td>0.7</td><td>15</td><td>Pass</td></tr>
<tr><td colspan="2">B_07.02_Bed 2 (SE)</td><td>0.7</td><td>17</td><td>Pass</td></tr>
<tr><td colspan="2">B_07.02_KLD (2 Bed)</td><td>0.7</td><td>N/A</td><td>Pass</td></tr>
<tr><td colspan="2">B_11.01_ KLD (2 Bed)</td><td>2.1</td><td>N/A</td><td>Pass</td></tr>
<tr><td colspan="2">B_01.02_Bed 1 (NW)</td><td>2.9</td><td>16</td><td>Pass</td></tr>
<tr><td colspan="2">C.01.01</td><td>0.7</td><td>N/A</td><td>Pass</td></tr>
<tr><td colspan="2">A_01.01_KLD (1 Bed)</td><td>2.5</td><td>N/A</td><td>Pass</td></tr>
<tr><td colspan="2">A_01.01_Bed 1 (N)</td><td>1.8</td><td>18</td><td>Pass</td></tr>
<tr><td colspan="2">A_07.01_Bed 1 (N)</td><td>0.5</td><td>12</td><td>Pass</td></tr>
<tr><td colspan="2">A_07.01_KLD (1 Bed)</td><td>0.9</td><td>N/A</td><td>Pass</td></tr>
<tr><td colspan="2">A_13.02_Bed 1 (NW)</td><td>1.4</td><td>17</td><td>Pass</td></tr>
<tr><td colspan="2">A_13.01_Double Bed</td><td>0.9</td><td>18</td><td>Pass</td></tr>
<tr><td colspan="2">A_13.01_KLD 1bed</td><td>1.4</td><td>N/A</td><td>Pass</td></tr>
<tr><td colspan="2">B_01.01_Double Bed 1</td><td>1.7</td><td>18</td><td>Pass</td></tr>
<tr><td colspan="2">B_01.01_Double Bed 2</td><td>0.6</td><td>15</td><td>Pass</td></tr>
<tr><td colspan="2">B_01.01_KLD (2 Bed)</td><td>0.6</td><td>N/A</td><td>Pass</td></tr>
<tr><td colspan="2">B_11.01_ Bed 2 (NE)</td><td>1.6</td><td>16</td><td>Pass</td></tr>
<tr><td colspan="2">C.00.01</td><td>1.1</td><td>N/A</td><td>Pass</td></tr>
<tr><td colspan="2">B_10.02_ Bed 1 (NW)</td><td>2.8</td><td>20</td><td>Pass</td></tr>
<tr><td colspan="2">B_10.02_ KLD (2 Bed)</td><td>0.7</td><td>N/A</td><td>Pass</td></tr>
<tr><td colspan="2">B_10.02_ Bed 2 (SE)</td><td>1.8</td><td>20</td><td>Pass</td></tr>
<tr><td colspan="2">B_10.03_ KLD (1 Bed)</td><td>0.7</td><td>N/A</td><td>Pass</td></tr>
<tr><td colspan="2">B_10.03_ Bedroom</td><td>2.4</td><td>18</td><td>Pass</td></tr>
<tr><td colspan="2">B_10.01_ Bed 2 (NE)</td><td>0.8</td><td>21</td><td>Pass</td></tr>
<tr><td colspan="2">A_13.02_Bed 2 (SE)</td><td>2.9</td><td>20</td><td>Pass</td></tr>
<tr><td colspan="2">B_11.03_ KLD (1 Bed)</td><td>1.1</td><td>N/A</td><td>Pass</td></tr>
<tr><td colspan="2">B_10.01_ KLD (2 Bed)</td><td>2.3</td><td>N/A</td><td>Pass</td></tr>
<tr><td rowspan="3">Total No. Pass</td><td>Bedrooms</td><td>31 / 31</td><td>31 / 31</td><td><b>31 / 31</b></td></tr>
<tr><td>Kitchen, Living, Dining (KLDs)</td><td>21 / 21</td><td>N/A</td><td><b>21 / 21</b></td></tr>
<tr><td colspan="3"><b>Overall compliance</b><br><b>% Pass</b></td><td><b>52/ 52</b><br><b>100%</b></td></tr>
</table>

# APPENDIX C – DETAILED RESULTS: CIBSE 2020S DSY2 AND DSY3

In line with the Part O methodology, the proposed development is required to be assessed against and pass the various criteria using the CIBSE 2020s DSY1 weather file. The Results section of the report demonstrates that all assessed units comply with both TM59 criteria. Both TM59 and GLA guidance recommend that in addition to DSY1 the following two additional TM49 design weather years for 2020s should be used to further test the design, even though, a pass against these is not mandatory:

- 1976: a year with a prolonged period of sustained warmth (DSY3);
- 2003: a year with a very intense single warm spell (DSY2).

The final iteration after the acoustic measures incorporated (iteration M2) has been assessed against the more extreme DSY2 and DSY3 weather files for 2020s and results are presented below.

| Room | CIBSE 2020s DSY2 | | Part O Compliance | CIBSE 2020s DSY3 | | Part O Compliance |
|---|---|---|---|---|---|---|
| | Criterion 1 | Criterion 2 | | Criterion 1 | Criterion 2 | |
| | ≤ 3% | ≤ 32hrs | | ≤ 3% | ≤ 32hrs | |
| A_01.02_Bedroom (Single) | 2 | 37 | Fail | 4.4 | 77 | Fail |
| A_01.02_Bedroom | 2.2 | 48 | Fail | 4.7 | 101 | Fail |
| A_01.03_Bedroom | 2.7 | 71 | Fail | 5.6 | 153 | Fail |
| A_01.03_Bedroom (Single) | 2.2 | 57 | Fail | 4.6 | 122 | Fail |
| A_07.02_Bedroom | 2.3 | 58 | Fail | 5.1 | 111 | Fail |
| A_07.03_Bedroom | 2.2 | 59 | Fail | 4.8 | 113 | Fail |
| B_01.02_Bed 2 (SE) | 2 | 63 | Fail | 4.5 | 127 | Fail |
| B_01.03_Bedroom | 1.8 | 56 | Fail | 4.4 | 112 | Fail |
| B_07.02_Bed 1 | 1.6 | 57 | Fail | 3.8 | 115 | Fail |
| B_07.02_Bed 2 (Single) | 1.9 | 52 | Fail | 4.5 | 108 | Fail |
| B_07.03_Bedroom | 1.7 | 38 | Fail | 4.1 | 82 | Fail |
| B_11.02_ Bed 1 (NW) | 1.8 | 55 | Fail | 3.8 | 102 | Fail |
| B_11.02_ Bed 2 (SE) | 1.8 | 55 | Fail | 4.4 | 116 | Fail |
| B_11.03_ Bedroom | 2.1 | 57 | Fail | 4.8 | 113 | Fail |
| B_07.01_Bed 1 (N) | 1.5 | 61 | Fail | 3.6 | 121 | Fail |
| B_07.01_Bed 2 (S) | 1.7 | 52 | Fail | 3.9 | 111 | Fail |
| B_07.02_Bed 1 (NW) | 1.9 | 49 | Fail | 4.2 | 105 | Fail |
| B_07.02_Bed 2 (SE) | 1.9 | 55 | Fail | 4.5 | 113 | Fail |
| B_01.02_Bed 1 (NW) | 1.9 | 55 | Fail | 4.3 | 109 | Fail |
| A_01.01_Bed 1 (N) | 1.2 | 57 | Fail | 3.2 | 115 | Fail |
| A_07.01_Bed 1 (N) | 2.1 | 51 | Fail | 4.5 | 112 | Fail |
| A_13.02_Bed 1 (NW) | 2.3 | 58 | Fail | 5 | 126 | Fail |
| A_13.01_Double Bed | 2.8 | 57 | Fail | 6.1 | 127 | Fail |
| B_01.01_Double Bed 1 | 1.4 | 55 | Fail | 3.4 | 115 | Fail |
| B_01.01_Double Bed 2 | 1.7 | 53 | Fail | 3.8 | 111 | Fail |
| B_11.01_ Bed 2 (NE) | 2.6 | 59 | Fail | 5.4 | 127 | Fail |
| B_10.02_ Bed 1 (NW) | 1.8 | 55 | Fail | 3.9 | 115 | Fail |
| B_10.02_ Bed 2 (SE) | 1.8 | 56 | Fail | 4.4 | 111 | Fail |
| B_10.03_ Bedroom | 2 | 60 | Fail | 4.8 | 116 | Fail |
| B_10.01_ Bed 2 (NE) | 2.6 | 58 | Fail | 5.5 | 77 | Fail |
| A_01.02_KLD (2 Bed) | 4.2 | N/A | Fail | 9 | N/A | Fail |
| A_01.03_KLD (2 Bed) | 4.6 | N/A | Fail | 9.6 | N/A | Fail |
| A_07.02_KLD (1 Bed) | 4.9 | N/A | Fail | 9.5 | N/A | Fail |
| A_07.03_KLD (1 Bed) | 3.8 | N/A | Fail | 7.6 | N/A | Fail |
| A_13.02_KLD (2 Bed) | 4.7 | N/A | Fail | 9.3 | N/A | Fail |
| A_13.02_Bed 2 (SE) | 3.7 | 59 | Fail | 6.9 | 119 | Fail |
| B_01.02_KLD (2 Bed) | 4.6 | N/A | Fail | 9.2 | N/A | Fail |
| B_01.03_KLD (1 Bed) | 4 | N/A | Fail | 8.4 | N/A | Fail |
| B_07.02_KLD (2 Bed) | 4.1 | N/A | Fail | 8.8 | N/A | Fail |

| **Room** | | **CIBSE 2020s DSY2** | | **Part O Compliance** | **CIBSE 2020s DSY3** | | **Part O Compliance** |
|---|---|---|---|---|---|---|---|
| | | Criterion 1 | Criterion 2 | | Criterion 1 | Criterion 2 | |
| | | ≤ 3% | ≤ 32hrs | | ≤ 3% | ≤ 32hrs | |
| B_07.03_KLD (1 Bed) | | 4 | N/A | Fail | 8.3 | N/A | Fail |
| B_11.02_ KLD (2 Bed) | | 4.4 | N/A | Fail | 9.3 | N/A | Fail |
| B_11.03_ KLD (1 Bed) | | 5.3 | N/A | Fail | 10.6 | N/A | Fail |
| B_07.01_KLD (2 Bed) | | 4.5 | N/A | Fail | 9 | N/A | Fail |
| B_07.02_KLD (2 Bed) | | 4.7 | N/A | Fail | 9.3 | N/A | Fail |
| B_11.01_ KLD (2 Bed) | | 5.1 | N/A | Fail | 10.5 | N/A | Fail |
| A_01.01_KLD (1 Bed) | | 4.2 | N/A | Fail | 8.5 | N/A | Fail |
| A_07.01_KLD (1 Bed) | | 3.9 | N/A | Fail | 7.8 | N/A | Fail |
| A_13.01_KLD 1bed | | 4.2 | N/A | Fail | 8.9 | N/A | Fail |
| B_01.01_KLD (2 Bed) | | 4.4 | N/A | Fail | 8.9 | N/A | Fail |
| B_10.02_ KLD (2 Bed) | | 4.4 | N/A | Fail | 9.3 | N/A | Fail |
| B_10.03_ KLD (1 Bed) | | 5.2 | N/A | Fail | 9.8 | N/A | Fail |
| B_10.01_ KLD (2 Bed) | | 5.1 | N/A | Fail | 10.5 | N/A | Fail |
| Total No. Pass | Bedrooms | 30 / 31 | 0 / 31 | **0 / 31** | / 31 | 0 / 31 | **0 / 31** |
| | Kitchen, Living, Dining (KLDs) | 0 / 21 | N/A | **0 / 21** | / 21 | N/A | **0 / 21** |
| | **Overall compliance** | | | **0 / 52** | | | **0 / 52** |
| | **% Pass** | | | **0%** | | | **0%** |

# APPENDIX B –DETAILED RENEWABLES APPRAISAL

## *BIOMASS HEATING – NOT ADOPTED*

A biomass system designed for this development would be fuelled by wood pellets due to their high energy content. Wood pellets also require less volume of storage than other biomass fuels, require less maintenance and produce considerably less ash residue.

The installation of a communal biomass boiler could replace the proposed communal ASHP back-up gas boiler system. A biomass system, however, would not be an appropriate low-carbon technology for the site for the following reasons:

- the burning of wood pellets releases substantially more NOx emissions than gas boiler equivalents. This would impact the air quality of the site which is located in an urban environment; and,
- storage and delivery of wood pellets would be difficult due to the site constraints and the lack of local biomass suppliers. Pellets would have to be transported from elsewhere in the UK.

For the reasons listed above, biomass is not considered feasible for this development.

Summary of technical/operational data and estimated $CO_2$ savings for biomass heating

| **Biomass** | | |
|---|---|---|
| % of heating load supplied by biomass | 50 | % |
| Biomass system efficiency | 90 | % |
| Carbon intensity of biomass | 0.028 | $kgCO_2/kWh$ |
| Backup system efficiency | 90 | % |
| Carbon intensity of backup | 0.210 | $kgCO_2/kWh$ |
| Heating demand met | 219,500 | kWh/yr. |
| Total $CO_2$ savings | 45.1 | t/yr. |
| Regulated baseline $CO_2$ emissions | 106.2 | t/yr. |
| Total baseline $CO_2$ emissions | 168.9 | t/yr. |
| % Regulated $CO_2$ reduction* | 42.5 | % |
| % Total $CO_2$ reduction* | 26.7 | % |

* % reduction from site baseline

## *SOLAR THERMAL – NOT ADOPTED*

Solar thermal arrays are available as evacuated tubes and flat plate collectors. Evacuated tubes are more efficient, produce higher temperatures and are more suited to the UK climate in general when compared to flat plate collectors.

Solar thermal arrays have similar requirements as PV arrays, in terms of their orientation and inclination. The most efficient use of solar thermal arrays would be to orientate them to the south, at an inclination of about 35°.

For this development solar thermal would be used for domestic hot water only. The use of solar thermal for space heating would not be practical as it is not required when solar thermal is at its most effective during the summer months.

If solar thermal were to be considered for this development, based on a solar fraction of 12%, 50m$^2$ solar thermal arrays would produce a regulated $CO_2$ saving of 4.7%.

Solar thermal panels are not considered a suitable technology for the following reasons:

- Solar thermal arrays would require additional plumbing which is likely to incur additional financial costs;
- The $CO_2$ savings achieved through PV are considerably more compared to solar thermal arrays, therefore the roof space would be better suited to a PV installation;

Additionally, the solar thermal would conflict with the ASHP installation since both systems respond to the domestic hot water demand. For these reasons, solar thermal technology would not be the most feasible option for the proposed development.

Summary of technical/operational data and estimated $CO_2$ savings for solar thermal

| **Solar thermal** | | |
|---|---|---|
| Collector type | Evacuated tube | |
| System efficiency | 40 | % |
| Orientation | South-east | |
| Predicted site solar energy | 1,080 | kWh/m$^2$.yr |
| Solar fraction | 11 | % |
| Total collector area | 50 | m$^2$ |
| Primary gas energy offset by solar thermal system | 23,990 | kWh/yr. |
| Total $CO_2$ savings | 5.0 | t/yr. |
| Regulated baseline $CO_2$ emissions | 97.0 | t/yr. |
| % Regulated $CO_2$ reduction* | 5.1 | % |

* % reduction from site baseline

## *GROUND SOURCE HEAT PUMPS – NOT ADOPTED*

The footprint of the development occupies a significant portion of the site. For this reason, a ground source loop would need to be incorporated within the foundations piles of the building.

A suitable ground source heat pump system for the site would include a closed ground loop, where liquid passes through the system, absorbing heat from the ground and relaying this heat via an electrically run heat pump into the building.

Studies have shown that ground source loops located within close proximity of structural foundations may result in a reduction of the life span of the loops. Thermal testing would need to be carried out on the foundations to determine the implications to the ground loops over time.

Ground source heat pumps would deliver space heating through a low temperature efficient distribution network such as underfloor heating. The annual space heating and cooling demand would be supplied by a system sized to meet 100% of the peak load.

The number of ground loops required would involve a significant amount of space on site and result in additional time at the beginning of the construction process. In addition, the capital cost of installing these ground loops would be very high. This cost is not considered financially feasible given the limited reduction of regulated carbon emissions. For these reasons, ground source heat pumps were not considered to be an appropriate renewable technology for the site.

Summary of technical/operational data and estimated $CO_2$ savings for GSHP

| **GSHP – Domestic Spaces** | | |
|---|---|---|
| COP heating | 2.98 | |
| Carbon intensity of electricity | 0.136 | $kgCO_2/kWh$ |
| Proportion of space heating and hot water met by GSHP | 100 | % |
| Energy met by GSHP | 300,440 | kWh/yr. |
| Energy used by GSHP | 75,110 | kWh/yr. |
| Total $CO_2$ savings | 60.6 | t/yr. |
| Regulated baseline $CO_2$ emissions | 97.0 | t/yr. |
| % Regulated $CO_2$ reduction* | 61 | % |

* % reduction from site baseline

## *WIND TURBINES – NOT ADOPTED*

Building-integrated turbines would be most suited to this site due to the limited amount of roof space, as opposed to stand alone turbines.

$CO_2$ savings from wind turbine technologies take into account their mounting height, the turbine wind curve and wind data. This information was obtained from the BERR website and used in the Carbon Trust Wind Yield Estimation Tool. The average annual wind speed at a mounting height of 10m above the building canopy is estimated to be 3.5m/s.

Due to the spacing required between wind turbines, approximately 1 turbine of 2.5kW or 1 turbine of 6kW could be sited on the roof. The two tables below outline $CO_2$ savings for a 2.5kW and 6kW roof-mounted wind turbine.

The results show that the $CO_2$ savings are minimal for each option, offering 0.4% and 0.9% savings over regulated $CO_2$ emissions for the 2.5kW and 6kW turbines respectively.

This technology is not considered appropriate for this development due to the low $CO_2$ savings achieved, and the significant visual impact the turbines have on the building.

Summary of technical/operational data and estimated $CO_2$ savings for wind turbines

| **Wind power – 2.5 KW** | | |
|---|---|---|
| Average wind speed at site | 3.5 | m/s |
| No. of turbines | 1 | |
| Electricity offset by turbine | 1,760 | kWh/yr. |
| Carbon intensity of offset electricity | 0.136 | $kgCO_2/kWh$ |
| Total $CO_2$ savings | 0.37 | t/yr. |
| Regulated baseline $CO_2$ emissions | 97.0 | t/yr. |
| % Regulated $CO_2$ reduction* | 0.4 | % |
| **Wind power – 6 KW** | | |
| Average wind speed at site | 3 | m/s |
| No. of turbines | 1 | |
| Electricity offset by turbine | 4,430 | kWh/yr. |
| Carbon intensity of offset electricity | 0.136 | $kgCO_2/kWh$ |
| Total $CO_2$ savings | 0.93 | t/yr. |
| Regulated baseline $CO_2$ emissions | 97.0 | t/yr. |
| % Regulated $CO_2$ reduction* | 0.9 | % |

* % reduction from site baseline

# APPENDIX C – SAP RESULTS

The table below lists a sample of the typical flats that were modelled using SAP methodology, the TER and DER outputs and the % $CO_2$ reduction achieved after the Be Lean, Be Clean and Be Green measures have been applied.

The results from these 36 flats were extrapolated over the entire development, in order to predict the energy consumption and carbon dioxide emissions for the domestic spaces of the Development.

