Project Future

Mechanical, Electrical and Public Health Engineering Services RIBA Stage 2

AXA IM-RA

Job No: 1028041
Doc Ref: DSQ-CDL-Z-XX-RP-Z-90220
Revision: P02
Revision Date: 29 January 2021

Project title	Project Future	**Job Number**
Report title	Mechanical, Electrical and Public Health Engineering Services RIBA Stage 2 Concept Design Report	1028041

Document Revision History

Revision Ref	Issue Date	Purpose of issue / description of revision
P01	22 January 2021	RIBA Stage 2 Issue
P02	29 January 2021	RIBA Stage 2 Issue – updated to reflect latest Energy Feasibility Study and to clarify recommendations.

Document Validation (latest issue)

29/01/2021

X Cundall MEP Design Team

Principal author

Signed by: Johnson, Stephen

29/01/2021

X M. Wilkinson

Checked by

Signed by: Wilkinson, Martyn

29/01/2021

X

Verified by

Signed by: Stewart, Alec

Executive Summary

The Strategic Briefing Document received from Radcliffes dated September 2020 highlights that AXA IM-RA key drivers for the refurbishment of Dolphin Square are:

- Enhancement of the Estate's built environment as a whole.
- Create a market leading product in the private rented sector.
- Ensuring that clear, consistent consideration is given to Environmental, Social and Governance from inception to operation and that through this ethos the project will generate the best results and minimize any risk of obsolescence.
- Provision of a repositioned product to realise an increase to the estimated rental value.
- Delivering accommodation which stands the test of time combining longevity with practicality while ensuring it is stylish, comfortable and meets modern living expectations.
- Improvements to environmental credentials are intrinsic to AXA's business principals and therefore to the project, the design will need to address how both the construction process and occupational use can be delivered and occupied with a reduction in carbon footprint – greater; efficiency, social impact and innovation should be harnessed at all stages.
- Delivery of integrated technology to improve the living experience and drive efficiency into the long term management processes of the asset.
- The addition of services which both improve the living experience and allow monetisation of the estates service offer.

Cundall have been appointed for RIBA stage 2 to provide the mechanical, electrical and public health engineering, as well as lifts, acoustics, fire and energy consultancy which are covered in separate reports.

The mechanical engineering options discuss the energy strategy scenarios for thermal improvements and provide the associated heating solutions for each of these scenarios, along with the merits of mechanical ventilation heat recovery systems (MVHR) on an apartment by apartment basis when compared with an alternative centralised House system and House central plant strategies.

The electrical systems include the necessary electricity infrastructure upgrades to support a reduction in gas use for heating and hot water production in favour of more sustainable or efficient technologies such as heat pumps and all other associated electrical components for both the apartment House blocks and common parts.

The public health engineering systems focus on basement 1 suspended drainage, apartment above ground drainage, install of new water authority supplies, house block plant rooms with associated plant domestic hot and cold-water systems taking consideration of the potential heating strategies for the energy scenarios and how these may be impacted should mechanical cooling be introduced into the scheme.

The replacement works presents an opportunity for offsite prefabrication for elements of both sanitary and domestic water service pipework and has been considered for in the services design strategy.

This RIBA stage 2 (The RIBA Plan of Work published by the RIBA in 2020) defines a stage report as: 'A report produced at the end of stage 2 (concept design) to capture decision making during the stage and record the outcome of the design process for review by the client'.

This report identifies the proposed MEP Concept designs for the major MEP plant items for the entire development, i.e. all four future proposed phases of the development.

The MEP approaches, suggested and identified within this report are generally of a phase specific or modular extendable nature thus allowing central plant to be built up within new energy centres with equipment selected with appropriate capacities matched to the particular phase of the construction (phases 1, 2, 3 or 4).

As Cundall, and the wider professional design team, progress to RIBA stage 3, the design team's approach will be to focus exclusively on the first phase of the proposed construction works namely:

- House Refurbishment Phase 1 - Duncan, Beatty, Rodney with the proposed construction period from October 21 to September 23.

It is essential that where options for MEP solutions are offered, agreed scenarios and strategies are recorded on the conclusion of the stage 2 process and decisions taken to allow the RIBA stage 3 to proceed with clarity. The following scenarios and strategies are recommended to be adopted in the development of the RIBA stage 3 design:

- Energy scenario 2, including associated improvements to the building fabric, ventilation provisions and heating plant.
- Continuous supply and extract ventilation provided on an apartment-by-apartment basis, using mechanical ventilation with heat recovery (MVHR) units located in each apartment.
- New, centralised heating plant at basement level, consisting of air source heat pumps and gas-fired boilers (with the potential inclusion of water source heat pumps) to operate in a bivalent system to provide a central low temperature hot water (LTHW) heating loop.
- Heat interface units (HIU) installed in each apartment to connect to the central heating loop, providing heat for space heating (radiators) and domestic hot water (DHW).
- Heating, cooling and ventilation of the swimming pool and lobby/common amenity areas are provided by separate plant to each other and to the apartments.
- New 6 MVA (2 No. 3MVA) connections to energise new, decarbonised energy centres and landlord system. New HV and LV equipment to be installed such as HV switchboards, transformers, LV switchboards, panelboards, and final circuit distribution boards.
- Existing DNO public network supply to be fully re-purposed to supply the apartments. New LV switchboards to be provided for apartments as to replace existing switchboards.
- The existing electrical distribution within the apartment Houses are to be replaced in phases. A new rising busbar with floor-by-floor group metering is recommended. This option is preferred as it replaces the existing systems on a like-for-like basis, freeing up valuable additional space which would be required in the basement.
- Electrical installations in apartments to be fully refurbished providing new LV, small power, lighting and fire alarm equipment.
- New double-stacked consumer units to be provided to each apartment and to include RCDs and AFDDs for arc fault protection as required per the latest wiring regulations.
- Wireless lighting controls within apartments and skirting containment used to avoid chasing cables into walls.
- New internal and external LED lighting to reflect the architectural design concept.