The following pages show the DER/TER Elmhurst SAP10 worksheets for a sample flat at the Be Lean, Be Clean and Be Green stages when using SAP10.2 carbon factors. The SAP outputs for all sample flats are available on request.

| SAP Ref No. | Unit Ref. | TER ($kgCO_2/m^2/yr$) | Be Lean/Be Clean | | Be Green | |
|---|---|---|---|---|---|---|
| | | | DER ($kgCO_2/m^2/yr$) | % $CO_2$ reduction | DER ($kgCO_2/m^2/yr$) | % $CO_2$ reduction |
| 1 | A1-Lower | 22.01 | 17.69 | 19.6 | 5.10 | 76.8 |
| 2 | A2-Lower | 16.08 | 12.82 | 20.3 | 3.81 | 76.3 |
| 3 | A3-Lower | 15.25 | 12.22 | 19.9 | 3.66 | 76.0 |
| 4 | A1-Mid | 18.67 | 16.13 | 13.6 | 4.68 | 74.9 |
| 5 | A2-Mid | 14.66 | 12.53 | 14.5 | 3.73 | 74.6 |
| 6 | A3-Mid | 12.79 | 11.12 | 13.1 | 3.35 | 73.8 |
| 7 | A4-Mid | 15.66 | 13.80 | 11.9 | 4.07 | 74.0 |
| 8 | A5-Mid | 14.65 | 13.09 | 10.7 | 3.88 | 73.5 |
| 9 | A6-Mid | 16.57 | 14.82 | 10.6 | 4.34 | 73.8 |
| 10 | A7-Mid | 14.67 | 12.98 | 11.5 | 3.84 | 73.8 |
| 11 | A8-Mid | 16.49 | 14.93 | 9.5 | 4.38 | 73.4 |
| 12 | A9-Mid | 18.88 | 17.13 | 9.3 | 4.96 | 73.7 |
| 13 | A10-Mid | 15.66 | 13.63 | 13.0 | 4.02 | 74.3 |
| 14 | A11-Mid | 15.16 | 12.92 | 14.8 | 3.83 | 74.7 |
| 15 | A7-Top | 16.52 | 13.91 | 15.8 | 4.09 | 75.2 |
| 16 | A8-Top | 20.39 | 16.63 | 18.4 | 4.85 | 76.2 |
| 17 | A9-Top | 22.53 | 18.73 | 16.9 | 5.41 | 76.0 |
| 18 | A11-Top | 18.37 | 14.31 | 22.1 | 4.22 | 77.0 |
| 19 | B1-Lower | 16.99 | 13.58 | 20.1 | 3.99 | 76.5 |
| 20 | B1-Lower-M | 18.41 | 15.33 | 16.7 | 4.46 | 75.8 |
| 21 | B2-Lower | 15.69 | 12.41 | 20.9 | 3.69 | 76.5 |
| 22 | B2-Lower-M | 17.04 | 13.77 | 19.2 | 4.06 | 76.2 |
| 23 | B3-Lower | 17.84 | 14.72 | 17.5 | 4.32 | 75.8 |
| 24 | B1-Mid | 14.30 | 11.85 | 17.1 | 3.51 | 75.5 |
| 25 | B1-Mid-M | 15.45 | 13.43 | 13.1 | 3.93 | 74.6 |

| SAP Ref No. | Unit Ref. | TER ($kgCO_2/m^2/yr$) | Be Lean/Be Clean | | Be Green | |
|---|---|---|---|---|---|---|
| | | | DER ($kgCO_2/m^2/yr$) | % $CO_2$ reduction | DER ($kgCO_2/m^2/yr$) | % $CO_2$ reduction |
| 26 | B2-Mid | 13.07 | 11.27 | 13.8 | 3.38 | 74.1 |
| 27 | B2-Mid-M | 14.17 | 12.55 | 11.4 | 3.72 | 73.7 |
| 28 | B3-Mid | 15.08 | 13.89 | 7.9 | 4.11 | 72.7 |
| 29 | B4-Mid | 16.41 | 15.20 | 7.4 | 4.45 | 72.9 |
| 30 | B5-Mid | 12.64 | 10.53 | 16.7 | 3.17 | 74.9 |
| 31 | B6-Mid | 15.22 | 12.89 | 15.3 | 3.8 | 75.0 |
| 32 | B1-Top | 16.75 | 13.41 | 19.9 | 3.94 | 76.5 |
| 33 | B2-Top | 15.74 | 12.65 | 19.6 | 3.76 | 76.1 |
| 34 | B4-Top | 20.01 | 16.80 | 16.0 | 4.90 | 75.5 |
| 35 | B5-Top | 15.56 | 12.06 | 22.5 | 3.59 | 76.9 |
| 36 | B6-Top | 18.23 | 14.33 | 21.4 | 4.20 | 77.0 |

# APPENDIX D – SBEM RESULTS

# BRUKL Output Document

HM Government

Compliance with England Building Regulations Part L 2021

**Project name**

## 9_604_Ringers Road_LEAN

As designed

**Date:** Wed Oct 19 16:04:13 2022

## Administrative information

### Building Details

**Address:** Ringers Road, London,

### Certifier details

**Name:**

**Telephone number:**

**Address:** Street Address, ,

### Certification tool

**Calculation engine:** SBEM

**Calculation engine version:** v6.1.b.0

**Interface to calculation engine:** Virtual Environment

**Interface to calculation engine version:** v7.0.15

**BRUKL compliance check version:** v6.1.b.0

**Foundation area [$m^2$]:** 193.95

## The $CO_2$ emission and primary energy rates of the building must not exceed the targets

| | | |
|---|---|---|
| Target $CO_2$ emission rate (TER), $kgCO_2/m^2$.annum | 14.64 | |
| Building $CO_2$ emission rate (BER), $kgCO_2/m^2$.annum | 12.32 | |
| Target primary energy rate (TPER), kWh/$m^2$.annum | 107.22 | |
| Building primary energy rate (BPER), kWh/$m^2$.annum | 91.09 | |
| Do the building's emission and primary energy rates exceed the targets? | BER =< TER | BPER =< TPER |

## The performance of the building fabric and fixed building services should achieve reasonable overall standards of energy efficiency

| Fabric element | $U_{a\text{-}Limit}$ | $U_{a\text{-}Calc}$ | $U_{i\text{-}Calc}$ | First surface with maximum value |
|---|---|---|---|---|
| Walls* | 0.26 | 0.15 | 0.15 | BS000017_W-1 |
| Floors | 0.18 | 0.1 | 0.1 | BS000017_F |
| Pitched roofs | 0.16 | - | - | No heat loss pitched roofs |
| Flat roofs | 0.18 | 0.1 | 0.1 | BS00000F_C |
| Windows** and roof windows | 1.6 | 1.2 | 1.2 | L000000C_W0_O0 |
| Rooflights*** | 2.2 | - | - | No external rooflights |
| Personnel doors^ | 1.6 | - | - | No external personnel doors |
| Vehicle access & similar large doors | 1.3 | - | - | No external vehicle access doors |
| High usage entrance doors | 3 | - | - | No external high usage entrance doors |

$U_{a\text{-}Limit}$ = Limiting area-weighted average U-values [W/($m^2$K)]

$U_{i\text{-}Calc}$ = Calculated maximum individual element U-values [W/($m^2$K)]

$U_{a\text{-}Calc}$ = Calculated area-weighted average U-values [W/($m^2$K)]

* Automatic U-value check by the tool does not apply to curtain walls whose limiting standard is similar to that for windows.

** Display windows and similar glazing are excluded from the U-value check.

*** Values for rooflights refer to the horizontal position.

^ For fire doors, limiting U-value is 1.8 W/$m^2$K

N.B.: Neither roof ventilators (inc. smoke vents) nor swimming pool basins are modelled or checked against the limiting standards by the tool.

| Air permeability | Limiting standard | This building |
|---|---|---|
| $m^3/(h.m^2)$ at 50 Pa | 8 | 3 |

## Building services

For details on the standard values listed below, system-specific guidance, and additional regulatory requirements, refer to the Approved Documents.

| | |
|---|---|
| **Whole building lighting automatic monitoring & targeting with alarms for out-of-range values** | YES |
| **Whole building electric power factor achieved by power factor correction** | >0.95 |

1- ASHP

| | Heating efficiency | Cooling efficiency | Radiant efficiency | SFP [W/(l/s)] | HR efficiency |
|---|---|---|---|---|---|
| **This system** | 2.64 | 6 | - | - | - |
| **Standard value** | 2.5* | 5 | N/A | N/A | N/A |
| **Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system** | | | | | YES |

* Standard shown is for all types >12 kW output, except absorption and gas engine heat pumps.

1- SYST0002-DHW

| | Water heating efficiency | Storage loss factor [kWh/litre per day] |
|---|---|---|
| **This building** | 1 | - |
| **Standard value** | 0.91 | N/A |

### Zone-level mechanical ventilation, exhaust, and terminal units

| ID | System type in the Approved Documents |
|---|---|
| A | Local supply or extract ventilation units |
| B | Zonal supply system where the fan is remote from the zone |
| C | Zonal extract system where the fan is remote from the zone |
| D | Zonal balanced supply and extract ventilation system |
| E | Local balanced supply and extract ventilation units |
| F | Other local ventilation units |
| G | Fan assisted terminal variable air volume units |
| H | Fan coil units |
| I | Kitchen extract with the fan remote from the zone and a grease filter |

NB: Limiting SFP may be increased by the amounts specified in the Approved Documents if the installation includes particular components.

| Zone name | SFP [W/(l/s)] | | | | | | | | | HR efficiency | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **ID of system type** | A | B | C | D | E | F | G | H | I | | |
| **Standard value** | 0.3 | 1.1 | 0.5 | 2.3 | 2 | 0.5 | 0.5 | 0.4 | 1 | Zone | Standard |
| A_BS_Co working space 02 | - | - | - | - | 0.8 | - | - | - | - | 0.8 | N/A |
| A_BS_WC | - | - | - | - | 0.8 | - | - | - | - | 0.8 | N/A |
| A_L00_Co working space 02 | - | - | - | - | 0.8 | - | - | - | - | 0.8 | N/A |
| A_L00_Residents Event space | - | - | - | - | 0.8 | - | - | - | - | 0.8 | N/A |
| A_L00_WC | - | - | - | - | 0.8 | - | - | - | - | 0.8 | N/A |
| B_BS_Comm. Office_Class E | - | - | - | - | 0.8 | - | - | - | - | 0.8 | N/A |
| B_L00_Comm. Bicycle cafe | - | - | - | - | 0.8 | - | - | - | - | 0.8 | N/A |
| B_L00_Office space_Class E | - | - | - | - | 0.8 | - | - | - | - | 0.8 | N/A |
| B_L01_Comm. Bicycle cafe | - | - | - | - | 0.8 | - | - | - | - | 0.8 | N/A |

| **General lighting and display lighting** | General luminaire | Display light source | |
|---|---|---|---|
| **Zone name** | Efficacy [lm/W] | Efficacy [lm/W] | Power density [W/m²] |
| **Standard value** | 95 | 80 | 0.3 |
| A_BS_Co working space 02 | 120 | - | - |

| General lighting and display lighting | General luminaire | Display light source | |
|---|---|---|---|
| **Zone name** | **Efficacy [lm/W]** | **Efficacy [lm/W]** | **Power density [W/m²]** |
| **Standard value** | 95 | 80 | 0.3 |
| A_BS_WC | 120 | - | - |
| A_L00_Co working space 02 | 120 | - | - |
| A_L00_Residents Event space | 120 | - | - |
| A_L00_WC | 120 | - | - |
| B_BS_Comm. Office_Class E | 120 | - | - |
| B_L00_Comm. Bicycle cafe | 120 | 100 | 1.5 |
| B_L00_Office space_Class E | 120 | - | - |
| B_L01_Comm. Bicycle cafe | 120 | 100 | 1.5 |

## The spaces in the building should have appropriate passive control measures to limit solar gains in summer

| Zone | Solar gain limit exceeded? (%) | Internal blinds used? |
|---|---|---|
| A_BS_Co working space 02 | N/A | N/A |
| A_BS_WC | N/A | N/A |
| A_L00_Co working space 02 | NO (-71.4%) | YES |
| A_L00_Residents Event space | NO (-81.7%) | YES |
| A_L00_WC | N/A | N/A |
| B_BS_Comm. Office_Class E | N/A | N/A |
| B_L00_Comm. Bicycle cafe | NO (-64.7%) | YES |
| B_L00_Office space_Class E | NO (-75.9%) | YES |
| B_L01_Comm. Bicycle cafe | NO (-84.1%) | YES |

## Regulation 25A: Consideration of high efficiency alternative energy systems

| | |
|---|---|
| **Were alternative energy systems considered and analysed as part of the design process?** | YES |
| Is evidence of such assessment available as a separate submission? | YES |
| Are any such measures included in the proposed design? | YES |

# Technical Data Sheet (Actual vs. Notional Building)

## Building Global Parameters

| | Actual | Notional |
|---|---|---|
| Floor area [m²] | 563.1 | 563.1 |
| External area [m²] | 965.1 | 965.1 |
| Weather | LON | LON |
| Infiltration [m³/hm²@ 50Pa] | 3 | 3 |
| Average conductance [W/K] | 385.24 | 526.28 |
| Average U-value [W/m²K] | 0.4 | 0.55 |
| Alpha value* [%] | 44.37 | 29.26 |

* Percentage of the building's average heat transfer coefficient which is due to thermal bridging

## Building Use

| % Area | Building Type |
|---|---|
| | Retail/Financial and Professional Services |
| **27** | **Restaurants and Cafes/Drinking Establishments/Takeaways** |
| **71** | **Offices and Workshop Businesses** |
| | General Industrial and Special Industrial Groups |
| | Storage or Distribution |
| | Hotels |
| | Residential Institutions: Hospitals and Care Homes |
| | Residential Institutions: Residential Schools |
| | Residential Institutions: Universities and Colleges |
| | Secure Residential Institutions |
| **2** | **Residential Spaces** |
| | Non-residential Institutions: Community/Day Centre |
| | Non-residential Institutions: Libraries, Museums, and Galleries |
| | Non-residential Institutions: Education |
| | Non-residential Institutions: Primary Health Care Building |
| | Non-residential Institutions: Crown and County Courts |
| | General Assembly and Leisure, Night Clubs, and Theatres |
| | Others: Passenger Terminals |
| | Others: Emergency Services |
| | Others: Miscellaneous 24hr Activities |
| | Others: Car Parks 24 hrs |
| | Others: Stand Alone Utility Block |

## Energy Consumption by End Use [kWh/m²]

| | Actual | Notional |
|---|---|---|
| Heating | 10.16 | 8.81 |
| Cooling | 7.05 | 11.43 |
| Auxiliary | 5.11 | 4.43 |
| Lighting | 11.31 | 11.68 |
| Hot water | 36.51 | 46.85 |
| Equipment* | 61.36 | 61.36 |
| **TOTAL**** | **70.14** | **83.2** |

* Energy used by equipment does not count towards the total for consumption or calculating emissions.
** Total is net of any electrical energy displaced by CHP generators, if applicable.

## Energy Production by Technology [kWh/m²]

| | Actual | Notional |
|---|---|---|
| Photovoltaic systems | 0 | 0 |
| Wind turbines | 0 | 0 |
| CHP generators | 0 | 0 |
| Solar thermal systems | 0 | 0 |
| *Displaced electricity* | *0* | *0* |

## Energy & $CO_2$ Emissions Summary

| | Actual | Notional |
|---|---|---|
| Heating + cooling demand [MJ/m²] | 208.49 | 264.72 |
| Primary energy [kWh/m²] | 91.09 | 107.22 |
| Total emissions [kg/m²] | 12.32 | 14.64 |

## HVAC Systems Performance

| System Type | | Heat dem MJ/m2 | Cool dem MJ/m2 | Heat con kWh/m2 | Cool con kWh/m2 | Aux con kWh/m2 | Heat SSEEF | Cool SSEER | Heat gen SEFF | Cool gen SEER |
|---|---|---|---|---|---|---|---|---|---|---|
| **[ST] Split or multi-split system, [HS] ASHP, [HFT] Electricity, [CFT] Electricity** | | | | | | | | | | |
| | **Actual** | 94.7 | 113.8 | 10.2 | 7 | 5.1 | 2.59 | 4.48 | 2.64 | 6 |
| | **Notional** | 83.7 | 181 | 8.8 | 11.4 | 2.7 | 2.64 | 4.4 | ---- | ---- |

## Key to terms

Heat dem [MJ/m2] = Heating energy demand
Cool dem [MJ/m2] = Cooling energy demand
Heat con [kWh/m2] = Heating energy consumption
Cool con [kWh/m2] = Cooling energy consumption
Aux con [kWh/m2] = Auxiliary energy consumption
Heat SSEFF = Heating system seasonal efficiency (for notional building, value depends on activity glazing class)
Cool SSEER = Cooling system seasonal energy efficiency ratio
Heat gen SSEFF = Heating generator seasonal efficiency
Cool gen SSEER = Cooling generator seasonal energy efficiency ratio
ST = System type
HS = Heat source
HFT = Heating fuel type
CFT = Cooling fuel type

# BRUKL Output Document

HM Government

## Compliance with England Building Regulations Part L 2021

**Project name**

## 9_604_Ringers Road_GREEN

As designed

**Date:** Wed Oct 19 15:42:17 2022

## Administrative information

### Building Details

**Address:** Ringers Road, London,

### Certifier details

**Name:**

**Telephone number:**

**Address:** Street Address, ,

### Certification tool

**Calculation engine:** SBEM

**Calculation engine version:** v6.1.b.0

**Interface to calculation engine:** Virtual Environment

**Interface to calculation engine version:** v7.0.15

**BRUKL compliance check version:** v6.1.b.0

**Foundation area [$m^2$]:** 193.95

## The $CO_2$ emission and primary energy rates of the building must not exceed the targets

| | | |
|---|---|---|
| Target $CO_2$ emission rate (TER), $kgCO_2/m^2$.annum | 14.64 | |
| Building $CO_2$ emission rate (BER), $kgCO_2/m^2$.annum | 8.16 | |
| Target primary energy rate (TPER), kWh/$m^2$.annum | 107.22 | |
| Building primary energy rate (BPER), kWh/$m^2$.annum | 43.01 | |
| Do the building's emission and primary energy rates exceed the targets? | BER =< TER | BPER =< TPER |

## The performance of the building fabric and fixed building services should achieve reasonable overall standards of energy efficiency

| Fabric element | $U_{a\text{-Limit}}$ | $U_{a\text{-Calc}}$ | $U_{i\text{-Calc}}$ | First surface with maximum value |
|---|---|---|---|---|
| Walls* | 0.26 | 0.15 | 0.15 | BS000017_W-1 |
| Floors | 0.18 | 0.1 | 0.1 | BS000017_F |
| Pitched roofs | 0.16 | - | - | No heat loss pitched roofs |
| Flat roofs | 0.18 | 0.1 | 0.1 | BS00000F_C |
| Windows** and roof windows | 1.6 | 1.2 | 1.2 | L000000C_W0_O0 |
| Rooflights*** | 2.2 | - | - | No external rooflights |
| Personnel doors^ | 1.6 | - | - | No external personnel doors |
| Vehicle access & similar large doors | 1.3 | - | - | No external vehicle access doors |
| High usage entrance doors | 3 | - | - | No external high usage entrance doors |

$U_{a\text{-Limit}}$ = Limiting area-weighted average U-values [W/($m^2$K)]
$U_{i\text{-Calc}}$ = Calculated maximum individual element U-values [W/($m^2$K)]
$U_{a\text{-Calc}}$ = Calculated area-weighted average U-values [W/($m^2$K)]

* Automatic U-value check by the tool does not apply to curtain walls whose limiting standard is similar to that for windows.

** Display windows and similar glazing are excluded from the U-value check.
*** Values for rooflights refer to the horizontal position.

^ For fire doors, limiting U-value is 1.8 W/$m^2$K

N.B.: Neither roof ventilators (inc. smoke vents) nor swimming pool basins are modelled or checked against the limiting standards by the tool.

| Air permeability | Limiting standard | This building |
|---|---|---|
| $m^3/(h.m^2)$ at 50 Pa | 8 | 3 |

**Building services**

**For details on the standard values listed below, system-specific guidance, and additional regulatory requirements, refer to the Approved Documents.**

| | |
|---|---|
| **Whole building lighting automatic monitoring & targeting with alarms for out-of-range values** | YES |
| **Whole building electric power factor achieved by power factor correction** | >0.95 |

1- ASHP

| | **Heating efficiency** | **Cooling efficiency** | **Radiant efficiency** | **SFP [W/(l/s)]** | **HR efficiency** |
|---|---|---|---|---|---|
| **This system** | 2.98 | 6 | - | - | - |
| **Standard value** | 2.5* | 5 | N/A | N/A | N/A |
| **Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system** | | | | | YES |

* Standard shown is for all types >12 kW output, except absorption and gas engine heat pumps.

1- SYST0002-DHW

| | **Water heating efficiency** | **Storage loss factor [kWh/litre per day]** |
|---|---|---|
| **This building** | 1 | - |
| **Standard value** | 0.91 | N/A |

**Zone-level mechanical ventilation, exhaust, and terminal units**

| **ID** | **System type in the Approved Documents** |
|---|---|
| A | Local supply or extract ventilation units |
| B | Zonal supply system where the fan is remote from the zone |
| C | Zonal extract system where the fan is remote from the zone |
| D | Zonal balanced supply and extract ventilation system |
| E | Local balanced supply and extract ventilation units |
| F | Other local ventilation units |
| G | Fan assisted terminal variable air volume units |
| H | Fan coil units |
| I | Kitchen extract with the fan remote from the zone and a grease filter |

NB: Limiting SFP may be increased by the amounts specified in the Approved Documents if the installation includes particular components.

| **Zone name** | **SFP [W/(l/s)]** | | | | | | | | | **HR efficiency** | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **ID of system type** | **A** | **B** | **C** | **D** | **E** | **F** | **G** | **H** | **I** | | |
| **Standard value** | 0.3 | 1.1 | 0.5 | 2.3 | 2 | 0.5 | 0.5 | 0.4 | 1 | **Zone** | **Standard** |
| A_BS_Co working space 02 | - | - | - | - | 0.8 | - | - | - | - | 0.8 | N/A |
| A_BS_WC | - | - | - | - | 0.8 | - | - | - | - | 0.8 | N/A |
| A_L00_Co working space 02 | - | - | - | - | 0.8 | - | - | - | - | 0.8 | N/A |
| A_L00_Residents Event space | - | - | - | - | 0.8 | - | - | - | - | 0.8 | N/A |
| A_L00_WC | - | - | - | - | 0.8 | - | - | - | - | 0.8 | N/A |
| B_BS_Comm. Office_Class E | - | - | - | - | 0.8 | - | - | - | - | 0.8 | N/A |
| B_L00_Comm. Bicycle cafe | - | - | - | - | 0.8 | - | - | - | - | 0.8 | N/A |
| B_L00_Office space_Class E | - | - | - | - | 0.8 | - | - | - | - | 0.8 | N/A |
| B_L01_Comm. Bicycle cafe | - | - | - | - | 0.8 | - | - | - | - | 0.8 | N/A |

| **General lighting and display lighting** | **General luminaire** | **Display light source** | |
|---|---|---|---|
| **Zone name** | **Efficacy [lm/W]** | **Efficacy [lm/W]** | **Power density [W/m²]** |
| **Standard value** | 95 | 80 | 0.3 |
| A_BS_Co working space 02 | 120 | - | - |

| General lighting and display lighting | General luminaire | Display light source | |
|---|---|---|---|
| **Zone name** | **Efficacy [lm/W]** | **Efficacy [lm/W]** | **Power density [W/m²]** |
| **Standard value** | 95 | 80 | 0.3 |
| A_BS_WC | 120 | - | - |
| A_L00_Co working space 02 | 120 | - | - |
| A_L00_Residents Event space | 120 | - | - |
| A_L00_WC | 120 | - | - |
| B_BS_Comm. Office_Class E | 120 | - | - |
| B_L00_Comm. Bicycle cafe | 120 | 100 | 1.5 |
| B_L00_Office space_Class E | 120 | - | - |
| B_L01_Comm. Bicycle cafe | 120 | 100 | 1.5 |

## The spaces in the building should have appropriate passive control measures to limit solar gains in summer

| Zone | Solar gain limit exceeded? (%) | Internal blinds used? |
|---|---|---|
| A_BS_Co working space 02 | N/A | N/A |
| A_BS_WC | N/A | N/A |
| A_L00_Co working space 02 | NO (-71.4%) | YES |
| A_L00_Residents Event space | NO (-81.7%) | YES |
| A_L00_WC | N/A | N/A |
| B_BS_Comm. Office_Class E | N/A | N/A |
| B_L00_Comm. Bicycle cafe | NO (-64.7%) | YES |
| B_L00_Office space_Class E | NO (-75.9%) | YES |
| B_L01_Comm. Bicycle cafe | NO (-84.1%) | YES |

## Regulation 25A: Consideration of high efficiency alternative energy systems

| **Were alternative energy systems considered and analysed as part of the design process?** | YES |
|---|---|
| Is evidence of such assessment available as a separate submission? | YES |
| Are any such measures included in the proposed design? | YES |

# Technical Data Sheet (Actual vs. Notional Building)

## Building Global Parameters

| | Actual | Notional |
|---|---|---|
| Floor area [m$^2$] | 563.1 | 563.1 |
| External area [m$^2$] | 965.1 | 965.1 |
| Weather | LON | LON |
| Infiltration [m$^3$/hm$^2$@ 50Pa] | 3 | 3 |
| Average conductance [W/K] | 385.24 | 526.28 |
| Average U-value [W/m$^2$K] | 0.4 | 0.55 |
| Alpha value* [%] | 44.37 | 29.26 |

* Percentage of the building's average heat transfer coefficient which is due to thermal bridging

## Building Use

| % Area | Building Type |
|---|---|
| | Retail/Financial and Professional Services |
| **27** | **Restaurants and Cafes/Drinking Establishments/Takeaways** |
| **71** | **Offices and Workshop Businesses** |
| | General Industrial and Special Industrial Groups |
| | Storage or Distribution |
| | Hotels |
| | Residential Institutions: Hospitals and Care Homes |
| | Residential Institutions: Residential Schools |
| | Residential Institutions: Universities and Colleges |
| | Secure Residential Institutions |
| **2** | **Residential Spaces** |
| | Non-residential Institutions: Community/Day Centre |
| | Non-residential Institutions: Libraries, Museums, and Galleries |
| | Non-residential Institutions: Education |
| | Non-residential Institutions: Primary Health Care Building |
| | Non-residential Institutions: Crown and County Courts |
| | General Assembly and Leisure, Night Clubs, and Theatres |
| | Others: Passenger Terminals |
| | Others: Emergency Services |
| | Others: Miscellaneous 24hr Activities |
| | Others: Car Parks 24 hrs |
| | Others: Stand Alone Utility Block |

## Energy Consumption by End Use [kWh/m$^2$]

| | Actual | Notional |
|---|---|---|
| Heating | 9 | 8.81 |
| Cooling | 7.05 | 11.43 |
| Auxiliary | 5.11 | 4.43 |
| Lighting | 11.31 | 11.68 |
| Hot water | 36.51 | 46.85 |
| Equipment* | 61.36 | 61.36 |
| **TOTAL**** | **68.98** | **83.2** |

* Energy used by equipment does not count towards the total for consumption or calculating emissions.
** Total is net of any electrical energy displaced by CHP generators, if applicable.

## Energy Production by Technology [kWh/m$^2$]

| | Actual | Notional |
|---|---|---|
| Photovoltaic systems | 31.7 | 0 |
| Wind turbines | 0 | 0 |
| CHP generators | 0 | 0 |
| Solar thermal systems | 0 | 0 |
| *Displaced electricity* | *31.7* | *0* |

## Energy & CO$_2$ Emissions Summary

| | Actual | Notional |
|---|---|---|
| Heating + cooling demand [MJ/m$^2$] | 208.49 | 264.72 |
| Primary energy [kWh/m$^2$] | 43.01 | 107.22 |
| Total emissions [kg/m$^2$] | 8.16 | 14.64 |

## HVAC Systems Performance

| System Type | | Heat dem MJ/m2 | Cool dem MJ/m2 | Heat con kWh/m2 | Cool con kWh/m2 | Aux con kWh/m2 | Heat SSEEF | Cool SSEER | Heat gen SEFF | Cool gen SEER |
|---|---|---|---|---|---|---|---|---|---|---|
| [ST] Split or multi-split system, [HS] ASHP, [HFT] Electricity, [CFT] Electricity | | | | | | | | | | |
| | **Actual** | 94.7 | 113.8 | 9 | 7 | 5.1 | 2.92 | 4.48 | 2.98 | 6 |
| | **Notional** | 83.7 | 181 | 8.8 | 11.4 | 2.7 | 2.64 | 4.4 | ---- | ---- |

## Key to terms

Heat dem [MJ/m2] = Heating energy demand
Cool dem [MJ/m2] = Cooling energy demand
Heat con [kWh/m2] = Heating energy consumption
Cool con [kWh/m2] = Cooling energy consumption
Aux con [kWh/m2] = Auxiliary energy consumption
Heat SSEFF = Heating system seasonal efficiency (for notional building, value depends on activity glazing class)
Cool SSEER = Cooling system seasonal energy efficiency ratio
Heat gen SSEFF = Heating generator seasonal efficiency
Cool gen SSEER = Cooling generator seasonal energy efficiency ratio
ST = System type
HS = Heat source
HFT = Heating fuel type
CFT = Cooling fuel type

# APPENDIX E – SAP AND SBEM MODELLING INPUTS

## Ringers Road SAP Calculation Assumptions

**20/04/2023**

*The figures listed below are assumptions only, based on a combination of best judgement at design stage and information from the design team where appropriate. Throughout the design stage the systems and size of renewable systems are likely to change whilst the building designs are being finalised. All information detailed in this design note is a basic recommendation at the Planning Stage Part L pre-assessment. It should be noted that this document is not exhaustive and the contractor should allow for flexibility on site where necessary.*

### Opaque Elements

**U-Values new elements**

**Floors**

| | | | |
|---|---|---|---|
| Ground and exposed floors/Cantilevered | 0.1 | $W/m^2.K$ | Based on best judgement on Planning Stage |
| Floor to commercial, corridors and stores | 0.1 | $W/m^2.K$ | Based on best judgement on Planning Stage |

**Walls**

| | | | |
|---|---|---|---|
| External walls | 0.15 | $W/m^2.K$ | Based on best judgement on Planning Stage |
| Walls to unheated corridors, stairs & lifts | 0.24 | $W/m^2.K$ | Based on best judgement on Planning Stage |
| Wall to commercial | 0.15 | $W/m^2.K$ | Based on best judgement on Planning Stage |
| Party walls - unit to unit | Zero heat loss - Fully filled cavity | | Based on best judgement on Planning Stage |

**Roofs / Ceilings**

| | | | |
|---|---|---|---|
| Flat roofs | 0.1 | $W/m^2.K$ | Based on best judgement on Planning Stage |

**Thermal Bridging**

| Junction | Targeted PSI (Ψ) value (W/m.K) | |
|---|---|---|
| | | Based on best judgement on Planning Stage |
| E1/E2 – Lintels | 0.05 | |
| E3 – Sills | 0.04 | |
| E4 – Jambs | 0.04 | |
| E5 – Ground floors | 0.08 | |
| E20/21 – Exposed floors (normal/ inverted) | 0.1 | |
| E22 – Basement floors | 0.1 | |
| E6 – Intermediate floor within dwelling | 0.03 | |
| E7 – Intermediate floor between dwellings | 0.04 | |
| E23 – Balcony where support penetrates wall insulation | 0.1 | |
| E24 – Eaves (ceiling/ rafter) | 0.08 | |
| E12/13 – Gables | 0.05 | |
| E14 – Flat roof | 0.05 | |
| E15 – Flat roof with parapet | 0.1 | |
| E16 – Corner (normal) | 0.045 | |
| E17 - Corner (inverted) | -0.09 | |
| E18/E25 – Party wall (standard/ staggered) | 0.06 | |
| P1 – Ground floors (party wall) | 0.08 | |
| P7/P8 – Exposed floors (party wall) | 0.1 | |
| P4 – Roof (party wall) | 0.1 | |

| | | |
|---|---|---|
| **Y-value (Thermal bridging)** | <0.06 | Based on best judgement on Planning Stage |

### Openings

| | | | |
|---|---|---|---|
| **Flat doors to external or corridors** | 1.0 | $W/m^2.K$ | Based on best judgement on Planning Stage |
| **New windows and glazed doors (pane and frame)** | 1.2 | $W/m^2.K$ | Based on best judgement on Planning Stage |
| Transmittance Factor (g value) | 50 | % | Based on best judgement on Planning Stage |
| Frame Factor | 0.7 | | Based on best judgement on Planning Stage |
| Glazing type | double-glazed low-e with argon filled | | Based on best judgement on Planning Stage |
| Air gap | 12mm | | Based on best judgement on Planning Stage |

### Ventilation

| | | |
|---|---|---|
| **Ventilation** | Mechanical ventilation | Based on best judgement on Planning Stage |
| MVHR to be confirmed | yes | Based on best judgement on Planning Stage |
| Extract fans assumed in kitchens and bathrooms | MVHR assumed | Based on best judgement on Planning Stage |
| Balanced with heat recovery | yes | Based on best judgement on Planning Stage |
| No. of wet rooms (excluding kitchen) | 1 or 2 | Dependant on dwelling layout |
| Insulated ridged ductwork | yes | Based on best judgement on Planning Stage |
| Product name modelled | Nuaire MRXBOX ECO2/ECO3 or similar | Based on best judgement on Planning Stage |

**Air permeability**

| | | | |
|---|---|---|---|
| Design air permeability rate (max) for new build | 3 | $m^3/hm^3$ | Based on best judgement on Planning Stage |

### Heating

**Community heating scheme - ASHP**

| | | | |
|---|---|---|---|
| Heating group | Community heating scheme | | Based on best judgement on Planning Stage |
| Heating type | Community heat pumps | | Based on best judgement on Planning Stage |
| Heating emitter type | Radiators | | Based on best judgement on Planning Stage |
| Heating Controls | Time and temperature zone control | | Based on best judgement on Planning Stage |
| Main heating efficiency - ASHP (SCOP) | 298 | % | Based on Manufacturers' datasheet |
| Heating fuel | electric heat pump | | Based on best judgement on Planning Stage |
| Heat fraction - ASHP | 100 | % | Based on best judgement on Planning Stage |

**Water Heating**

| | | | |
|---|---|---|---|
| From main heating system | Yes | | Based on best judgement on Planning Stage |
| Cylinder volume | 3 | litres | Based on best judgement on Planning Stage |
| Insulation | Factory - 25mm minimum | | Building Control requirement |
| Cylinder in heated space | Yes | | Based on best judgement on Planning Stage |
| Cylinderstat | Yes | | Building Control requirement |
| Primary pipework insulated | Yes | | Building Control requirement |
| Insulated amount | Fully insulated primary pipework | | Based on best judgement on Planning Stage |
| Water heating timed separately | Yes | | Building Control requirement |

### Lighting

| | | | |
|---|---|---|---|
| Low energy lights | 100 | % | Based on best judgement on Planning Stage |

### Domestic water consumption

| | | |
|---|---|---|
| | Yes | London Plan/Part G compliance requirement |

Water consumption in dwellings to be less than 105litres/person/day

## 9_604_Ringers Road SBEM Calculation Assumptions

**20/04/2023**

The figures listed below are assumptions only, based on a combination of best judgement at design stage and information from the design team where appropriate. Throughout the design stage the systems and size of renewable systems are likely to change whilst the building designs are being finalised. All information detailed in this design note is a basic recommendation at the BREEAM and Planning Stage Part L pre-assessment. It should be noted that this document is not exhaustive and the contractor should allow for flexibility on site where necessary.

## Opaque Elements

**U-Values**

| | | |
|---|---|---|
| Ground floor | 0.1 W/m$^2$.K | Based on best judgement on Planning Stage |
| External walls | 0.15 W/m$^2$.K | Based on best judgement on Planning Stage |
| Roofs | 0.1 W/m$^2$.K | Based on best judgement on Planning Stage |

## Openings

**Windows / Glazed doors**

| | | |
|---|---|---|
| U-Value | 1.2 W/m$^2$.K | Based on best judgement on Planning Stage |
| Transmittance Factor (g value) | 40 % | Based on best judgement on Planning Stage |
| Frame Factor | 20 % | Based on best judgement on Planning Stage |
| Addition of blinds in the glazing construction to reduce cooling | Internal-White-Medium translucent-Trasnmission factor 0.3 | Based on best judgement on Planning Stage |

## Ventilation

Supply and extract

| | | |
|---|---|---|
| MVHR assumed | Yes | Based on best judgement on Planning Stage |
| Specific Fan Power | 0.8 W/l/s | Based on best judgement on Planning Stage |

Extract only (WC, kitchens, etc)

| | | |
|---|---|---|
| MVHR assumed | No | |
| Specific Fan Power | 0.4 W/l/s | Based on best judgement on Planning Stage |

**Heat Recovery**

| | | |
|---|---|---|
| Heat Recovery assumed | Yes | Based on best judgement on Planning Stage |
| Type | Plate heat exchanger | Based on best judgement on Planning Stage |
| Efficiency | 0.8 | Based on best judgement on Planning Stage |

**Air permeability**

| | | |
|---|---|---|
| Design air permeability rate | 3 m$^3$/hm$^2$ | Based on best judgement on Planning Stage |

## Heating/ DHW

**Electric ASHP**

| | | |
|---|---|---|
| HVAC system type | Split or multi-split system | |
| Seasonal efficiency | | |
| Seasonal EER / Nominal EER in cooling mode | 6.0/6.0 | Based on best judgement on Planning Stage |
| Seasonal COP / Nominal COP in heating mode | 2.98 | Based on best judgement on Planning Stage |

**System Controls (proposed)**

| | | |
|---|---|---|
| Central time control | no | Based on best judgement on Planning Stage |
| Optimum start/stop control | no | Based on best judgement on Planning Stage |
| Local time control (i.e. room by room) | yes | Based on best judgement on Planning Stage |
| Local temperature control (i.e. room by room) | yes | Based on best judgement on Planning Stage |
| Weather compensation control | no | Based on best judgement on Planning Stage |

**Hot Water**

Electric

| | | |
|---|---|---|
| DHW Generator type | Heat Pump | Based on best judgement on Planning Stage |
| Meter: | Electricity | |
| Generator seasonal | Default 1.0 | |

## Ductwork and metering (proposed)

Ductwork and AHU leakage

| | | |
|---|---|---|
| Ductwork leakage tested? | Yes | Based on best judgement on Planning Stage |
| CEN classification | Class D | Based on best judgement on Planning Stage |
| AHU meets CEN leakage standards? | Yes | Based on best judgement on Planning Stage |
| CEN classification | Class L1 | Based on best judgement on Planning Stage |

**Metering provision**

| | | |
|---|---|---|
| The system has provision for metering | Yes | Based on best judgement on Planning Stage |
| The metering warns "out of range" values | Yes | Based on best judgement on Planning Stage |

## Lighting and lighting controls

**Proposed**

| | | |
|---|---|---|
| Lamp efficacy | 120 lm/cW | Based on best judgement on Planning Stage |
| Light Output Ratio LED Lighting | 1.00 | Based on best judgement on Planning Stage |
| Display Lighting Efficiency | 100 lm/W | Based on best judgement on Planning Stage |
| Photoelectric lighting control (addressable) | Yes, where feasible | Based on best judgement on Planning Stage |
| Occupancy Sensing | Yes, where feasible | Based on best judgement on Planning Stage |
| Parasitic Power | 0.05 W/m$^2$ | Based on best judgement on Planning Stage |

## Renewable Technologies

| | | |
|---|---|---|
| Total PV output | 24.13 kWp | Based on best judgement on Planning Stage |
| PV efficiency | 19 % | Based on best judgement on Planning Stage |
| No. of panels | 83 | Based on best judgement on Planning Stage |
| Tilt of Collector/ orientation | South | Based on best judgement on Planning Stage |
| Overshading | No | Based on best judgement on Planning Stage |

# APPENDIX F – GLA CARBON EMISSION REPORTING SPREADSHEET

# Part L 2021 Performance

## Residential

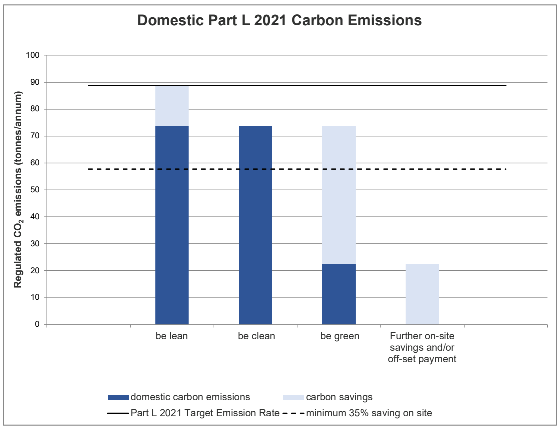
**Table 1:** Carbon Dioxide Emissions after each stage of the Energy Hierarchy for residential buildings

| | Carbon Dioxide Emissions for residential buildings (Tonnes CO$_2$ per annum) | |
|---|---|---|
| | Regulated | Unregulated |
| Baseline: Part L 2021 of the Building Regulations Compliant Development | 88.8 | 54.1 |
| After energy demand reduction (be lean) | 73.8 | 54.1 |
| After heat network connection (be clean) | 73.8 | 54.1 |
| After renewable energy (be green) | 22.6 | 54.1 |