Contents

1.0

Introduction, Summary and Risks

1.0 Introduction, Summary and Risks

1.1 Introduction

This report has been prepared on behalf of AXA IM-RA in response to their instruction for Cundall to develop a RIBA stage 2 conceptual design report for the planned refurbishment works to the 1,069 residential apartments and 165 serviced apartments at the Dolphin Square, Chichester Street, London SW1V 3LX.

Dolphin Square is the largest private residence in the United Kingdom, providing accommodation to more than 2,500 residents. The estate itself is vast with around 1,055,000 sq. ft. of accommodation.

Accommodation is provided in 13 blocks (Houses), each named after a famous navigator or admiral. At the south (Thames) side of the Square the houses are Grenville, Drake, Raleigh, and Hawkins. Moving from the river up the west side, there are Nelson, Howard, Beatty, and Duncan. A hotel and administration offices, on the north side of the Square, are in Rodney House. Heading south from the hotel there are Keyes, Hood, Collingwood, and Frobisher.

This report develops the following particular elements of the building Mechanical, Electrical and Plumbing (MEP) requirements which include although not limited to:

- Incoming utilities, electrical, gas, water, fire water, drainage, and associated incoming plantrooms and equipment.
- Main mechanical, electrical and plumbing plant rooms and spatial planning - including horizontal services distribution and vertical risers.
- Consideration given to the existing facility, existing MEP plantrooms and distribution strategies and the phasing of the planned construction and the proposed modular progression of plant with capacities aligned with the construction phasing proposals and requirements.
- UKPN electrical substations, statutory requirements, public and private distribution systems.
- Lighting systems, including emergency lighting, security lighting, aesthetic lighting and controls.
- Security systems, CCTV, access control, intercoms, pending further client / specialist input.
- Fire alarm and detection systems.
- IT, Communication, TV and Entertainment systems.
- Mechanical energy centres and associated heating and hot water systems, distribution pipework and pumps.
- Cooling systems.
- Ventilation, car-park, common parts, apartments, specialist areas, swimming pool and amenity areas.
- Basement suspended combined foul and surface water drainage to drainage outfalls.
- Basement interface of substructure and suspended drainage installations.
- Apartment foul, wastewater and ventilation installations.
- Thames Water utility network water supplies and metering strategy in accordance with TW policy.
- Water treatment for waterborne pathogens within cold water systems.
- Basement domestic water storage, temperature control and distribution.
- Basement soft water generation, storage and distribution.
- Apartment domestic hot and cold water services installations.
- Apartment domestic fire sprinkler provision.
- Services for the fire strategy including dry risers, smoke ventilation, etc.

1.2 Key Assumptions

Through our engagement on the project and the high-level briefings that we received we have noted the following, key procurement requirements (reference Hollis Procurement Report dated 10 November 2020) recommendations:

The proposal is to utilise the JCT Design and Build contract, with an amended tender process to allow for a shortlist of contractors to include for RIBA stage 4 (detailed design) to be included in their tender. The proposed procurement route is summarised as follows:

- Project design to be taken to RIBA stage 3 and tendered to four contractors.
- Shortlist of two contractors taken to the next stage.
- During the RIBA stage 3 tender period, the design is to be progressed through to RIBA stage 4.
- Two shortlisted contractors presented with RIBA stage 4 - requested to provide best and final offer.
- Design team to be novated. Consideration to be given to continuation of oversight for client (potential conflict of interest, which is often resolved with an internal Chinese wall).
- Successful contractor to be appointed under a framework to deliver all phases of the project, although award of subsequent phases will be subject to the performance of the contractor.
- Subsequent award will also be subject to agreement of costs, and KPIs.

Each phase of work will be awarded under the framework as a separate contract and will require the contractor to meet the necessary performance KPIs.

It is proposed that the M&E Engineer and Architect are novated to the contractor.

With regards to the proposed time-frames and programme, we have received reference RAD-DSQ-MP01-4.3-201127 DESIGN PROC which identifies the following key design milestones for the project:

- MEP stage 2 design available 22 Jan 21.
- Architectural and MEP stage 3 available 9 Jun 21.
- Architectural stage 4 strip-out and architectural enabling/diversions package 9 Jun 21, note this is assumed to be for Phase 1 of the proposed construction works only i.e. Duncan, Beatty and Rodney only.
- Architectural and MEP stage 4 available 9 Sep 21.
- With regards to time-frame and programme, we have received reference RAD-DSQ-MP01-4.3-201127 DESIGN PROC which identifies the following key design milestones for the project:
- Commence Two-stage tender for House Refurb Contractor 6 Apr 21.
- Commence Single-stage tender for strip-out (phase1) from 4 May 21.
- Appoint Strip-out Contractor on 18 Aug 21.
- Appoint House Refurb Contractor on 2 Dec 21.

With regards to time-frame and programme, we have received reference RAD-DSQ-MP01-4.3-201127 SUMMARY which identifies the following key design milestones for the project:

- House Refurbishment Phase 1 - Duncan, Beatty, Rodney 07 Oct 21 to Sep 23.
- House Refurbishment Phase 2 - Keyes, Hood, Collingwood, Frobisher 02 Oct 23 to 14 Nov 25.
- House Refurbishment Phase 3 - Grenville, Drake, Howard 17 Nov 25 to May 27.
- House Refurbishment Phase 4 - Nelson, Hawkins, Raleigh 27 May 27 to 20 Oct 28.

1.3 Major Risks, Outstanding Information and Key Issues

The main items of risk which could affect the technical content of this report or the cost associated within this project are detailed below:

- Because of the phased approach to the project, there are both existing and new utility services (electrical supplies) which may require upgrading (replacement due to age and condition or in the case of new supplies - increased capacities) replacing or diverting which can only be undertaken by the Electrical Statutory Utility Company UKPN or with their guidance and acceptance. Some of which may require to be undertaken in advance of the main House Refurbishments. Cundall have received a budget cost confirming the availability of the required new capacity to supply the energy centres and new Landlord system. The final location, setup, and space allowance for DNO equipment is yet to be confirmed. This remains a major risk to the proposed start dates for construction activities and costs to follow the strategies outlined.
- The provision of all other new utility services (i.e. water, telecommunications) which can only be undertaken by the Statutory Utility Companies or the vendor, which must be undertaken in parallel with the main building construction and be available at the appropriate time in the construction programme for the setting to work and commissioning.
- The inclusion of new mechanical heating and hot water energy centres and associated electrical substations/ energy centres which will serve the refurbished Houses alongside all existing MEP plant which will serve

those existing Houses which are to be refurbished as a future phase of work.