**Table 2:** Regulated Carbon Dioxide savings from each stage of the Energy Hierarchy for residential buildings

| | Regulated residential carbon dioxide savings | |
|---|---|---|
| | (Tonnes CO$_2$ per annum) | (%) |
| Be lean: savings from energy demand reduction | 15.0 | 17% |
| Be clean: savings from heat network | 0.0 | 0% |
| Be green: savings from renewable energy | 51.2 | 58% |
| **Cumulative on site savings** | **66.2** | **75%** |
| Annual savings from off-set payment | 22.6 | - |
| | (Tonnes CO$_2$) | |
| **Cumulative savings for off-set payment** | **678** | - |
| **Cash in-lieu contribution (£)** | **64,398** | |

*carbon price is based on GLA recommended price of £95 per tonne of carbon dioxide unless Local Planning Authority price is inputted in the 'Development Information' tab



Domestic Part L 2021 Carbon Emissions

## Non-residential

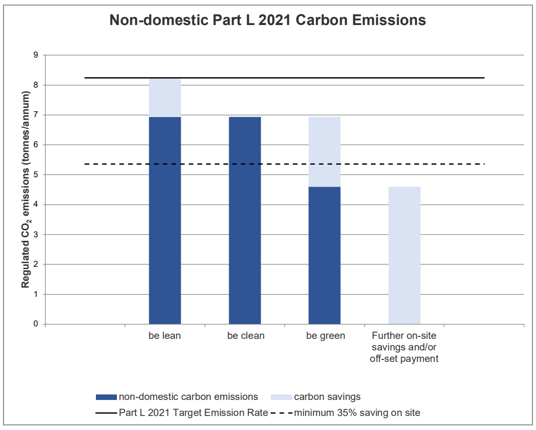
**Table 3:** Carbon Dioxide Emissions after each stage of the Energy Hierarchy for non-residential buildings

| | Carbon Dioxide Emissions for non-residential buildings (Tonnes CO$_2$ per annum) | |
|---|---|---|
| | Regulated | Unregulated |
| Baseline: Part L 2021 of the Building Regulations Compliant Development | 8.2 | 6.1 |
| After energy demand reduction (be lean) | 6.9 | 6.1 |
| After heat network connection (be clean) | 6.9 | 6.1 |
| After renewable energy (be green) | 4.6 | 6.1 |

**Table 4:** Regulated Carbon Dioxide savings from each stage of the Energy Hierarchy for non-residential buildings

| | Regulated non-residential carbon dioxide savings | |
|---|---|---|
| | (Tonnes CO$_2$ per annum) | (%) |
| Be lean: savings from energy demand reduction | 1.3 | 16% |
| Be clean: savings from heat network | 0.0 | 0% |
| Be green: savings from renewable energy | 2.3 | 28% |
| **Total Cumulative Savings** | **3.6** | **44%** |
| Annual savings from off-set payment | 4.6 | - |
| | (Tonnes CO$_2$) | |
| **Cumulative savings for off-set payment** | **138** | - |
| **Cash in-lieu contribution (£)** | **13,095** | |

*carbon price is based on GLA recommended price of £95 per tonne of carbon dioxide unless Local Planning Authority price is inputted in the 'Development Information' tab



Non-domestic Part L 2021 Carbon Emissions

## SITE-WIDE

| | Total regulated emissions (Tonnes CO$_2$ / year) | CO$_2$ savings (Tonnes CO$_2$ / year) | Percentage savings (%) |
|---|---|---|---|
| Part L 2021 baseline | 97.0 | | |
| Be lean | 80.8 | 16.3 | 17% |
| Be clean | 80.8 | 0.0 | 0% |
| Be green | 27.2 | 53.6 | 55% |
| Total Savings | - | 69.8 | 72% |
| | - | CO$_2$ savings off-set (Tonnes CO$_2$) | - |
| Off-set | - | **815.7** | - |

| | Target Fabric Energy Efficiency (kWh/m²) | Dwelling Fabric Energy Efficiency (kWh/m²) | Improvement (%) |
|---|---|---|---|
| **Development total** | 35.87 | 35.30 | 2% |

| | Area weighted non-residential cooling demand (MJ/m$^2$) | Total non-residential cooling demand (MJ/year) |
|---|---|---|
| **Actual** | 113.8 | 64080.78 |
| **Notional** | 181 | 101921.1 |

# APPENDIX G – BE SEEN SPREADSHEET

MAYOR OF LONDON

## OVERALL PROGRESS 100%

| | | |
|---|---|---|
| CURRENT REPORTING STAGE - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - >> | Planning | * |

## CONTEXTUAL DATA

*Progress: 100%*

+ ORGANISATION & CONTACT DETAILS

### ORGANISATION DETAILS

| | | |
|---|---|---|
| Organisation Name | Substantia Group | * |
| Organisation Address | 38 Shad Thames, Butler Wharf, London, SE1 2YD | * |

### CONTACT DETAILS

| | | |
|---|---|---|
| Contact Name | Terry Pullen | * |
| Email | terry@sub-group.com | * |
| Additional Email(s) | | |
| Telephone No. | 020-3770-1788 | * |
| Mobile No. | | |

+ DEVELOPMENT INFORMATION

### OVERALL DEVELOPMENT DETAILS

| | | |
|---|---|---|
| Planning Reference Number | N/A | * |
| Name of Whole Development | Ringers Road | * |

### DEVELOPMENT LOCATION

| | | | |
|---|---|---|---|
| **Development Address** | | | |
| Address Line 1 | | Ringers Road | * |
| Address Line 2 | | | |
| Address Line 3 | | | |
| Address Line 4 | | | |
| London Borough | | Bromley | * |
| Postcode | | BR1 1HT | * |
| **Ordnance Survey Reference** | | | |
| Development UPRN (if available) | | N/A | |
| **Geo-Location Coordinates** | | | |
| Latitude (to 6 decimal places) | *Please add if available ->* | | |
| Longitude (to 6 decimal places, +ve or -ve) | *Please add if available ->* | | |

### DEVELOPMENT TOTAL AREA BREAKDOWN

| | | | |
|---|---|---|---|
| **Residential** | | | |
| Total Residential Floor Area | GIA m2 | 5,664 | * |
| Dwelling Counts | | | |
| Flats | number | 94 | * |
| House | number | 0 | * |
| **Non-Residential** | | | |
| Non-Residential Floor Area Breakdown | | *Please include complete non-resi details below* | |
| Landlord Circulation (in Residential Blocks) | GIA m2 | | * |
| General office (A2, B1, B8, D1 planning classes) | GIA m2 | 410 | * |
| High street agency (A2 planning classes) | GIA m2 | | * |
| General retail (A1, SG planning classes) | GIA m2 | | * |
| Large non-food shop (A1 planning classes) | GIA m2 | | * |
| Small food store | GIA m2 | | * |
| Large food store | GIA m2 | | * |
| Restaurant (A3, A5 planning classes) | GIA m2 | 153 | * |
| Bar, pub or licensed club (A4 planning classes) | GIA m2 | | * |
| Hotel (C1 planning classes) | GIA m2 | | * |
| Cultural Activities | GIA m2 | | * |
| Entertainment halls (D2 planning classes) | GIA m2 | | * |
| Swimming pool centre | GIA m2 | | * |
| Fitness and health centre | GIA m2 | | * |
| Dry sports and leisure facility (D2 planning classes) | GIA m2 | | * |
| Covered car park | GIA m2 | | * |
| Public buildings with light usage (D1, SG planning class | GIA m2 | | * |
| Schools and seasonal public buildings (D1, D2 planning | GIA m2 | | * |
| University campus | GIA m2 | | * |
| Clinic (D1 planning classes) | GIA m2 | | * |
| Hospital (clinical and research) | GIA m2 | | * |
| Long term residential (C1, C2, C2A planning classes) | GIA m2 | | * |
| General accommodation (C1, C2, C3 planning classes) | GIA m2 | | * |
| Emergency services (SG planning classes) | GIA m2 | | * |
| Laboratory or operating theatre | GIA m2 | | * |
| Public waiting or circulation (SG planning classes) | GIA m2 | | * |
| Terminal (B8 planning classes) | GIA m2 | | * |
| Workshop (B1, B2 planning classes) | GIA m2 | | * |
| Storage Facility (B8 planning classes) | GIA m2 | | * |
| Cold Storage (B8 planning classes) | GIA m2 | | * |

**Overall Development Summary**

| | | | |
|---|---|---|---|
| Total Development Floor Area | | | |
| Residential | GIA m2 | 5,664 | |
| Non-Residential | GIA m2 | 563 | |
| Total | GIA m2 | 6,227 | |
| Total Non-Residential Uses | | General office; Restaurant | |

\+ SUPPLEMENTARY FILES AND UPCOMING REPORTING STAGES

SUPPLEMENTARY FILES

| | | |
|---|---|---|
| **Site Plan** | | |
| Does the development have a site plan? | Yes | * |
| What is the site plan filename? | 18.085.100.04 - Proposed site plan - Ground Floor | * |
| **Best Practice Documents** | | |
| Does the development have a predicted DEC? | No | * |
| Is there a base building energy rating (in line with DFP)? | No | * |

ANTICIPATED DATES FOR UPCOMING REPORTING STAGES

| | | |
|---|---|---|
| As-Built Stage | NA | * |
| Operational Year 1 End | NA | * |

## DEVELOPMENT PERFORMANCE AND EMISSIONS

*Progress: 100%*

\+ DEVELOPMENT PERFORMANCE

DEVELOPMENT OVERALL PREDICTED PERFORMANCE

| | | | |
|---|---|---|---|
| **Predicted Performance Calculation Details** | | | |
| Fuel Carbon Intensity Source (aligned with planning energy statement | | SAP 10.0 | * |
| **Residential Elements of the development** | | | |
| Predicted Annual Energy Use | | *Fill in all applicable fuels below* | |
| Annual Electricity Use | kWh/yr | 403,667 | * |
| Annual Gas Use | kWh/yr | 0 | * |
| Annual Oil Use (if applicable) | kWh/yr | 0 | * |
| Annual Biomass Use (if applicable) | kWh/yr | 0 | * |
| Annual District Htg Use (if applicable) | kWh/yr | 0 | * |
| Annual District Clg Use (if applicable) | kWh/yr | 0 | * |
| Elec Generation, Gross (if applicable) | kWh/yr | 0 | * |
| Solar Thermal Generation (if applicable) | kWh/yr | 0 | * |
| Predicted Annual Carbon Emissions | tCO2/yr | 23 | * |
| **Non-Residential Elements of the development (Part L Calculation)** | | | |
| Predicted Annual Energy Use | | *Fill in all applicable fuels below* | |
| Annual Electricity Use | kWh/yr | 56,430 | * |
| Annual Gas Use | kWh/yr | 0 | * |
| Annual Oil Use (if applicable) | kWh/yr | 0 | * |
| Annual Biomass Use (if applicable) | kWh/yr | 0 | * |
| Annual District Htg Use (if applicable) | kWh/yr | 0 | * |
| Annual District Clg Use (if applicable) | kWh/yr | 0 | * |
| Elec Generation, Gross (if applicable) | kWh/yr | 17,850 | * |
| Solar Thermal Generation (if applicable) | kWh/yr | 0 | * |
| Predicted Annual Carbon Emissions | tCO2/yr | 11 | * |
| **Non-Residential Elements of the development (TM54 Calculation)** | | | |
| Predicted Annual Energy Use | | *Fill in all applicable fuels below* | |
| Annual Electricity Use | kWh/yr | 0 | * |
| Annual Gas Use | kWh/yr | 0 | * |
| Annual Oil Use (if applicable) | kWh/yr | 0 | * |
| Annual Biomass Use (if applicable) | kWh/yr | 0 | * |
| Annual District Htg Use (if applicable) | kWh/yr | 0 | * |
| Annual District Clg Use (if applicable) | kWh/yr | 0 | * |
| Elec Generation, Gross (if applicable) | kWh/yr | 0 | * |
| Solar Thermal Generation (if applicable) | kWh/yr | 0 | * |
| Predicted Annual Carbon Emissions | tCO2/yr | 0 | * |

CARBON OFFSETTING

| | | | |
|---|---|---|---|
| Predicted Carbon Shortfall (aligned with planning energy st | tCO2 | 816 | * |
| Total Committed Carbon Offset | £ | 77,520 | * |

**END**

# APPENDIX H – COUNCIL CORRESPONDENCE

**Jack Sewell**

---

**From:** Nowak-John, Agnieszka <Agnieszka.Nowak-John@bromley.gov.uk>
**Sent:** 20 May 2022 10:36
**To:** Mark Batchelor
**Cc:** Kostas Mastronikolaou
**Subject:** RE: Ringers Road

Hi Mark,

I'm good thank you, I hope all is well at your end also.

The Policy officer commenting on energy and sustainability matters considers that this can be dealt with through email.

In terms of the question whether there are any existing or planned networks in the vicinity, which are feasible to connect to, we can confirm that at the time of writing, the only existing energy centre is at Bromley South in the St Mark's Square development.

Other recent major applications have not been permitted so, it is not believed that there are any opportunities closer to this site. That does not mean to say that this particular proposal could not include an energy centre itself.

For info, as part of the new local plan work, our Policy Team might be undertaking some helpful feasibility work on this subject – not just in Bromley.

I am aware I owe you comments from UD officer, but unfortunately I am still waiting. I think it is a good time to discuss an EoT as the statutory deadline is approaching fast and there are outstanding matters.

Thanks

Aggie

Agnieszka Nowak-John
Principal Planner
Development Management – Major Developments
**Housing, Planning and Regeneration Services**
**Bromley Council, Civic Centre, Stockwell Close, Bromley BR1 3UH**
**020 8313 4747**
Agnieszka.Nowak-John@bromley.gov.uk
**www.bromley.gov.uk**

---

**From:** Mark Batchelor <MarkBatchelor@boyerplanning.co.uk>
**Sent:** 19 May 2022 22:07
**To:** Nowak-John, Agnieszka <Agnieszka.Nowak-John@bromley.gov.uk>
**Cc:** Kostas Mastronikolaou <kostasm@xco2.com>
**Subject:** Ringers Road

Hi Aggie,

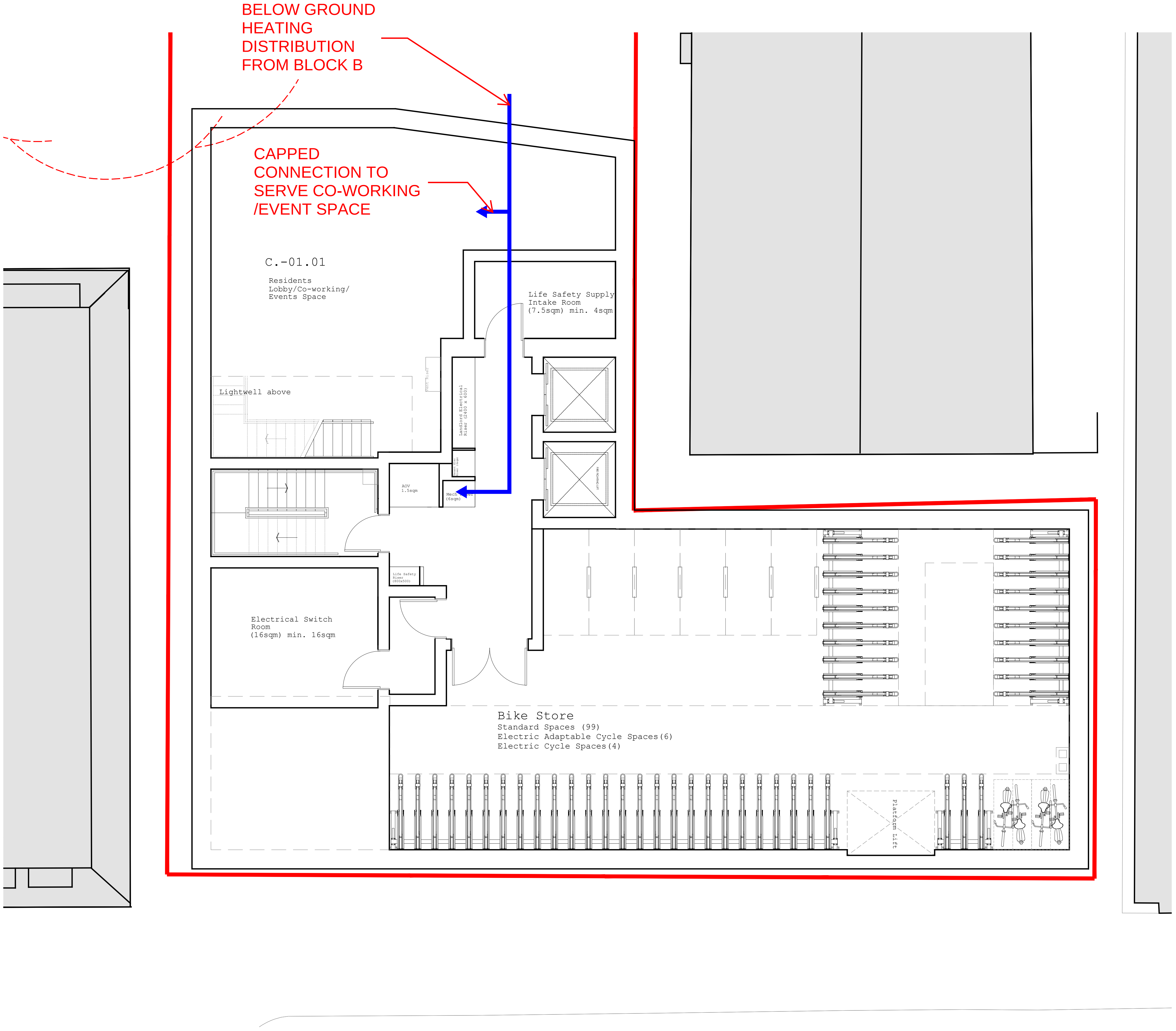
Hope you are well?

We’re looking at the GLA’s energy comments and note the need for dialogue with your energy advisor around district heating, etc. I don’t have their details, are you able to put them in touch with Kostas (copied) who’s handling matters for us?