- The thermal modelling of the Houses, spaces and apartments and the ability to establish an acceptable internal environment with mechanical ventilation whilst demonstrating full compliance with the Energy Strategy accepted scenario (1, 2 or 3 as selected).
- Future changes to the Building Regulations, such as Part L, or The London Plan which may impose more challenging requirements and unfavourable results when using fossil fuel systems such as natural gas or air quality expectations.
- London Planning requirements relating to energy/carbon emission reductions and sustainability.
- London Plan requirements relating to site attenuation of surface water discharge from site to local authority sewers.
- Requirements to carry out a BREEAM Sustainability certification scheme assessment (where credits appropriate at RIBA stage 2 and appointment of additional specialist reports is beneficial).
- Requirement to implement WELL assessment credits.

1.4 Energy Assessment

The assessment results illustrated are based on a simplified energy assessment. A detailed energy assessment may be considered at the start of the next design phase RIBA 3 and may also provide benefits of meeting BREEAM / WELL credits. Refer to Appendix G for details on BREEAM / WELL credits relevant to MEP installation and considered for this scheme.

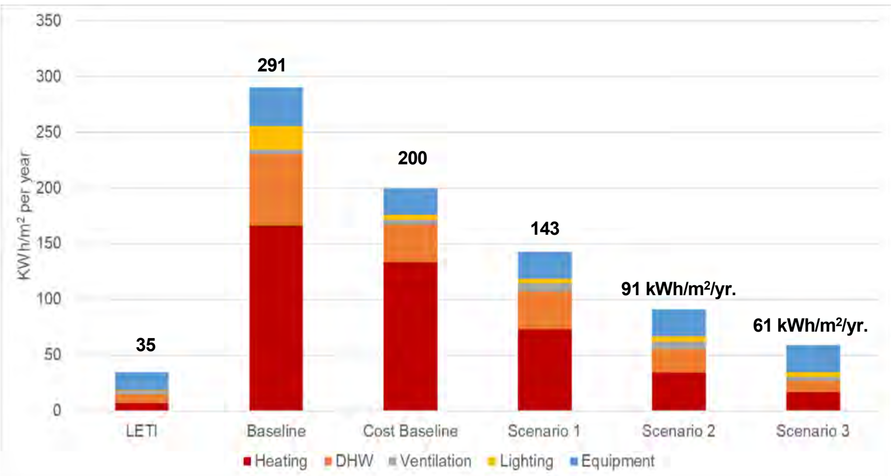


Figure 1.4.1 - Energy demand assessment - kWh/m²/yr.

Apartments equipment consumption such as dishwasher, fridge freezer, washer / dryer, oven, TV and other electronics, is based on new energy efficient equipment being provided and is therefore a fixed element that cannot be influenced significantly.

For the heat energy strategy, the major savings in energy are associated with heating and hot water:

- Scenario 1 – ~50% reduced heating energy through improved air tightness and double glazing. The central plant provides heat and hot water based on efficiency using boilers.
- Scenario 2 – Reduce demand – Insulate external walls. The central plant includes heat pumps and boilers.
- Scenario 3 – Meet demand with increased centralised energy centre efficient plant.

Should a ‘best in class’ refurbishment approach be adopted, it is recommended that the Passivhaus EnerPHIT standard is adopted for some or all apartments. To achieve certification will result in a low energy, well-refurbished (thermal bridges and air tightness) and comfortable dwelling.

1.5 The Site and Planning

Dolphin Square is the largest private rental building in the UK. The site is, Dolphin Square, Chichester Street, London SW1V 3LX.

The site consists of 1,069 residential apartments and 165 serviced apartments at the ~1,055,000 sq. ft. estate.

The site is home to more than 2,500 residents.

A planning consultant appointment via DP9 is imminent to assist this element of the project. We have made initial assessments for the engineering systems likely to affect the planning process such as noise limitations on new external plant which have been covered in the Cundall Acoustic report, and the position and size of external equipment that would change the visual appearance of the building.

We are aware of the listed nature of the central garden areas, and potential resistance to change the external appearance of the building from Westminster City Council and affiliated conservation groups.

Figure 1.5.1 - Aerial image of site.

1.6 Services Strategy Summary

The project consists of the major refurbishment of the existing 13 Houses of Dolphin Square. The sequencing of the work is framed within four construction phases and the services equipment and distribution strategies allow plant to be selected with suitable capacities appropriately sized for the construction phase or individual House being refurbished. Within Rodney House there are no long-lease residential users, instead there are amenity spaces including serviced apartments, a Reception, Lobby, Cafes and Lounges, Bar and Grill, Retail and associated terraces and external works.

The sequencing of the works requires the existing Houses, individual apartments, shared spaces, plant and equipment to remain fully operational and live and remain unaffected whilst the individual Houses are refurbished. By way of example within Construction Phase 1 Duncan House is refurbished alongside Beatty House. We have sequenced our proposals for Duncan to be handed over in advance of Beatty starting to be refurbished. This approach of start and complete each House one at a time is at the forefront of our servicing strategy and thinking.

Alongside this thinking, is to retain the existing operational by minimising the work on the existing. Effectively we would look to maintain all existing horizontal distribution from existing plant spaces to the connection to the riser operational. We would look to isolate in close proximity to the House risers and strip and remove upwards from this point.