Many thanks
Mark.
**Mark Batchelor**
Director

T 0203 268 2434
M07970 889 220
L linkedin.com/boyer
Wboyerplanning.co.uk
A 24 Southwark Bridge Road, London, SE1 9HF

# APPENDIX I – MEP LAYOUTS DETAILING DHN CONNECTION AND ROUTE



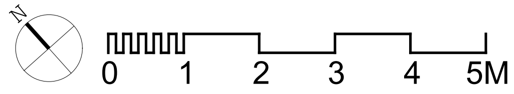
🟥 Site Boundary

▭ Removed Trees

| | |
|---|---|
| XCO2 | Job No 9677 MVD/TG<br>Dwg No 9604-SK-M&E-02<br>Date 20/07/2021 |

Job Title Ringer's Road

Dwg Title MEP Risers & Plant Room Spatial Planning



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T +44 (0)1303 260 515 | **E** kent@hollawaystudio.co.uk | **W** www.hollawaystudio.co.uk

**Project** | Ringers Road
Bromley

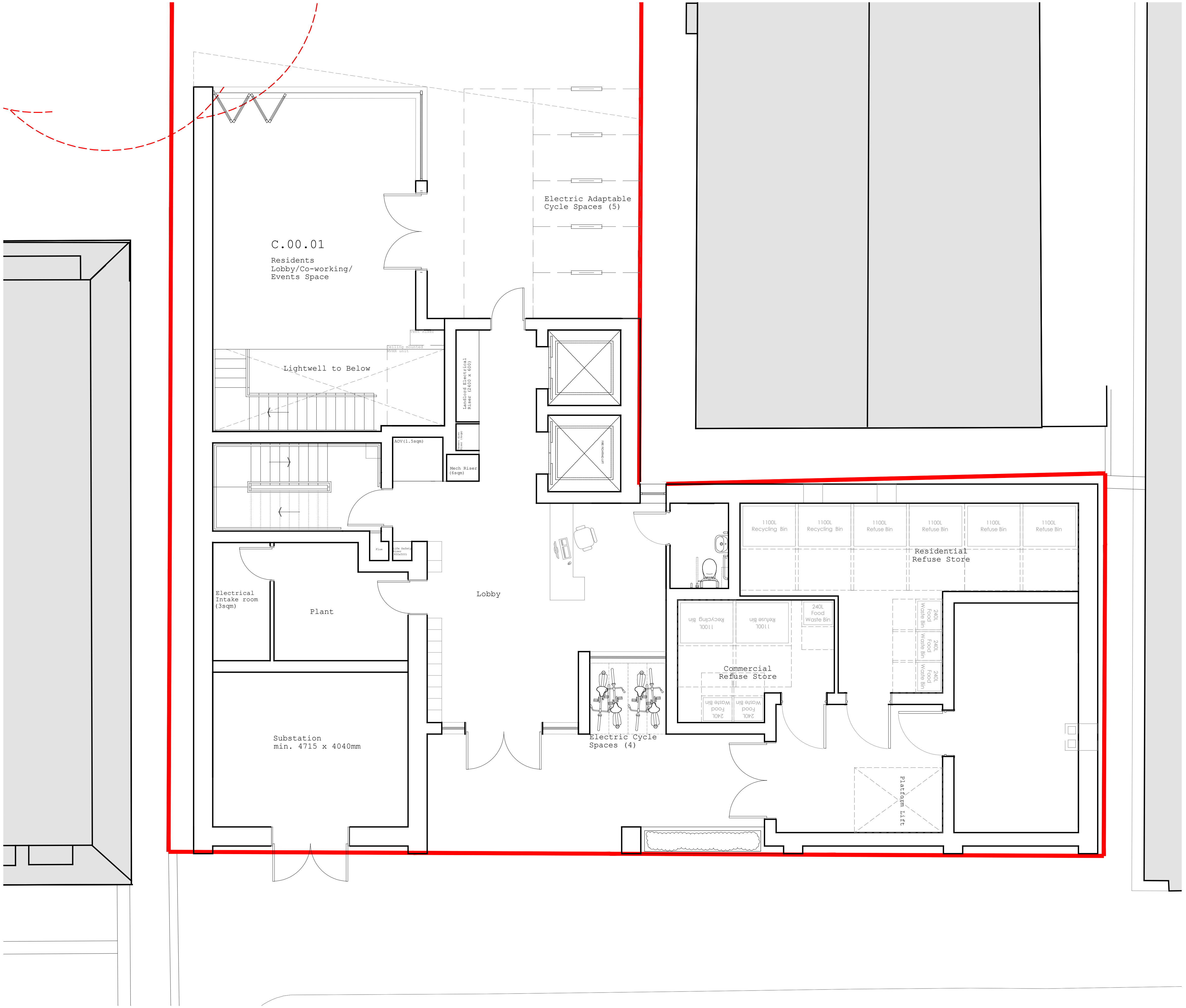
**Client** | The Substantia Group

**Title** | Proposed Lower Ground Floor - Block A

**Status** | PRELIMINARY

**Scale@A3** | 1:100 **Date** | 11.12.20 **Drawn** GG | **Chk'd** LG |

| Project Number | Drawing Number | Revision |
|---|---|---|
| 18.085 | 200.00 | R1 |



🟥 Site Boundary

⬚ Removed Trees

**XCO2**

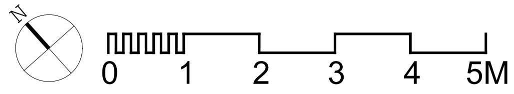
Job No 9677 MVD/TG

Dwg No 9604-SK-M&E-02

Date 20/07/2021

Job Title Ringer's Road

Dwg Title MEP Risers & Plant Room Spatial Planning



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**Project** | Ringers Road
Bromley

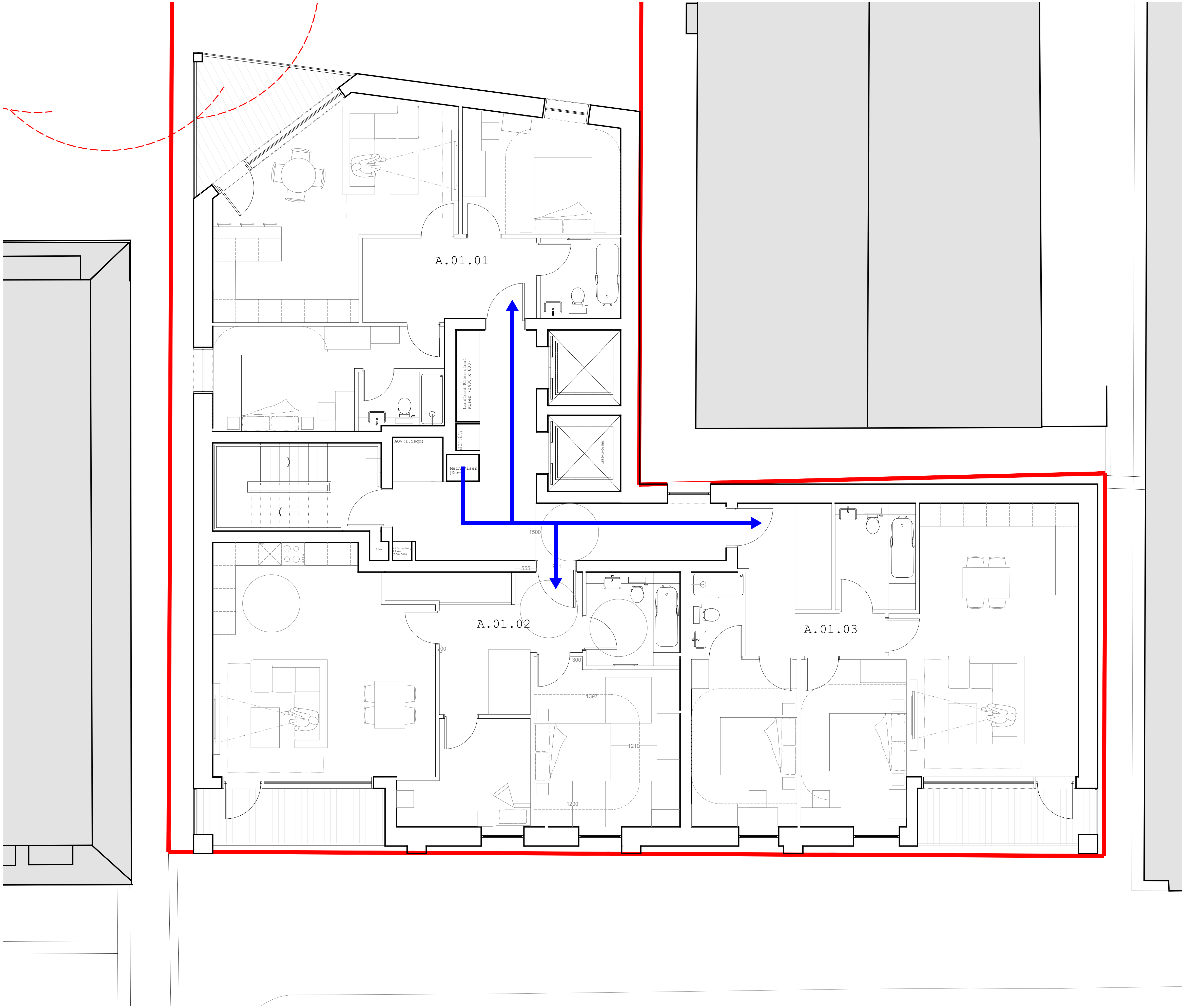
**Client** | The Substantia Group

**Title** | Proposed Ground Floor - Block A

**Status** | PRELIMINARY

**Scale@A3** | 1:100 **Date** | 11.12.20 **Drawn** GG | **Chk'd** LC |

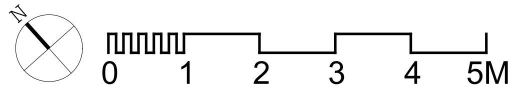
Project Number 18.085
Drawing Number 200.01
Revision R1



□ Site Boundary

⬚ Removed Trees

Job No 9677 MVD/TG
Dwg No 9604-SK-M&E-02
Date 20/07/2021
Job Title Ringer's Road
Dwg Title MEP Risers & Plant Room Spatial Planning



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**Project** | Ringers Road
Bromley

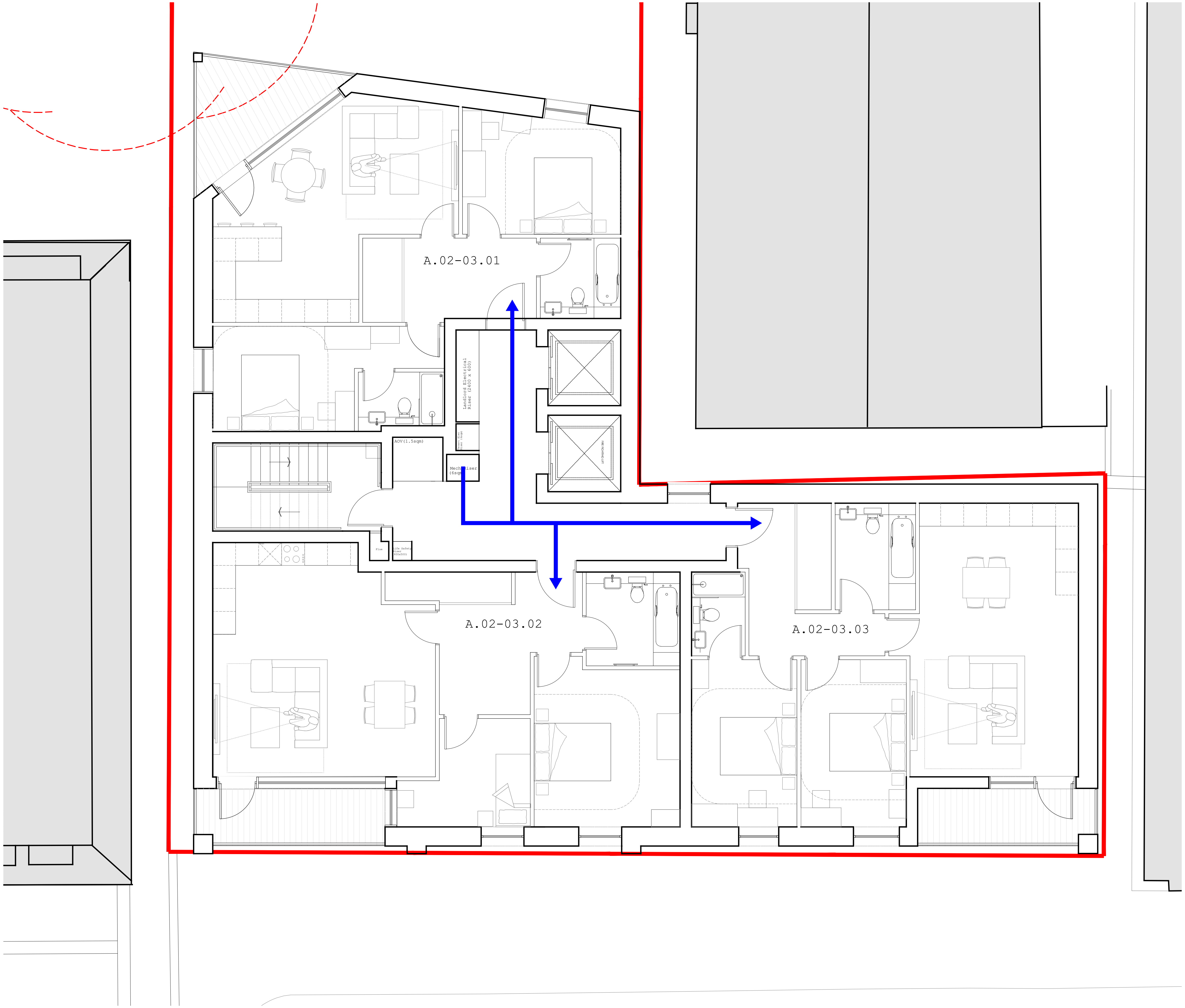
**Client** | The Substantia Group

**Title** | Proposed 1st Floor - Block A

**Status** | PRELIMINARY

**Scale@A3** | 1:100 **Date** | 11.12.20 **Drawn** GG| **Chk'd** LC |

Project Number 18.085
Drawing Number 200.02
Revision R1



🟥 Site Boundary

⬚ Removed Trees

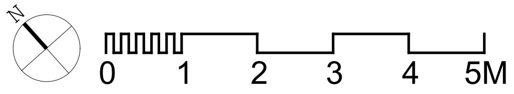
Job No 9677 MVD/TG

Dwg No 9604-SK-M&E-02

Date 20/07/2021

Job Title Ringer's Road

Dwg Title MEP Risers & Plant Room Spatial Planning



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**Project** | Ringers Road
Bromley

**Client** | The Substantia Group

**Title** | Proposed 2nd-3rd Floors - Block A

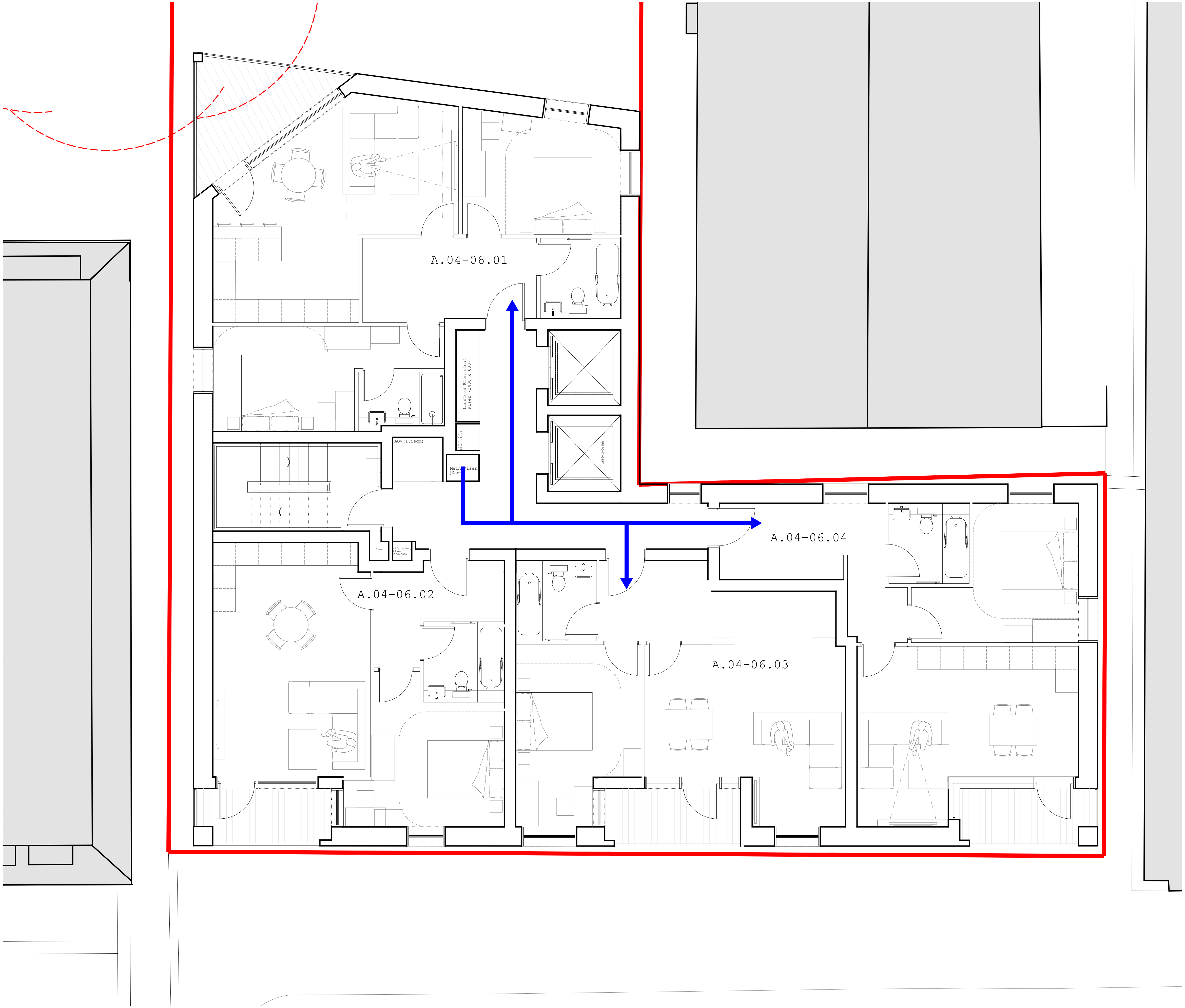
**Status** | PRELIMINARY

**Scale@A3** | 1:100 **Date** | 11.12.20 **Drawn** GG | **Chk'd** LC |

Project Number 18.085

Drawing Number 200.03

Revision R1



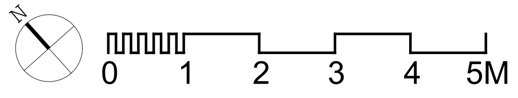
🟥 Site Boundary

⬚ Removed Trees

XCO2

Job No 9677 MVD/TG
Dwg No 9604-SK-M&E-02
Date 20/07/2021

Job Title Ringer's Road
Dwg Title MEP Risers & Plant Room Spatial Planning



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**Project** | Ringers Road
Bromley

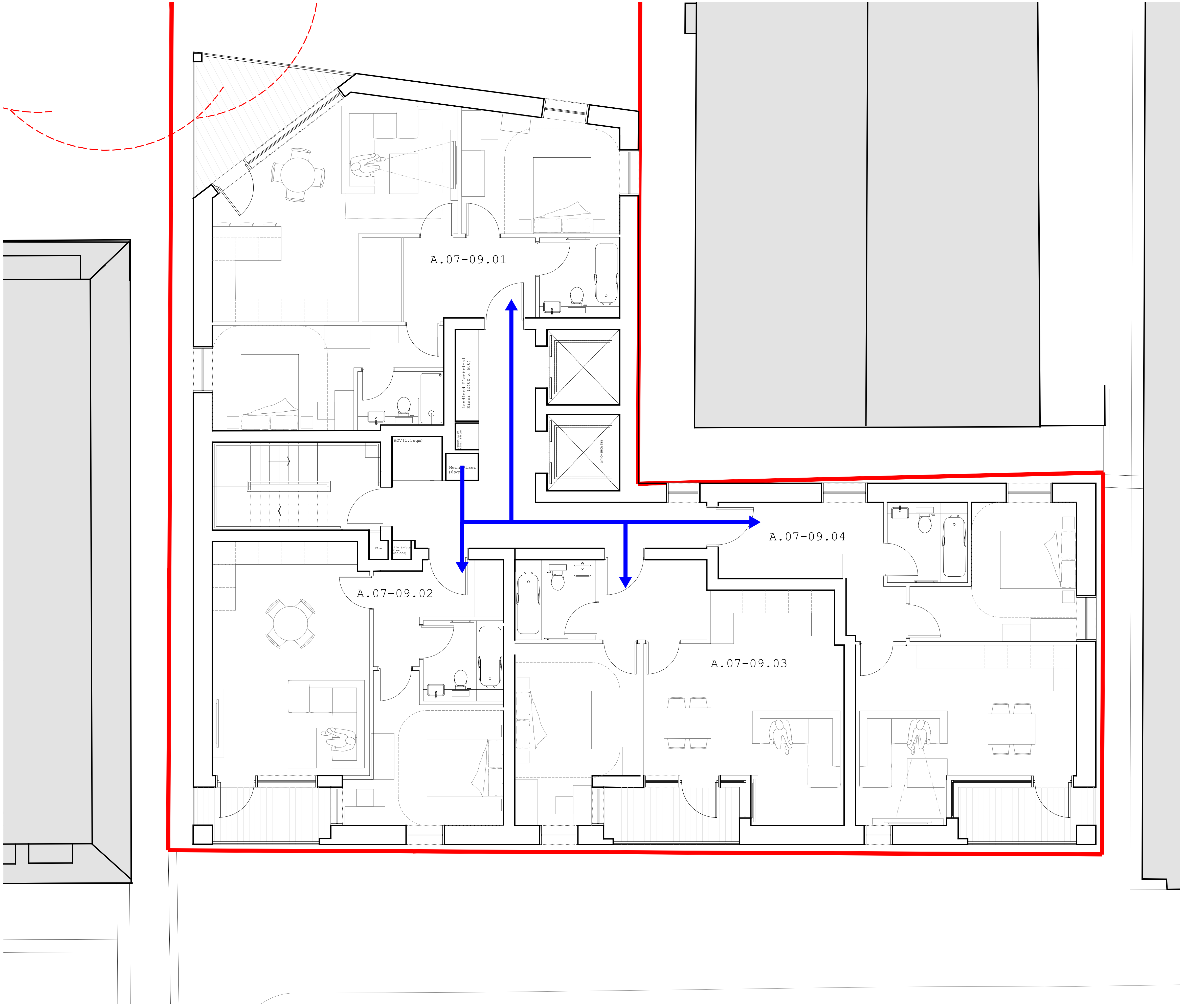
**Client** | The Substantia Group

**Title** | Proposed 4th-6th Floors - Block A

**Status** | PRELIMINARY

**Scale@A3** | 1:100 **Date** | 11.12.20 **Drawn** GG | **Chk'd** LC |

Project Number 18.085
Drawing Number 200.04
Revision R1



🟥 Site Boundary

⬚ Removed Trees

| | |
|---|---|
| XCO2 | Job No 9677 MVD/TG<br>Dwg No 9604-SK-M&E-02<br>Date 20/07/2021 |
| Job Title Ringer's Road<br>Dwg Title MEP Risers & Plant Room Spatial Planning | |