The proposal is to establish new ‘Mechanical Energy Centres’, new ‘Electrical Energy Centres’ and new ‘Public Health’ facilities all alongside the existing and effectively with new distributed services running in parallel with the existing. These new plant facilities will be located within the basement. New horizontal services distribution will emanate from all new plantrooms to connect into isolating plantrooms (mechanical plate heat exchanger rooms) or electrical switchgear or connect directly to existing or newly formed service risers. The mechanical, electrical and public health services strategies have been developed to provide, where practical, dedicated plant to service each of the House or functional spaces.

1.6.1 Mechanical Services

The existing mechanical plant rooms located in Keys (which serve from Hood to Beatty), Howard (which serve Howard to Raleigh) and Collingwood (which serve Collingwood to Drake) each comprise gas boilers and hot water calorifiers serving the apartments and some of the common parts. Pending final decisions on the energy strategy it is the intention to have a low temperature heat loop fed from two heating energy centres, which generate the majority of the heat from heat pumps (air source with the possibility of a water source contribution) which then in colder months is topped up by hydrogen ready gas boilers due to the drop in efficiency of heat pumps at lower ambient temperatures. The heat loops then connect to a series of plate heat exchangers (PHX), one per House which then deliver heat energy to each apartment to heat interface units (HIUs). The HIUs each have two further heat exchangers in them for Domestic Hot Water (DHW) and Low Temperature Hot Water heating (LTHW). The DHW PHX is supplied with softened water, and as the water is generated as an when it is needed this reduces the risk of Legionella. The LTHW feeds conventional radiators in the apartment albeit the radiators are larger due to the reduced temperature of supply and bigger temperature drops. The feed to each HIU will be metered via MID compliant meters which will then have the capacity to bill the Tenant for all heat energy used. Should mechanical cooling be required then an alternate heating and cooling strategy would be proposed using an ambient loop which has fan coil units (FCUs) in each room with refrigeration circuits in each FCU which would extract or reject energy to the loop pending the time of year, and the loop temperature would be maintained by external heat pump plant to add or extract heat to the loop pending the season. With this option however there will be significant CAPEX investment needed and also the need for stored hot water in each apartment or via central systems which is harder to manage from a legionella perspective.

Ventilation to each apartment is proposed to be via individual Mechanical Ventilation Heat Recovery (MVHR) devices rather than central systems. The principal reasons are for mitigation of fire separation, noise isolation and demand-based ventilation control amongst many other factors.

1.6.2 Electrical Services

Ideally, the two existing UKPN substations (north and south) will be retained and all associated 'public' network electrical distribution systems i.e. transformers, RMUs, submains will all remain unchanged. We are aware of some historical issues on the site with regards to the condition of the 'private' network electrical distribution systems i.e. rising busbars, tap-offs, fuse-boards, localised metering facilities and cut-outs and its longevity. Due to history of failure of some equipment and local fire, this is considered a high-risk item and is included as such within Section 1.3.

Our recommendation on conclusion of the stage 2 exercise is for the private network to be replaced on a like-for-like basis with new busbars and floor by floor group metering. Accommodation Houses will be upgraded on a House-by-House basis. The rising busbar current ratings will be increased in line with the anticipated increase in electrical demand. Refer to Section 6.3 for details on the alternative arrangements proposed.

Alongside the replacement of the residential electricity network, it will be necessary to provide a new dedicated electricity infrastructure to support the new 'mechanical energy centres' and all Landlord associated systems. A new electricity infrastructure including HV switch room, substations and low voltage switchgear to support a reduction in gas use for heating and hot water production in favour of more sustainable or efficient technologies such as Heat Pumps and all other associated electrical components for both the apartment Houses and common parts.

1.6.3 Public Health Services

Existing water supplies for human consumption are drawn from the site's boreholes/wells, delivered to 2 No. domestic cold water storage reservoirs, treated for water quality and boosted to a roof level ring main via packaged pump sets located within basement plant rooms. The 2 No. roof level ring mains serve House cold water storage tanks with gravity cold water services from the roof mounted tanks serving apartment kitchens and bathrooms.

Existing domestic hot water generated via storage calorifiers located within basement plant rooms serve 3 No. distribution systems delivering domestic hot water to apartment kitchens and bathrooms via basement/roof flow and return pipework circuits.

Previous site survey reports have identified a number of system issues with both cold and hot water circuits in terms of poor pressure, circulation, dead legs and backflow non-compliance with best practice and statutory compliance.

Above ground sanitation consists of foul, wastewater and ventilation or anti-siphon stacks generally located with service risers adjacent to apartment bathrooms and kitchens. Local low-level branch foul and wastewater pipework serving foul 7 wastewater discharge from apartment sanitary fittings discharge to the adjacent stacks. The apartment drainage stacks transport down through apartment floors, to a basement combined drainage network with a series of outfalls connecting to the site's existing private drainage network prior to its connections to the local authority public sewers.

Roof areas are drained to internally located rainwater pipes via small poor preforming rainwater outlets generally located adjacent to service ducts as they penetrate the roof levels

1.7 Exclusions

The following systems, services and items are specifically excluded from the M&E Building Services scope and this report, such services will be separately detailed by the Architect, or AXA IM-RA or their designated responsible persons:

- Rainwater detailed design.
- Smart Building technologies.
- IT / AV / digital engineering.
- Catering engineering.
- Security and access control systems.
- Existing underground drainage.
- Flooding site protection.