N

0 1 2 3 4 5M

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**Project** | Ringers Road
Bromley

**Client** | The Substantia Group

**Title** | Proposed 7th-9th Floors - Block A

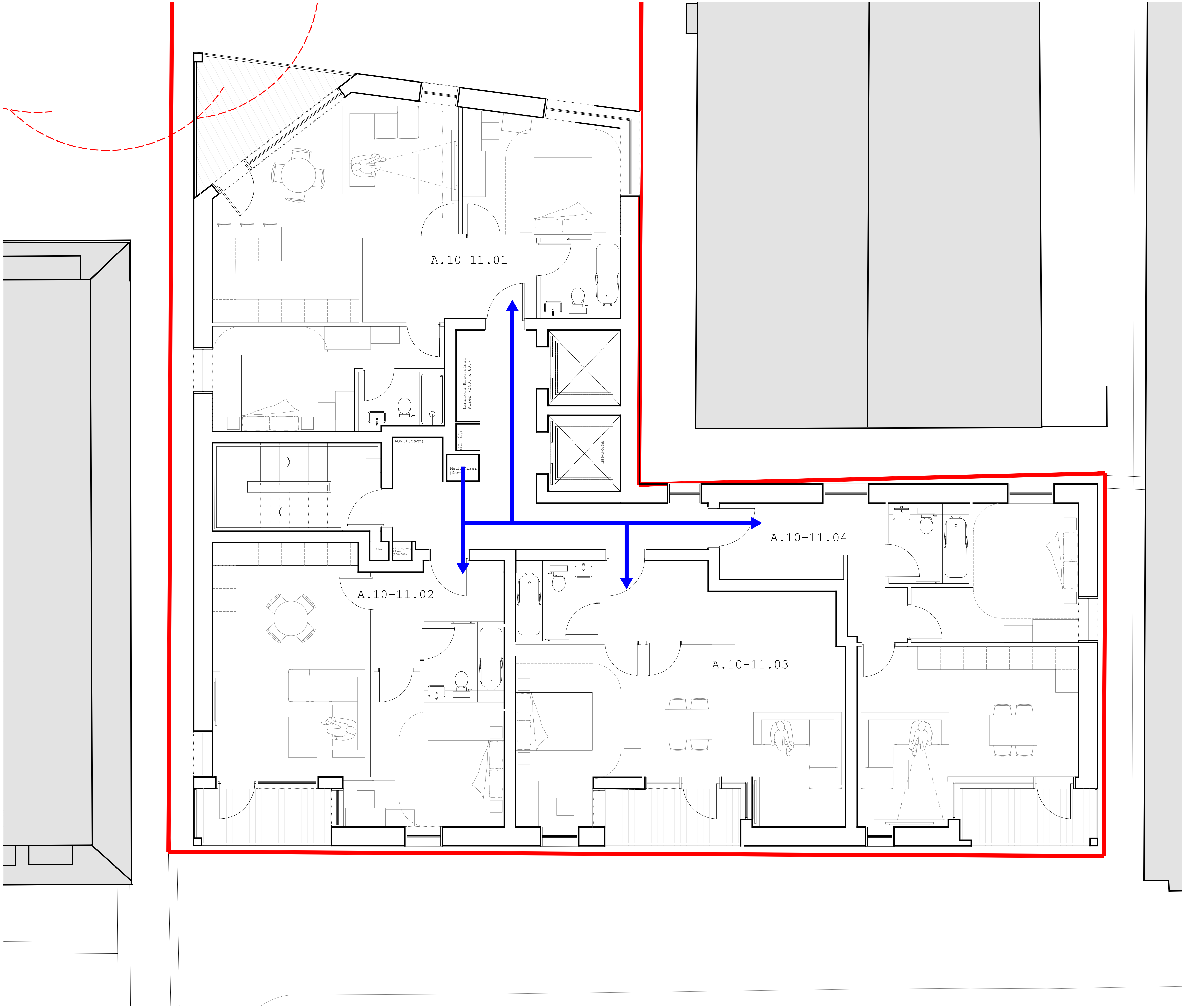
**Status** | PRELIMINARY

**Scale@A3** | 1:100 **Date** | 11.12.20 **Drawn** GG | **Chk'd** LC |

Project Number
18.085

Drawing Number
200.05

Revision
R1



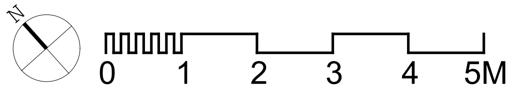
🟥 Site Boundary

▭ Removed Trees

XCO2

Job No 9677 MVD/TG
Dwg No 9604-SK-M&E-02
Date 20/07/2021

Job Title Ringer's Road
Dwg Title MEP Risers & Plant Room Spatial Planning



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**Project** | Ringers Road
Bromley

**Client** | The Substantia Group

**Title** | Proposed 10th-11th Floors - Block A

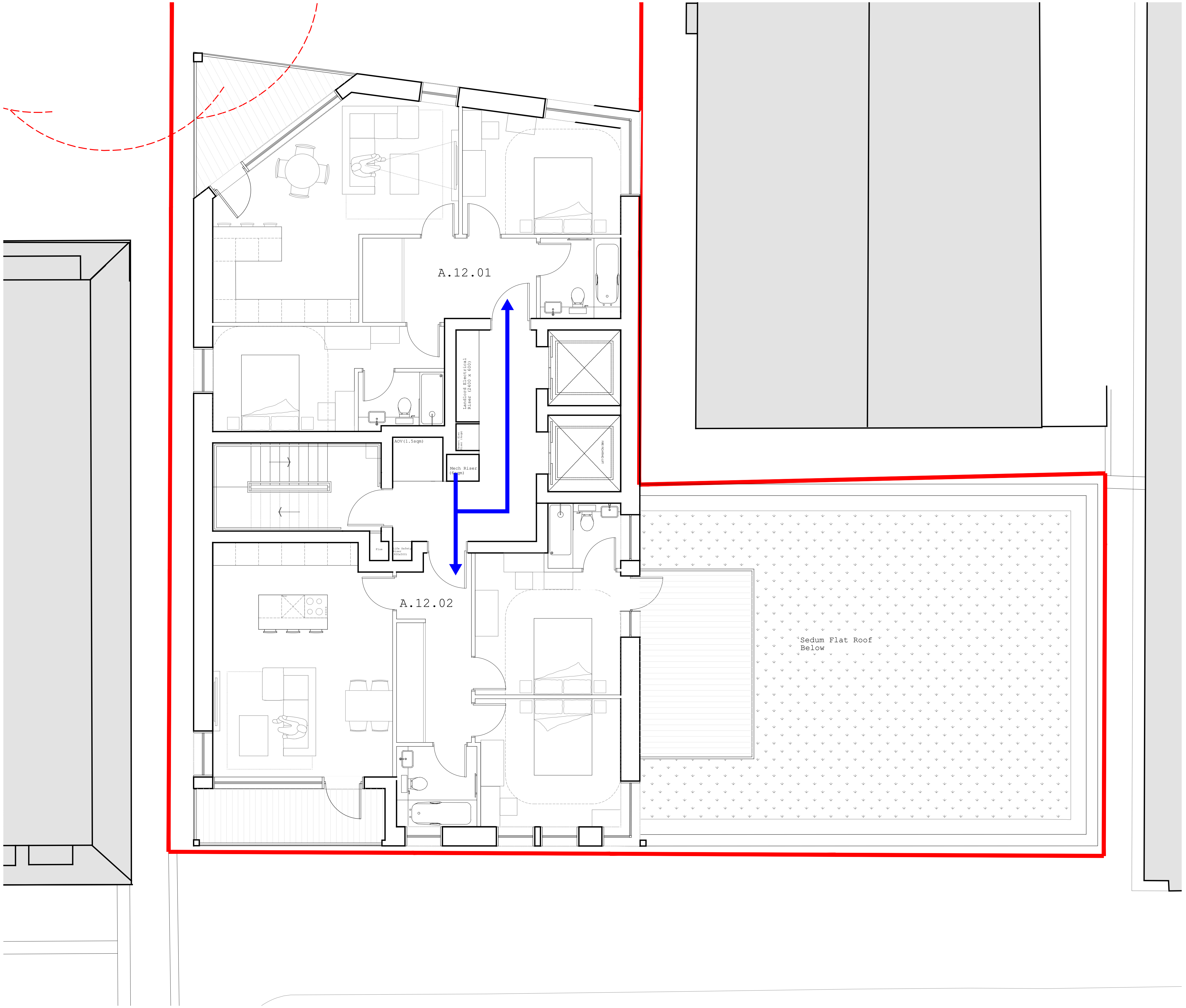
**Status** | PRELIMINARY

**Scale@A3** | 1:100 **Date** | 11.12.20 **Drawn** GG **Chk'd** LC |

Project Number
18.085

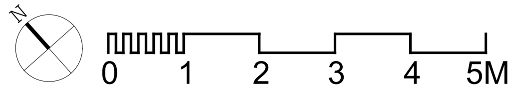
Drawing Number
200.06

Revision
R1



🟥 Site Boundary

⬚ Removed Trees



XCO2

Job No 9677 MVD/TG
Dwg No 9604-SK-M&E-02
Date 20/07/2021

Job Title Ringer's Road
Dwg Title MEP Risers & Plant Room Spatial Planning

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**Project** | Ringers Road
Bromley

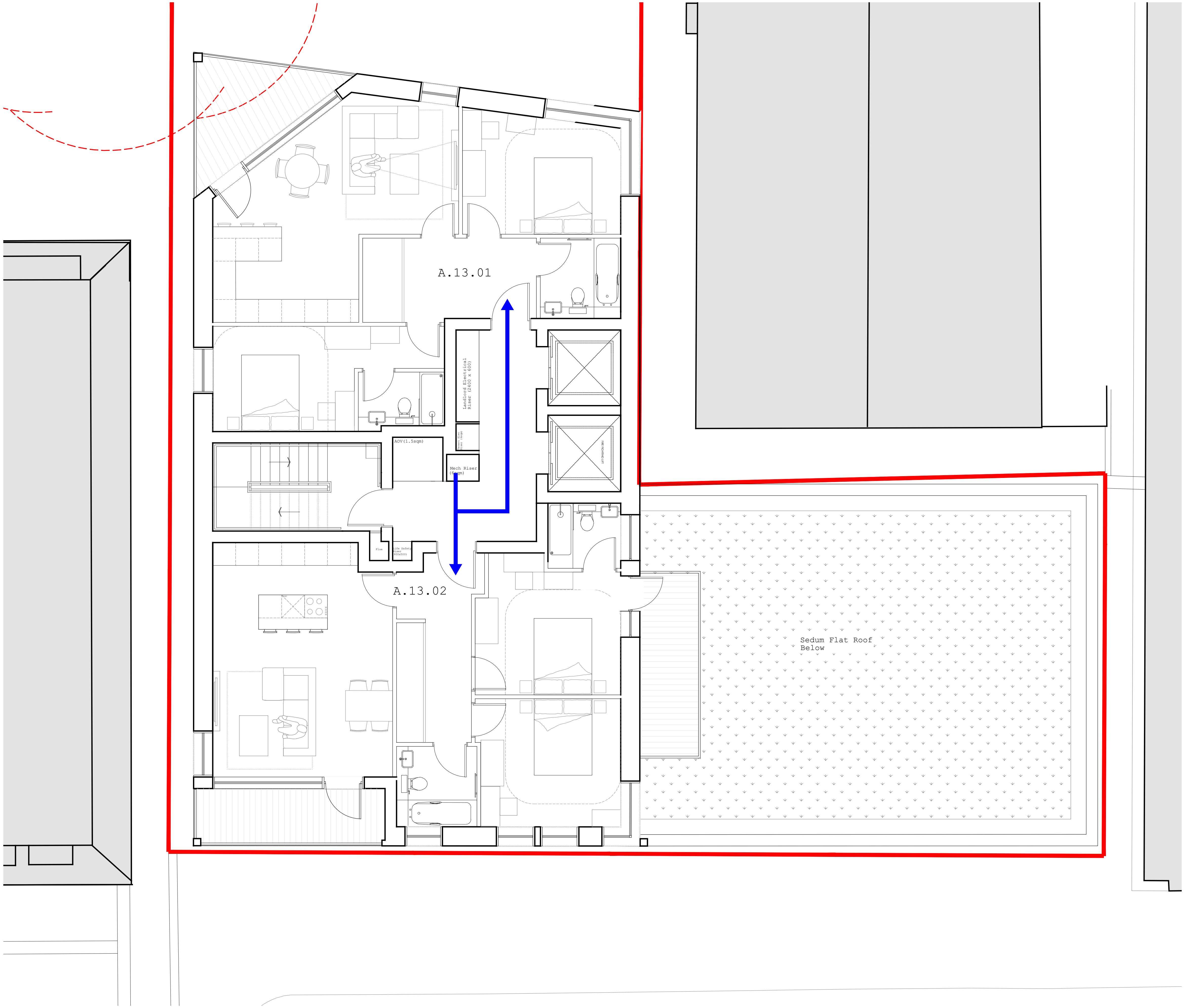
**Client** | The Substantia Group

**Title** | Proposed 12th Floor - Block A

**Status** | PRELIMINARY

**Scale@A3** | 1:100 **Date** | 11.12.20 **Drawn** GG | **Chk'd** LG |

Project Number 18.085
Drawing Number 200.07
Revision R1



🟥 Site Boundary

⬚ Removed Trees

XCO2

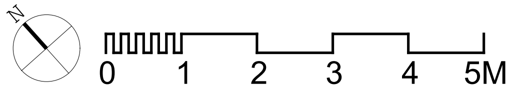
Job No 9677 MVD/TG

Dwg No 9604-SK-M&E-02

Date 20/07/2021

Job Title Ringer's Road

Dwg Title MEP Risers & Plant Room Spatial Planning



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T +44 (0)1303 260 515 | **E** kent@hollawaystudio.co.uk | **W** www.hollawaystudio.co.uk

**Project** | Ringers Road
Bromley

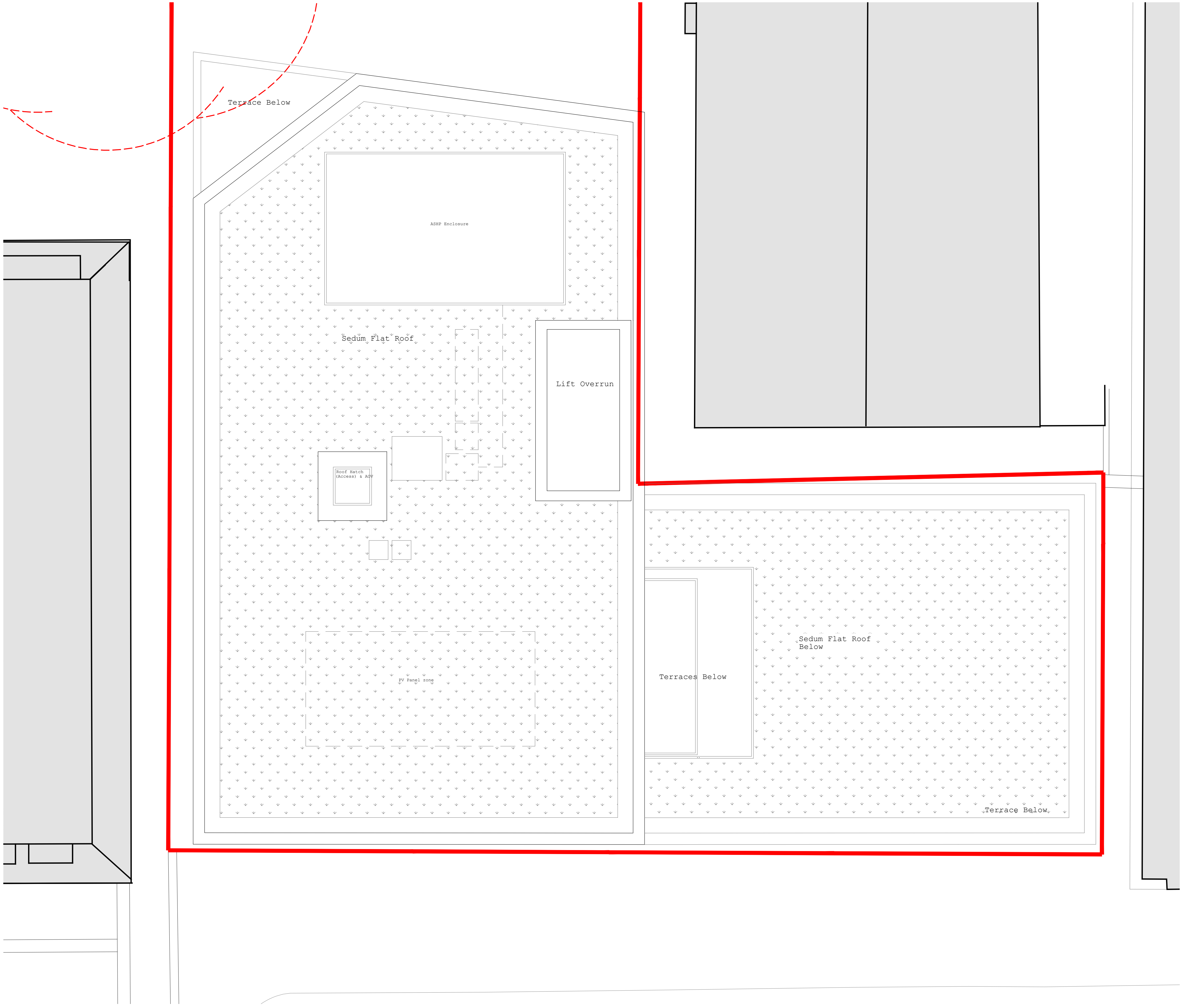
**Client** | The Substantia Group

**Title** | Proposed 13th Floor - Block A

**Status** | PRELIMINARY

**Scale@A3** | 1:100 **Date** | 11.12.20 **Drawn** GG | **Chk'd** LC |

Project Number 18.085 Drawing Number 200.08 Revision R1



🟥 Site Boundary

⬚ Removed Trees

XCO2

Job No 9677 MVD/TG
Dwg No 9604-SK-M&E-02
Date 20/07/2021
Job Title Ringer's Road
Dwg Title MEP Risers & Plant Room Spatial Planning

N

0 1 2 3 4 5M

**Hollaway**

**London** | 10a Acton Street | London | WC1X 9NG
T +44 (0) 20 7096 5425 | **E** london@hollawaystudio.co.uk | **W** www.hollawaystudio.co.uk

**Kent** | The Tramway Stables | Rampart Road | Hythe | Kent | CT21 5BG
T +44 (0)1303 260 515 | **E** kent@hollawaystudio.co.uk | **W** www.hollawaystudio.co.uk

**Project** | Ringers Road
Bromley

**Client** | The Substantia Group

**Title** | Proposed Roof Plan - Block A

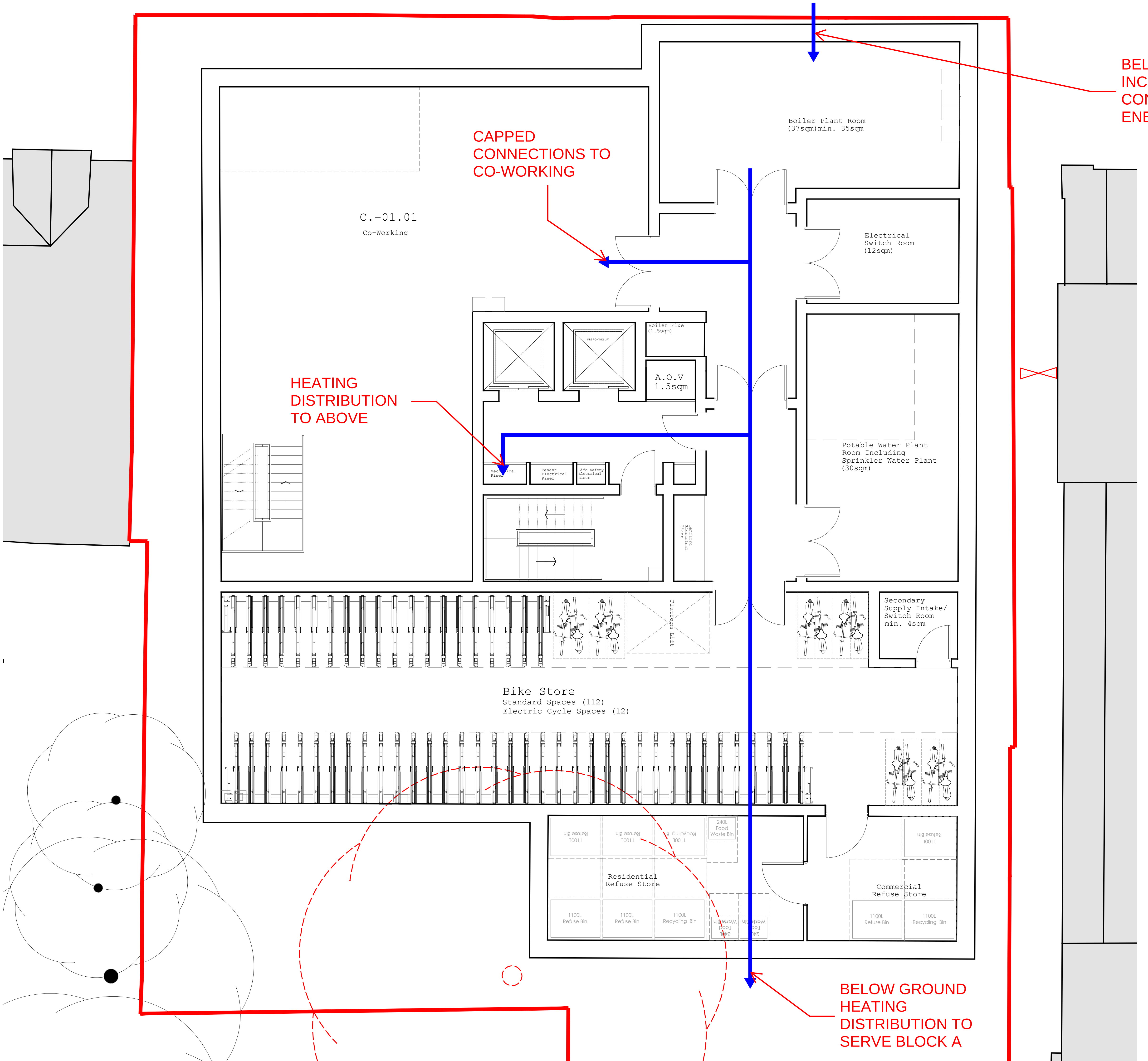
**Status** | PRELIMINARY

**Scale@A3** | 1:100 **Date** | 11.12.20 **Drawn** GG | **Chk'd** LC |

Project Number
18.085

Drawing Number
200.09

Revision
R1



BELOW GROUND
INCOMING DHN
CONNECTIONS TO
ENERGY CENTRE

CAPPED
CONNECTIONS TO
CO-WORKING

HEATING
DISTRIBUTION
TO ABOVE

BELOW GROUND
HEATING
DISTRIBUTION TO
SERVE BLOCK A

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T +44 (0) 20 7096 5425 | **E** london@hollawaystudio.co.uk | **W** www.hollawaystudio.co.uk

**Kent** | The Tramway Stables | Rampart Road | Hythe | Kent | CT21 5BG
T +44 (0)1303 260 515 | **E** kent@hollawaystudio.co.uk | **W** www.hollawaystudio.co.uk

**Project** | Ringers Road
Bromley

**Client** | The Substantia Group

**Title** | Proposed Lower Ground Floor - Block B

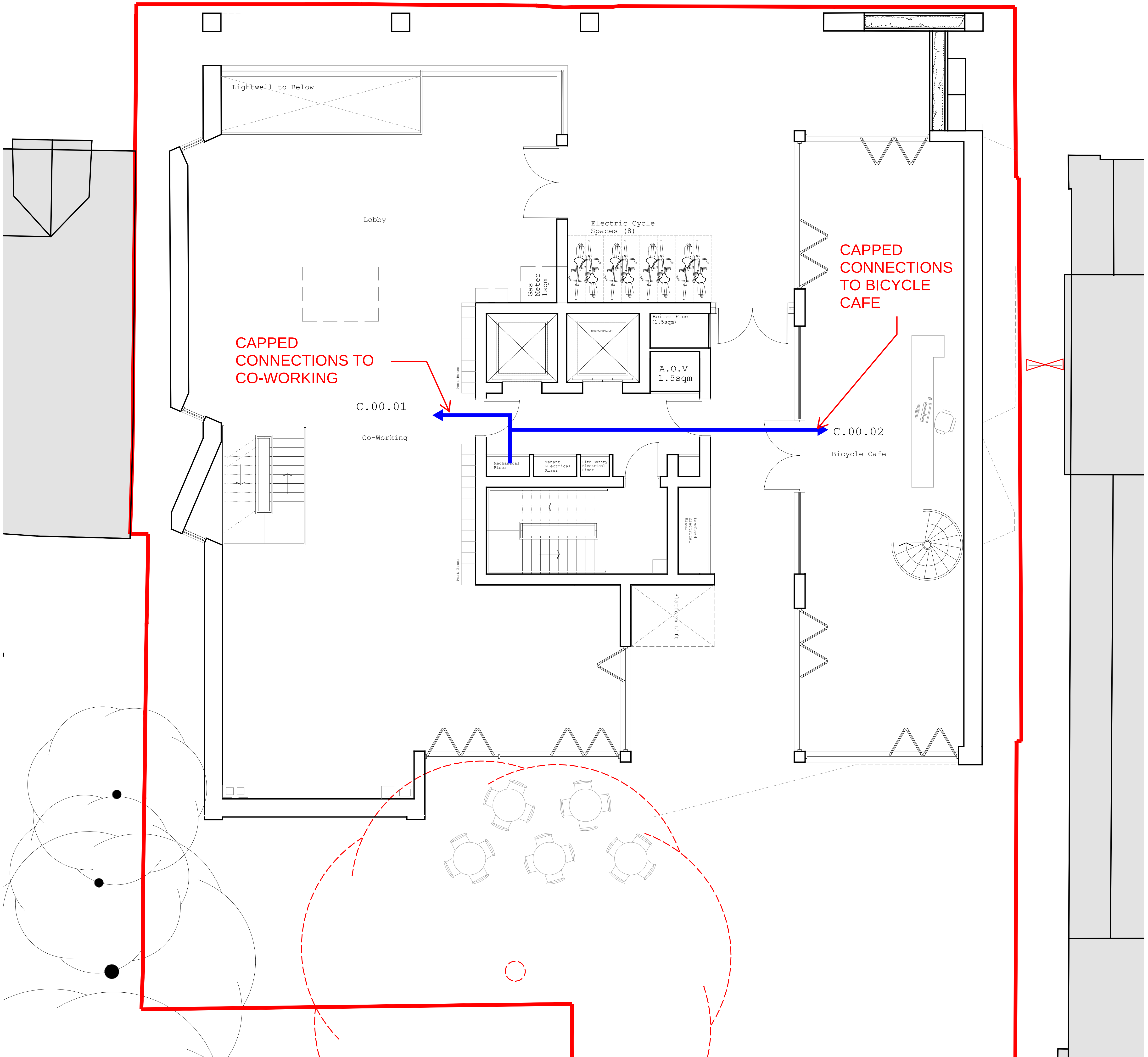
**Status** | PRELIMINARY

**Scale@A3** | 1:100 **Date** | 13.01.21 **Drawn** | GG **Chk'd** | LC

Project Number
18.085

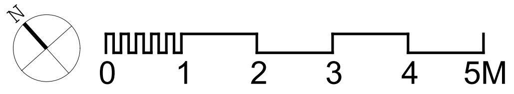
Drawing Number
210.00

Revision
R1



🟥 Site Boundary

⬚ Removed Trees



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T +44 (0) 20 7096 5425 | **E** london@hollawaystudio.co.uk | **W** www.hollawaystudio.co.uk

**Kent** | The Tramway Stables | Rampart Road | Hythe | Kent | CT21 5BG
T +44 (0)1303 260 515 | **E** kent@hollawaystudio.co.uk | **W** www.hollawaystudio.co.uk

**Project** | Ringers Road
Bromley

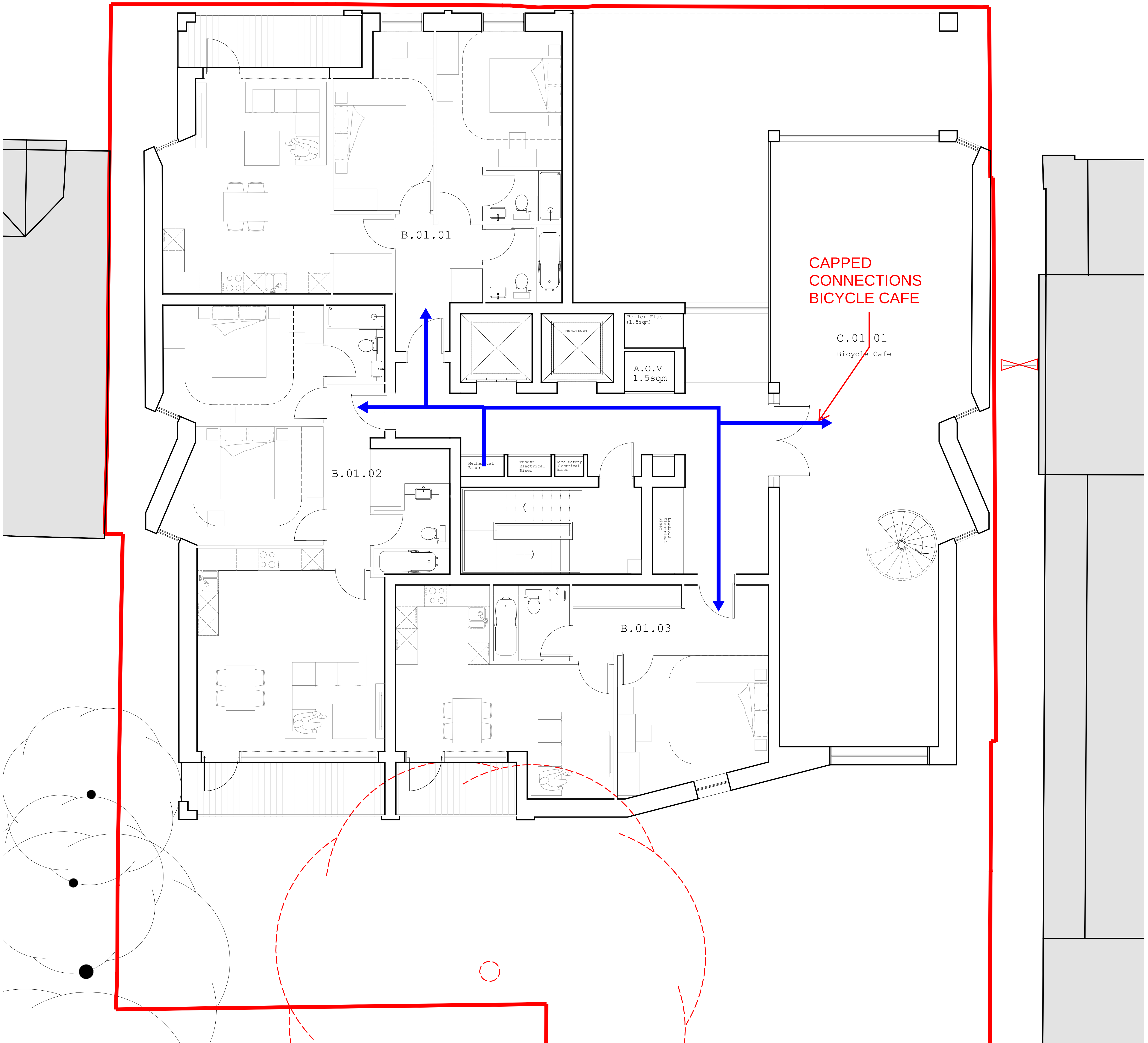
**Client** | The Substantia Group

**Title** | Proposed Ground Floor - Block B

**Status** | PRELIMINARY

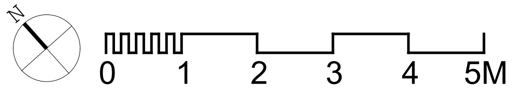
**Scale@A3** | 1:100 **Date** | 13.01.21 **Drawn** | GG **Chk'd** | LC

| Project Number | Drawing Number | Revision |
|---|---|---|
| 18.085 | 210.01 | R1 |



🟥 Site Boundary

▭ Removed Trees



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**London** | 10a Acton Street | London | WC1X 9NG
T +44 (0) 20 7096 5425 | **E** london@hollawaystudio.co.uk | **W** www.hollawaystudio.co.uk

**Kent** | The Tramway Stables | Rampart Road | Hythe | Kent | CT21 5BG
T +44 (0)1303 260 515 | **E** kent@hollawaystudio.co.uk | **W** www.hollawaystudio.co.uk

**Project** | Ringers Road
Bromley

**Client** | The Substantia Group

**Title** | Proposed First Floor - Block B

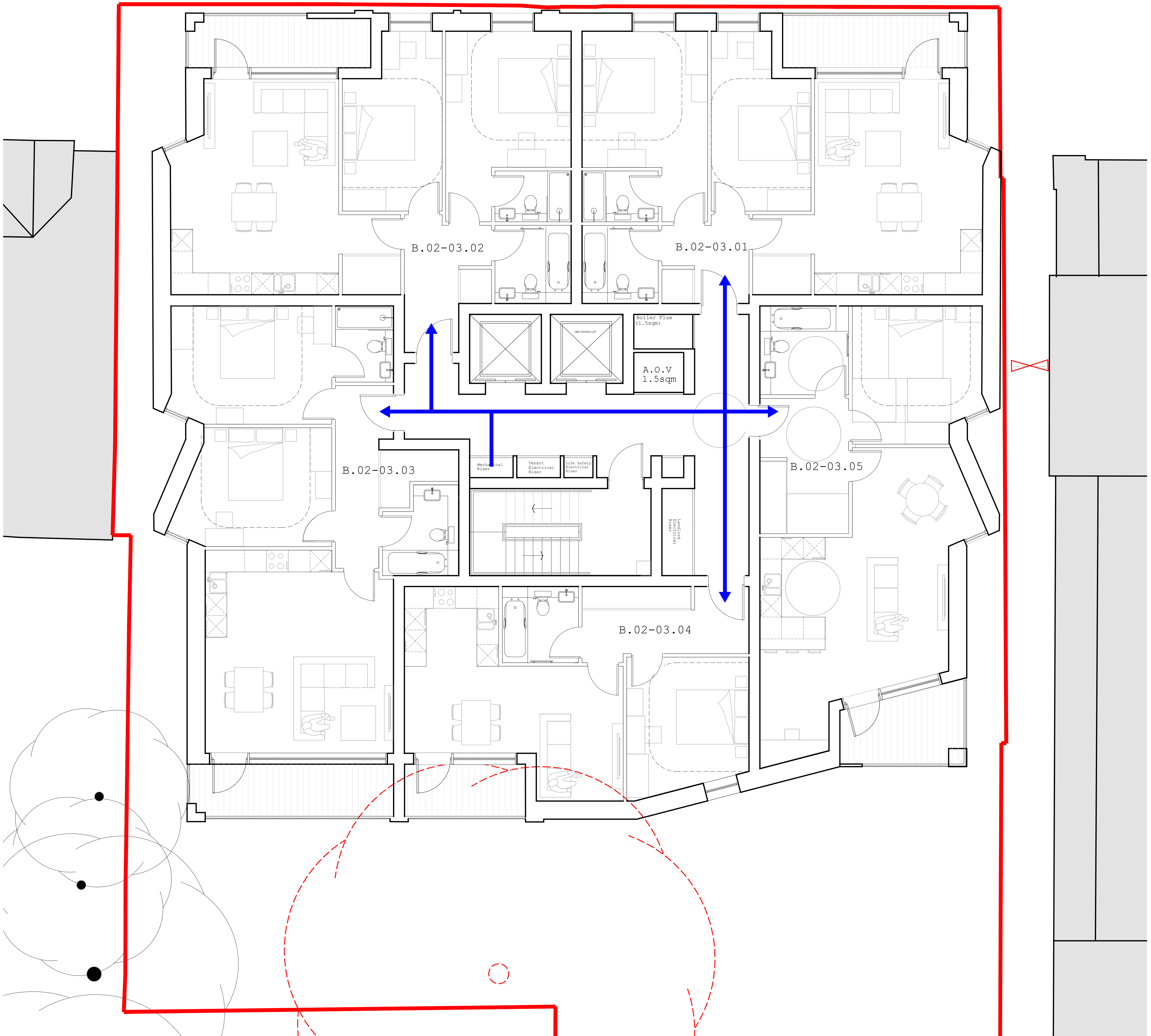
**Status** | PRELIMINARY

**Scale@A3** | 1:100 **Date** | 21.05.20 **Drawn** | GG **Chk'd** | LC

Project Number
18.085

Drawing Number
210.02

Revision
R1



🟥 Site Boundary

⬚ Removed Trees

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T +44 (0) 20 7096 5425 | **E** london@hollawaystudio.co.uk | **W** www.hollawaystudio.co.uk

**Kent** | The Tramway Stables | Rampart Road | Hythe | Kent | CT21 5BG
T +44 (0)1303 260 515 | **E** kent@hollawaystudio.co.uk | **W** www.hollawaystudio.co.uk

**Project** | Ringers Road
Bromley

**Client** | The Substantia Group

**Title** | Proposed 2nd-3rdFloors - Block B

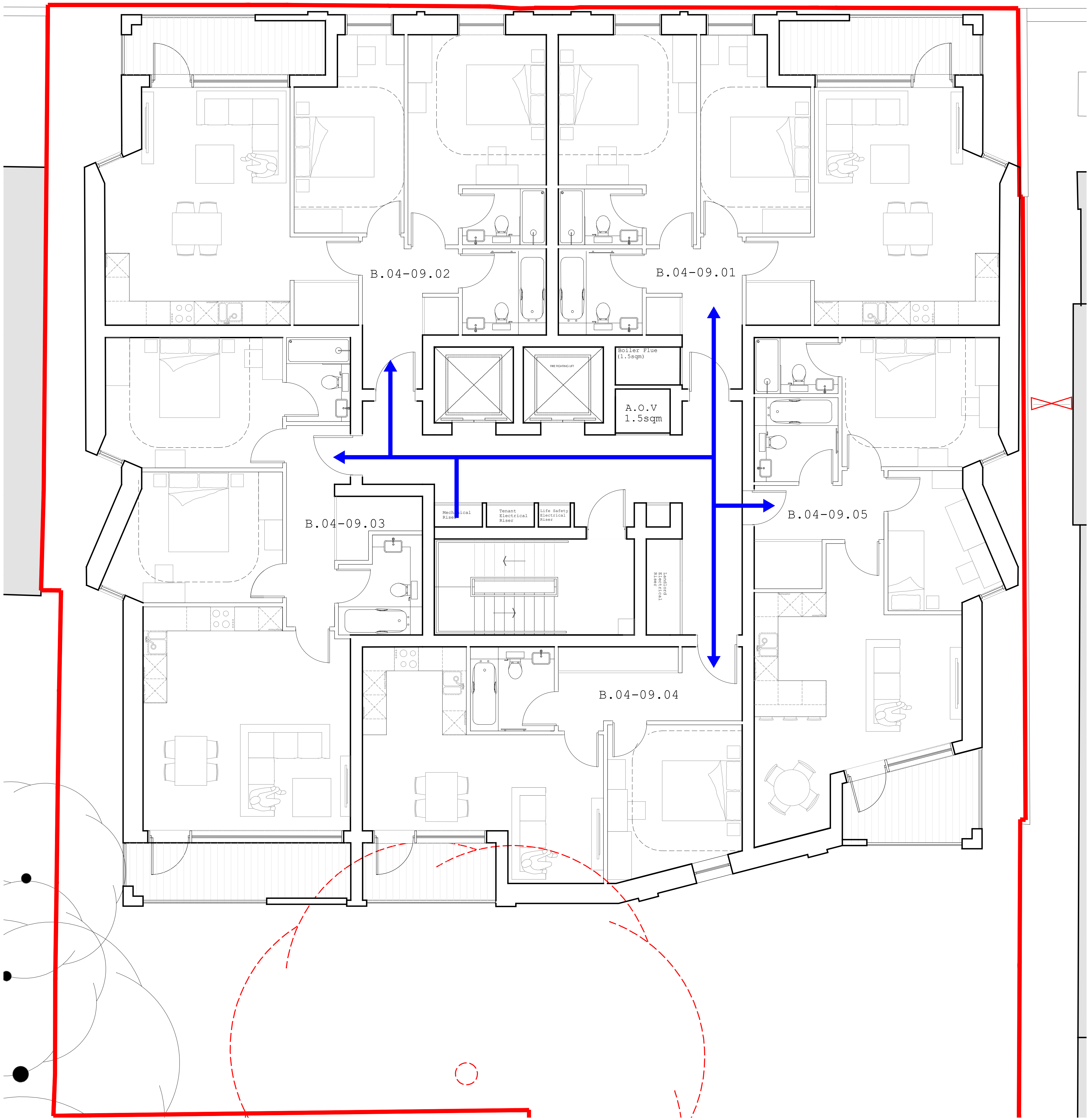
**Status** | PRELIMINARY

**Scale@A3** | 1:100 **Date** | 13.01.21 **Drawn** | GG **Chk'd** | LC

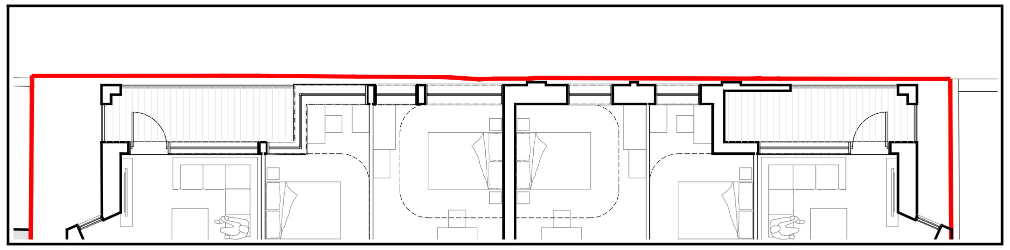
Project Number
18.085

Drawing Number
210.03

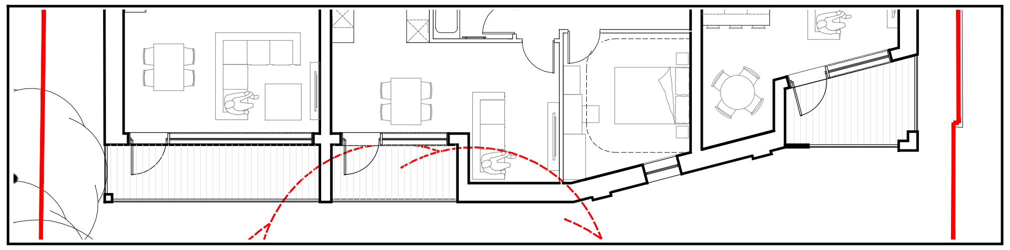
Revision
R1

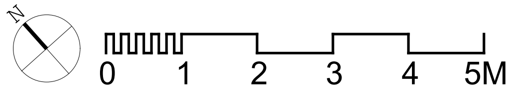


Floor 8-9 North Elevation Changes 1:200@A3



Floor 7-9 South Elevation Changes 1:200@A3





Site Boundary

Removed Trees

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**London** | 10a Acton Street | London | WC1X 9NG
T +44 (0) 20 7096 5425 | **E** london@hollawaystudio.co.uk | **W** www.hollawaystudio.co.uk