1.8 Contractor's Design Portion (CDP)

The following works and elements are subject to contractor's design portion supplement (CDPS), or similar and as detailed in the contract, include but not limited to:

- Detailed spatial coordination.
- Installation and fabrication details.
- Detailing of builderswork holes smaller than 350 mm x 350 mm.
- Services support systems.
- Pipework expansion, guide and anchoring requirements and detailing to suit working drawings.
- Final sizing and positioning of commissioning sets and control valves to suit working drawings.
- Water treatment systems.
- Verification and any reselection of pump duties based on final equipment selection and installation drawings.
- Verification and any reselection of fan duties based on final equipment selection and installation drawings to meet the required specific fan powers (SFP).
- Car park impulse ventilation and associated CFD analysis.
- Smoke ventilation shafts and associated CFD analysis.
- Refrigeration pipework distribution and sizing.
- Boiler flue systems including supports and provisions for expansion and fire rating and comment on the suitability of any enclosing shaft.
- Generator flue systems including supports and provisions for expansion and fire rating.
- BMS and environmental control systems, including the control of self-contained plant.
- Incorporation of interfaces, inclusive of relays and other devices, and modifications to hardware and software.
- Energy metering and billing systems.
- Fire detection and alarm systems, including detailed cause and effect.
- Sprinkler and drencher systems including alarm, controls and electrical interfaces.
- Other specialised fire suppression systems (gas/ water/ mist/ etc.) including alarm, control and electrical interfaces and works related to room sealing, venting and integrity testing (as required).
- Fire stopping and review of materials at all fire barriers to ensure they meet the intent of the fire strategy.
- Lightning protection systems.
- Lighting control systems.
- Modifications to plantroom lighting to suit final plant positioning.
- Detailed implementation of modifications to existing modular wiring systems.
- Security and intruder detection systems, video entry and access control systems, and CCTV systems.
- Design of electrical trace heating and water leak detection systems.
- Vertical and horizontal transportation systems.
- Final selection of attenuators and anti-vibration mounts to meet the criteria specified.
- Systems and equipment specified by performance.
- Special systems.

1.9 Document Control and Classification

The changes to this document will be tracked following the issue of any further versions, incorporating AXA IM-RA and the design team's input together with any further comments from any other associated party.

2.0

Design Parameters and Other Criteria

2.0 Design Parameters and Other Criteria

2.1 General Design Standards

The following Design Criteria should be read in conjunction with all other relevant design criteria as contained within the Building Regulations, all relevant Local and Statutory Authorities' Requirements, all relevant British and European Standards, and all other guidance and documentation as listed within this report, all other mechanical and electrical reports and the materials and workmanship specification.

- British Standards, Codes of Practice and Building Regulations
- CIBSE Guides and Technical Memoranda
- BSRIA Guides
- CIPHE Guides
- BS7671: Requirement for electrical installation (IET Wiring Regulations)
- Local and Statutory Authority Requirements
- Domestic and Non-Domestic Building Services Compliance Guide
- Building Regulations and other legislation
- Building accreditation and certification
- CIBSE Guidelines
- ASHRAE Guidelines
- BSRIA Guidelines
- Building Regulations Part L2A
- British Council for Offices Guide to Best Practice in the Specification of Offices
- Clean Air Act and Environmental Protection Act
- DW 144 Ductwork & DW 172 Kitchen Ventilation
- Building Regulations
- Code of practice for fire safety in the design BS9999
- Loss Prevention Council (LPC)
- Radio Communications Agency
- HSE ACoP and Guidance L8
- Health and Safety at Work Act
- The Statutory Fire Officer Requirements
- CDM Regulations
- Gas Safety and LPG Regulations

2.2 Environmental Targets

Energy Performance Certificate (EPC) Min Asset Band “B”

Air leakage	Refer to air testing report. Refer to environmental report for future targets.	Subject to separate Part L analysis

Table 2.2.1 Air leakage criteria.

2.3 Mechanical Design Criteria

This section outlines the design criteria relating to the mechanical services.

2.3.1 Design Conditions

External Design Conditions	Summer	Winter	Comments
Outdoor design temperatures	30°C d.b. 50% RH 22.3°C w.b.	-4°C d.b. 100% RH	Based on CIBSE weather data for London, UK.

Table 2.3.1 - External design conditions.

Based on the above external ambient conditions, the environmental systems will be designed to achieve the internal conditions outlined within the following sections.

The indoor conditions within the following table are identified within CIBSE design and Sport England guidance as below.

Area	Summer	Winter
Living Rooms / Studios	Not controlled	22°C +/-2°C
Kitchens	Not controlled	19°C +/-2°C
Bedrooms	Not controlled	19°C +/-2°C
Bathrooms	Not controlled	22°C +/-2°C
Hallways	Not controlled	22°C +/-2°C
Corridors, Stairs and Circulation Spaces	Not controlled	19°C +/-2°C
Reception Areas	23°C +/-2°C	19°C +/-2°C
Restaurant	24°C +/-2°C	22°C +/-2°C
Squash Courts	Not controlled	12°C +/-2°C
Gym	18°C +/-2°C	16°C +/-2°C
Swimming Pool Hall (sport England values)	29°C Hall 28°C Water	29°C Hall 28°C Water
Changing Areas	24°C +/-2°C	24°C +/-2°C
Communal Toilets and Washing Areas	Not controlled	21°C +/-2°C
Plantrooms	Not controlled	10°C min

Table 2.3.2 - Internal design conditions.

Notes:

Values above refer to dry bulb air temperatures. +/-2°C is the allowable measurement tolerance due to equipment control bands, temperature variation around the space, etc.

2.3.2 Casual Gains

Casual gains will be dependent upon the occupant activity levels within the space, the equipment located within the space and the space artificial lighting solution.

Assessment of casual gains shall be carried out in the further stages of the project as more information becomes available, hence has not been included within this report.

2.3.3 Ventilation Design Parameters

Continuous extract ventilation rates and minimum whole dwelling ventilation rates as per Building Regulations Part F 2010 Tables 5.1a and 5.1b.

Room	Minimum High Extract Rate	Minimum Low Extract Rate
Kitchen	13 l/s	At least the minimum whole dwelling ventilation rate as per below.
Utility Room	8 l/s	
Bathroom	8 l/s	
Sanitary Accommodation	6 l/s	

Table 2.3.3 - Extract ventilation criteria.

Number of Bedrooms	Whole Dwelling Ventilation Rate [a, b]
1	13 l/s
2	17 l/s
3	21 l/s
4	25 l/s
5	29 l/s

Table 2.3.4 - Whole dwelling ventilation criteria.

Notes:

a. In addition, the whole dwelling ventilation rate shall not be less than 0.3 l/s/m² of internal floor area.
b. This is based on two occupants in the main bedroom and a single occupant in all other bedrooms.

Ventilation requirements to generator room to be confirmed at RIBA stage 3.

Smoke ventilation has been covered in the Cundall Fire Report.

Maximum duct velocities for general ventilation purposes are shown in Table 2.3.5.

Area	Velocity
Risers (for centralised MVHR option)	< 5.0 m/s
Horizontal distribution (common areas)	< 4.0 m/s
Horizontal distribution (apartments)	< 3.0 m/s
Final run-outs to grilles (common areas)	< 2.0 m/s
Final run-outs to grilles (apartments)	< 2.0 m/s

Table 2.3.5 - Maximum duct velocities.

2.3.4 Heating Design Parameters

Parameter	Criteria
LTHW flow temperature	Landlord circuits (primary): 63°C [a] Apartments circuits (secondary space heating): 50°C
LTHW return temperature	Landlord: 30°C [b] Apartments: 30°C [b]
LTHW system maximum pipework velocities	Up to 40 mm dia. < 1.0 m/s Up to 80 mm dia. < 1.5 m/s Above 80 mm dia. 2.0 m/s

Table 2.3.6 - LTHW system criteria.

Notes:

a. Includes allowance for 3°C transmission loss from energy centre to apartments pending next stage of design
b. Return temperatures will vary according to outdoor weather conditions and Apartments demand for space heating and hot water.

2.4 Public Health Design Criteria

This section outlines the design criteria relating to the public health services. The criteria are based on industry best practise data and design guidance.

2.4.1 Water Services Design Parameters

Pipework Systems	Criteria
Hot/cold water system maximum pipework velocities	Up to 40 mm dia. < 1.0 m/s Up to 80 mm dia. < 1.5 m/s Above 80 mm dia. 2.0 m/s
Hot/cold pipework installations tabulated loading units	BSEN 806 part 3 Table 2
Hot/cold water system terminal point of use pressure	2.0 - 2.5 bar
Above ground drainage vertical installations	K factor 0.7
Above ground drainage tabulated discharge units	Table 2 Discharge Units (DU)
Above ground horizontal drainage fill capacity (d/D)	Max 0.75 with minimum achieving hydraulic gradient

Table 2.4.1 - Water services pipework criteria.

Number of Bedrooms	Storage per Bedroom/litres (for ambient loop option only)
Studio	210
1 Bed	210
2 Bed	130
3 Bed	100
4 Bed	100
5 bed	100

Table 2.4.2 - Ambient loop storage criteria.

HWS Temperatures	Proposed
HWS flow temperatures	50 - 55°C
HWS discharge temperature for ablutions	38 - 43°C
HWS discharge temperature for sinks/dish washing	45°C

Table 2.4.3 - Hot water storage criteria.

2.4.2 Pipework Calculations

Determine by calculation utilising approved methodology, recognised data flow and pipe sizing calculations for vertical/horizontal domestic water installations incorporate 15% design margins for system losses.

2.4.3 Plant Calculations

Determine by calculation utilising approved methodology and recognised data flow calculations for water boosting plant, cold water storage and domestic hot water generating plant with 15% design margins.

Cold water storage volumes assessed on apartment type, estimated at daily water demand (DWD) diversified from 24 hour to 6 hour storage to encourage tank content turnover and maintain water quality.

2.5 Electrical Design Criteria

This section outlines the design criteria relating to the Electrical services. Where possible, criteria are taken from those recommended by the Chartered Institution of Building Services Engineers (CIBSE) and the latest revision of BS 7671 Requirement for Electrical Installations and all associated amendments (18th Edition).

2.5.1 Power Requirements

Where exact equipment details or power usage are known these are to be used and where the details are unknown the following shall be used to assess the anticipated maximum demand:

Area	Power Densities W/m²		
	Lighting	Power	HVAC
Car Parks	10 W/m²	5 W/m²	-
Circulation Areas (background)	10 W/m²	5 W/m²	40 W/m²
Reception/Entrances	15 W/m²	5 W/m²	40 W/m²
Office Area	10 W/m²	23 W/m²	50 W/m²

Plant Rooms	10 W/m^2	5 W/m^2	20 W/m^2
Stores	8 W/m^2	10 W/m^2	20 W/m^2
Lockers/Changing Rooms	10 W/m^2	5 W/m^2	40 W/m^2
Gym/Swimming Pool	12 W/m^2	15 W/m^2	70 W/m^2
Terrace/Garden	10 W/m^2	5 W/m^2	-
Residential Apartments	1.5 kVA to 2.5 kVA dependant on apartment (based on no electrical heating or cooling within apartments)		
Retail units/Shops	160 W/m^2 (per unit)		
Restaurant/Kitchen	600 W/m^2 (per unit)		
Lounges/Cafes	225 W/m^2 (per unit)		
Comms Rooms	3 kW per cabinet		
Lifts	15 kVA per lift		

Table 2.5.1 - Power requirements.

2.5.2 Lighting

General internal lighting will be designed generally in accordance to BS EN 12464-1 with the exception of any BOH offices and meeting room which will be based on the requirement of Lighting Guide 7: Office Lighting produced by the society of light and lighting engineers and the apartment Houses which will be based on CIBSE SLL Lighting Guide 9: Lighting for Communal Residential Buildings.

Initial light levels shall be increased where necessary to allow for LED ageing and luminaire deterioration as per CIBSE lighting guide. We have assumed normal economic life for luminaires.

New external lighting (access and perimeter) will be designed in accordance with reference guidance in accordance with BS 5489-1:2013 and BS EN 12464-2.