**Kent** | The Tramway Stables | Rampart Road | Hythe | Kent | CT21 5BG
T +44 (0)1303 260 515 | **E** kent@hollawaystudio.co.uk | **W** www.hollawaystudio.co.uk

**Project** | Ringers Road
Bromley

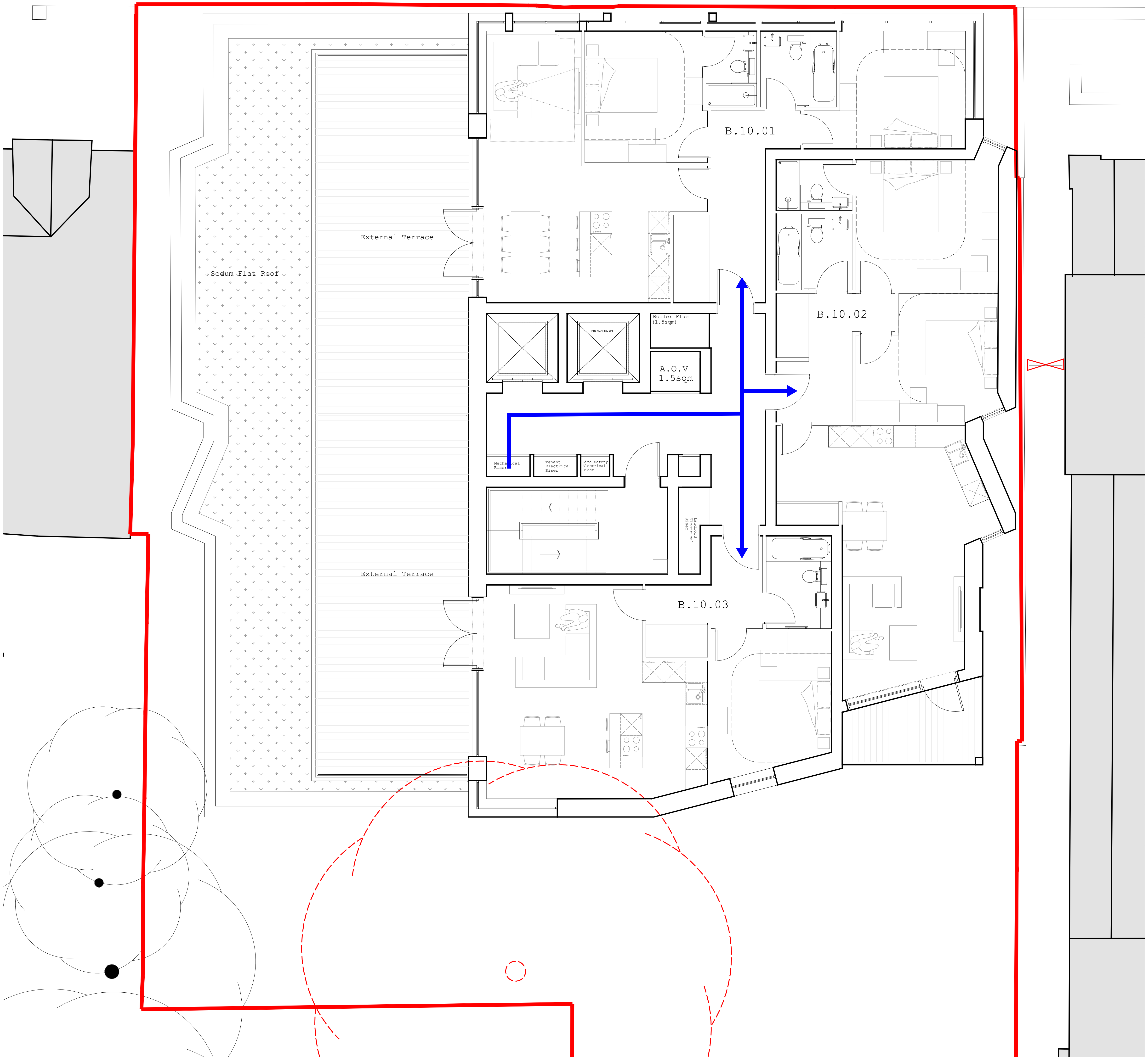
**Client** | The Substantia Group

**Title** | Proposed 4th-9th Floors - Block B

**Status** | PRELIMINARY

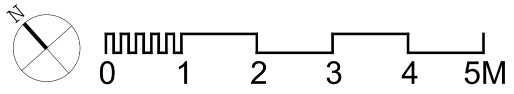
**Scale@A3** | 1:100 **Date** | 13.01.21 **Drawn** | GG **Chk'd** | LC

| Project Number | Drawing Number | Revision |
|---|---|---|
| 18.085 | 210.04 | R1 |



🟥 Site Boundary

⬚ Removed Trees



**Hollaway**

**London** | 10a Acton Street | London | WC1X 9NG
T +44 (0) 20 7096 5425 | **E** london@hollawaystudio.co.uk | **W** www.hollawaystudio.co.uk

**Kent** | The Tramway Stables | Rampart Road | Hythe | Kent | CT21 5BG
T +44 (0)1303 260 515 | **E** kent@hollawaystudio.co.uk | **W** www.hollawaystudio.co.uk

**Project** | Ringers Road
Bromley

**Client** | The Substantia Group

**Title** | Proposed 10th Floor - Block B

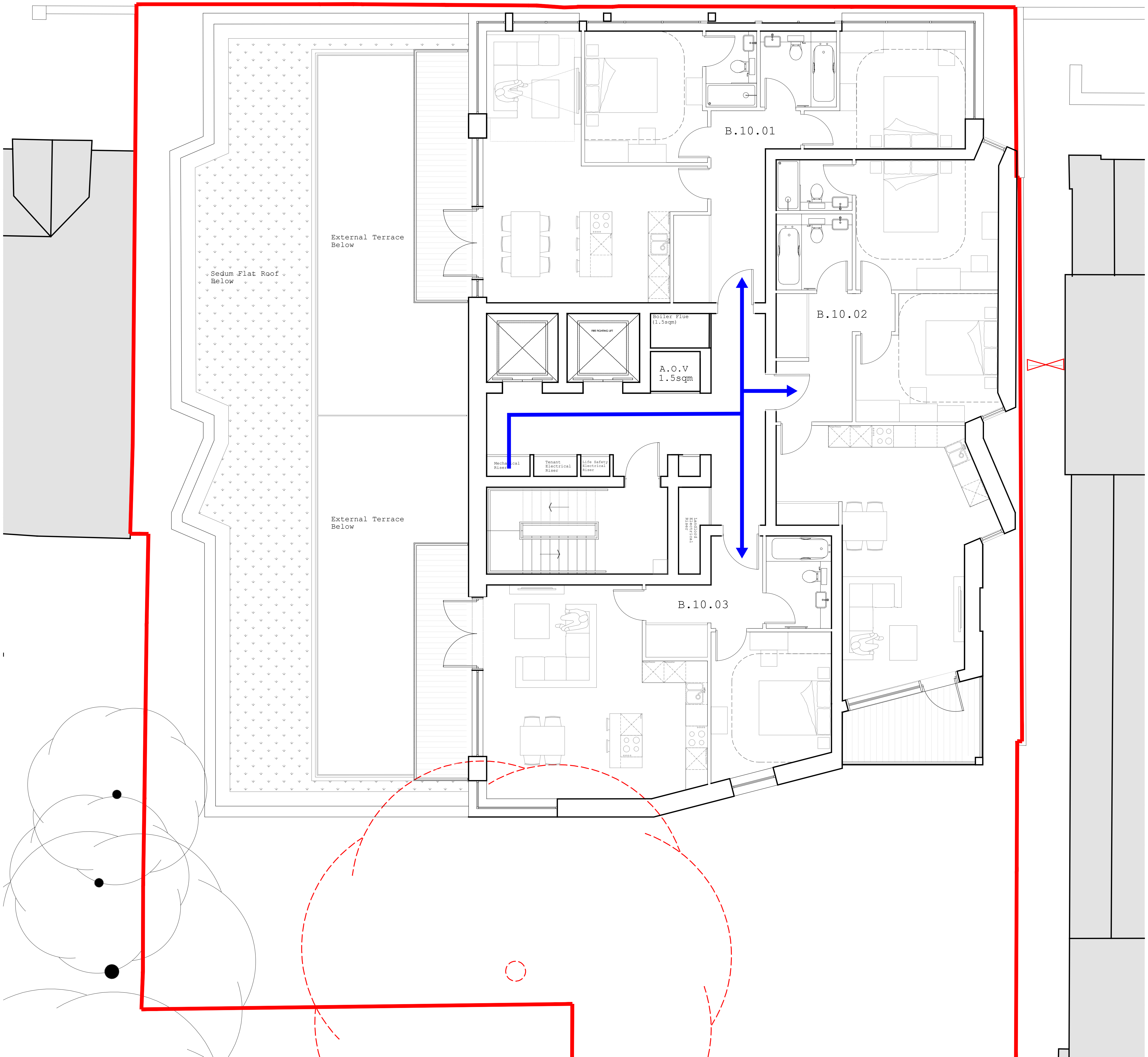
**Status** | PRELIMINARY

**Scale@A3** | 1:100 **Date** | 13.01.21 **Drawn** | GG **Chk'd** | LC

Project Number
18.085

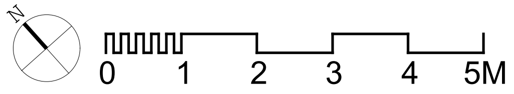
Drawing Number
210.05

Revision
R1



🟥 Site Boundary

⬚ Removed Trees



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**London** | 10a Acton Street | London | WC1X 9NG
T +44 (0) 20 7096 5425 | **E** london@hollawaystudio.co.uk | **W** www.hollawaystudio.co.uk

**Kent** | The Tramway Stables | Rampart Road | Hythe | Kent | CT21 5BG
T +44 (0)1303 260 515 | **E** kent@hollawaystudio.co.uk | **W** www.hollawaystudio.co.uk

**Project** | Ringers Road
Bromley

**Client** | The Substantia Group

**Title** | Proposed 11th Floor - Block B

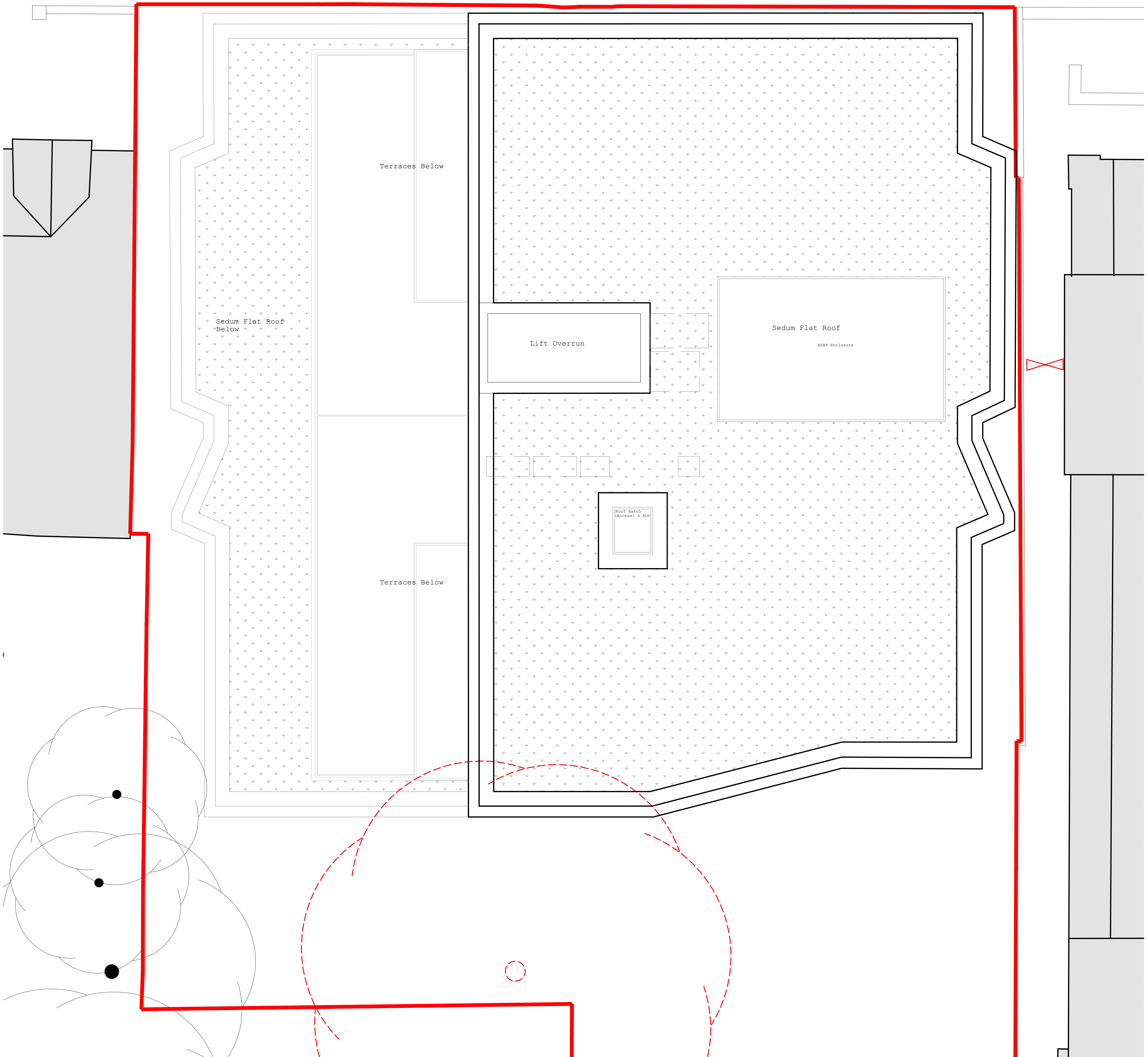
**Status** | PRELIMINARY

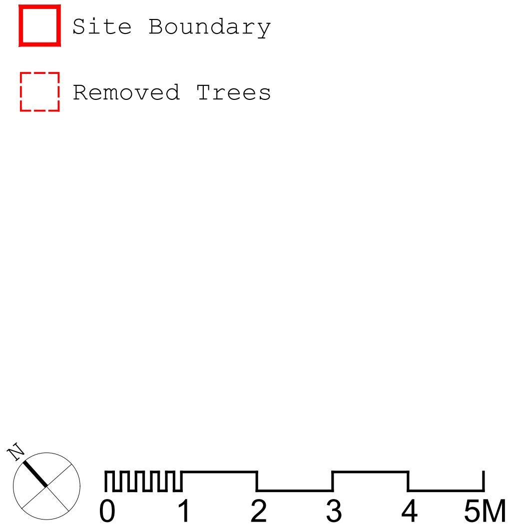
**Scale@A3** | 1:100 **Date** | 13.01.21 **Drawn** | GG **Chk'd** | LC

Project Number
18.085

Drawing Number
210.06

Revision
R1





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**London** | 10a Acton Street | London | WC1X 9NG
T +44 (0) 20 7096 5425 | **E** london@hollawaystudio.co.uk | **W** www.hollawaystudio.co.uk

**Kent** | The Tramway Stables | Rampart Road | Hythe | Kent | CT21 5BG
T +44 (0)1303 260 515 | **E** kent@hollawaystudio.co.uk | **W** www.hollawaystudio.co.uk

**Project** | Ringers Road
Bromley

**Client** | The Substantia Group

**Title** | Proposed Roof Plan - Block B

**Status** | PRELIMINARY

**Scale@A3** | 1:100 **Date** | 13.01.21 **Drawn** | GG **Chk'd** | LC

Project Number
18.085

Drawing Number
210.07

Revision
R1

# APPENDIX J - GOOD HOMES ALLIANCE EARLY-STAGE OVERHEATING RISK TOOL

# EARLY STAGE OVERHEATING RISK TOOL

Version 1.0, July 2019

Good
Homes
Alliance

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.

**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?**<br>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?**<br>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?**<br>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 | 1 |

## Site characteristics

| | | | |
|---|---|---|---|
| **#3 Does the site have barriers to windows opening?**<br>- Noise/Acoustic risks<br>- Poor air quality/smells e.g. near factory or car park or very busy road<br>- Security risks/crime<br>- 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?**<br>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?**<br>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?**<br>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?**<br>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?**<br>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 | 0 |

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

## Solar heat gains and ventilation

| | | | |
|---|---|---|---|
| **#6 What is the estimated average glazing ratio for the dwellings?**<br>(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?**<br>Single aspect dwellings have all openings on the same facade. This reduces the potential for ventilation | Single-aspect | 3 | 3 |
| | Dual aspect | 0 | |

| | | Full | Part | |
|---|---|---|---|---|
| **#13 Is there useful external shading?**<br>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** | >65% | 6 | 3 | 0 |
| | >50% | 4 | 2 | |
| | >35% | 2 | 1 | |

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

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| TOTAL SCORE | 8 | = | Sum of contributing factors: | 15 | *minus* | Sum of mitigating factors: | 7 |

| | | |
|---|---|---|
| **score >12:**<br>Incorporate design changes to reduce risk factors and increase mitigation factors<br>AND Carry out a detailed assessment (e.g. dynamic modelling against CIBSE TM59) | **score between 8 and 12:**<br>Seek design changes to reduce risk factors and/or increase mitigation factors<br>AND Carry out a detailed assessment (e.g. dynamic modelling against CIBSE TM59) | **score <8:**<br>Ensure the mitigating measures are retained, and that risk factors do not increase (e.g. in planning conditions) |

**XCO2**
56 Kingsway Place, Sans Walk
London EC1R 0LU

+44 (0)20 7700 1000
mail@xco2.com
xco2.com