Use the following criteria, as a minimum, for all internal lighting calculations:

- Reflectance: Ceiling / wall / floor – 70% / 50% / 20% (final figures dependent upon internal finishes)
- All-inclusive maintenance factor – maximum of 0.75

As the general arrangement layouts for the apartments develop, we will design lighting layouts for the uses of the space, as a guide the criteria in Table 2.5.2 shall apply:

Area	Average Light Levels (lux)	Glare Ratio (UGR)	Uniformity (Uo)	Colour Rendition Index (Ra)
Internal				
BOH/ Administrative Offices areas	500 lux @desk level	19	0.6 (0.8 uniformity over the task area)	80
Reception	300 lux @desk level	22	0.6	80
Circulation, corridors	100 lux @floor level	28	0.4	40
Lift Lobbies/Entrances	200 lux @floor level	22	0.4	80
Stairwells	150 lux @tread height	25	0.4	80
WCs / Showers	200 lux @floor level	25	0.4	80
Plantrooms / Risers	200 lux @floor level	25	0.4	60
Lockers	200@floor level	25	0.4	80
Stores	100 lux @floor level	25	0.4	60
Launderettes	200 lux @counter level	22	0.6	80
Car Park	75 lux	25	0.4	40
Kitchen counter	200 lux @counter level	22	0.6	80
Apartments	Apartments will generally have a good level of uniformity but will be designed meet the aesthetics from the architect and client team.			
External				
Walkways	5 lux	50 (GR)	0.25	20
Staircases and Ramps	50-100 lux	-	15:1 ratio	40
Entrances/Exits	100 lux	-	0.4	40
Roadway	10 lux	50 (GR)	0.4	20
Gardens	10 lux	28	0.4	20
Terrace	100	28	0.6	40

Table 2.5.2 - Lighting criteria.

The emergency lighting installation will be designed in accordance with the Lighting Guide 12: Emergency Lighting such that a minimum of 0.5 lux is achieved with open plan spaces and a minimum of 1 lux on escape routes and 15 lux in plantrooms and “high risk” areas based on risk assessments.

2.6 Acoustics

Cundall acoustic consultant have been appointed to provide a review of acoustic requirements for the development.

Cundall are normally responsible for ensuring engineering plant and systems are designed and specified to comply with the acoustic consultant’s criteria.

The following tables provide examples of building areas with typical noise levels.

2.6.1 Internal Noise Rating

Building Area	Noise Criteria (NR)
Living / Dining Rooms	<30
Bedrooms	<25
Kitchen (without hood operating)	<40
Bathrooms	<35
Plant Rooms	<75

Table 2.6.1 - Internal Noise Criteria

3.0

Environmental Strategy and Sustainability

3.0 Environmental Strategy and Sustainability

3.1 Energy Scenarios

The energy feasibility study conducted for this project, reviewed three energy reduction scenarios, beyond the baseline costed proposal. In carrying out the energy feasibility study, has raised the following issues requiring an investment decision and possibly further exploration:

- Insulating the external walls.
- Providing triple glazing.
- Ventilation to be local to each apartment or centralised via roof air handling plant.
- Apartments heating and hot water via local heat pumps or heat interface units.
- Apartments to include cooling (providing useful heat / energy balance).
- Energy centre mix of technologies, heat pumps and boilers.
- Open-loop groundwater integration to increase effective heat pump use.
- Assessing risk of discomfort and overheating.

Figure 3.2.1 shows how the 2019 energy baseline, the Cost Baseline and three Scenarios, compare against the London Energy Transformation Initiatives' (LETI) energy use intensity (EUI) target of 35 kWh/m²/year. This EUI is the challenge to the industry to be achieved in all residential buildings by 2050 in support of the future 'Net Zero' built environment. It is noted that further fuel utility use savings and reductions in energy may be achieved through the following:

- Local Mechanical Ventilation and Heat Recovery (MVHR), based on removing riser constraints improving the optimum fan efficiencies to be achieved.
- Provision of shower wastewater heat recovery.
- Energy balancing using limited cooling via heat pumps and ambient loop system to share energy to heat hot water.

Scenario 3 typically achieves a B rated EPC. With further investigation into the heat source efficiencies an A rating may be achieved. This would likely require further fabric enhancements such as wall insulation to achieve ~1.0 W/m²K. During the design development there may be limitations as to what can be achieved. Smaller apartments may have insufficient space to accommodate local water storage in utility cupboards.

With the phased approach to the refurbishment, may allow opportunities to test the provision of certain measures presented, such as wall insulation, air tightness and localised ventilation. As apartments are occupied and cost data established this may inform subsequent phases.

Should a 'best in class' refurbishment approach be adopted, it is recommended that the Passivhaus EnerPHIT standard is adopted for some or all apartments. To achieve certification will result in a low energy, well-refurbished (thermal bridges and air tightness) and comfortable dwelling.

3.2 Energy Feasibility Report Recommendation

Refer to DSQ-CDL-XX-XX-RP-SY-70201

As phases are developed a fully fossil fuel free, all heat pump energy centre, may be considered again, as, and when efficient technology is available.

The design team met on the 8th February 2021 to collectively review the scenarios and make the following recommendation based on energy performance, carbon emissions, cost, programme, design, risk and best practice.

It is recommended that the general principles in Scenario 2 are instructed and designed at RIBA Stage 3. This does not include insulation to the walls. Elements of Scenario 3 are also recommended for design at RIBA Stage 3.

In summary:

- Central Energy Centre including boiler and air-source heat pump (typically operating ~80% via heat pumps per year).
- Distribution of water at high temperature to reduce/minimise stored water thus reducing risk of legionella.
- Each apartment to have a Heat Interface Unit (HIU) allowing direct apartment energy billing for heating and hot water heating.
- Triple glazing to be further investigated and is deemed to be a low-cost addition to improve, acoustics, energy and comfort.
- Local mechanical supply and extract ventilation units is preferred compared with centralised. This is mainly to avoid costly acoustic/fire control measures and has added benefits of tenant paying for their own ventilation and likely energy/carbon reductions overall. Noting increased maintenance and visual impact of wall grilles/air bricks (possibly a planning issue due to local conservation area).
- Roof mounted photovoltaic panels is recommended.
- Further investigation may be needed at the start of RIBA Stage 3 into the integration of water source heat pumps from the boreholes.

It is noted that the Scenario 3 heat pumps, for each apartment, with an energy sharing ambient loop, is not recommended due to the requirement for stored water in each apartment (risk of legionella), increased maintenance costs and that the energy sharing opportunity is low unless cooling becomes a requirement.

It is further noted that with improved air tightness, and reduced infiltration, the apartments may retain heat for longer with reduced ability to lose the heat. This may impact on the apartments being warmer than pre-refurbishment during periods of warm weather, exacerbated by climate change, leading to the potential for complaints due to discomfort. Cooling retro-fitted later would be more disruptive for scenario 2 than scenario 3.

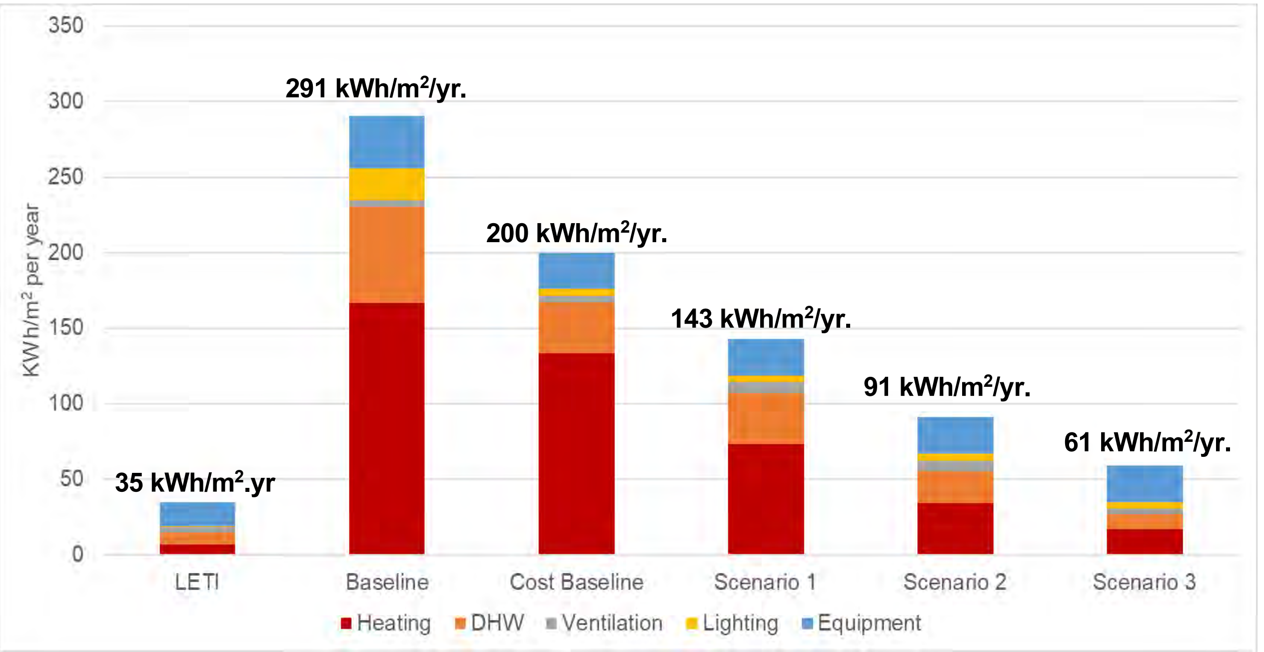


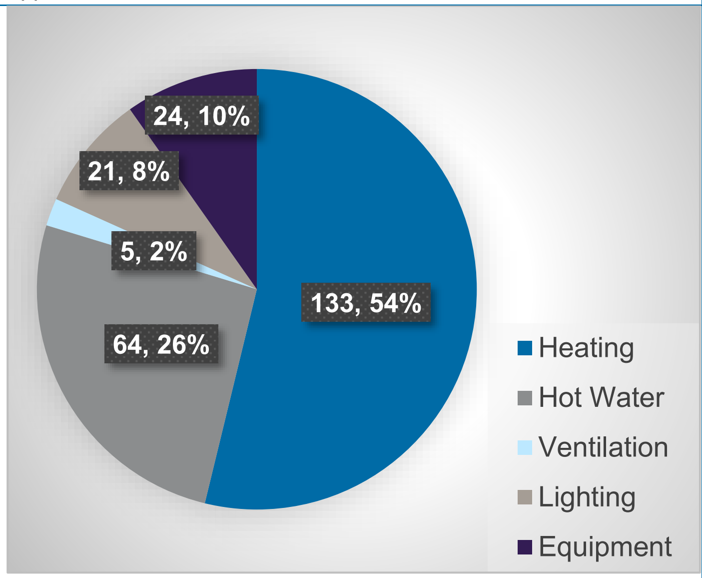
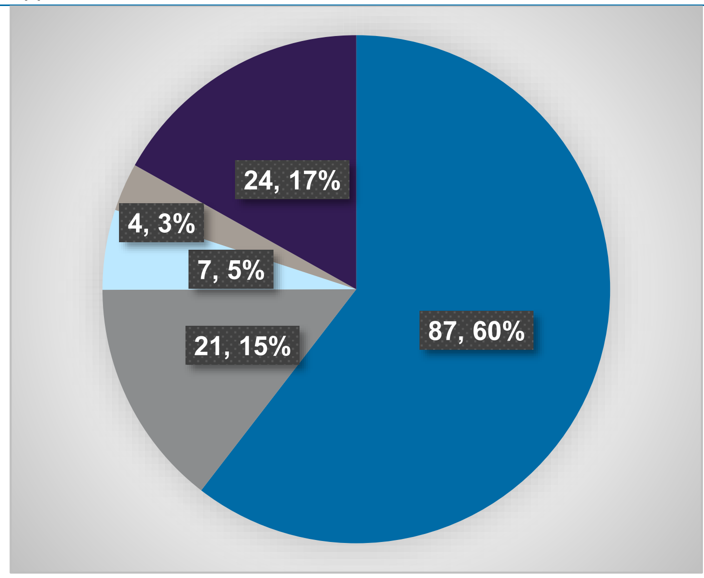
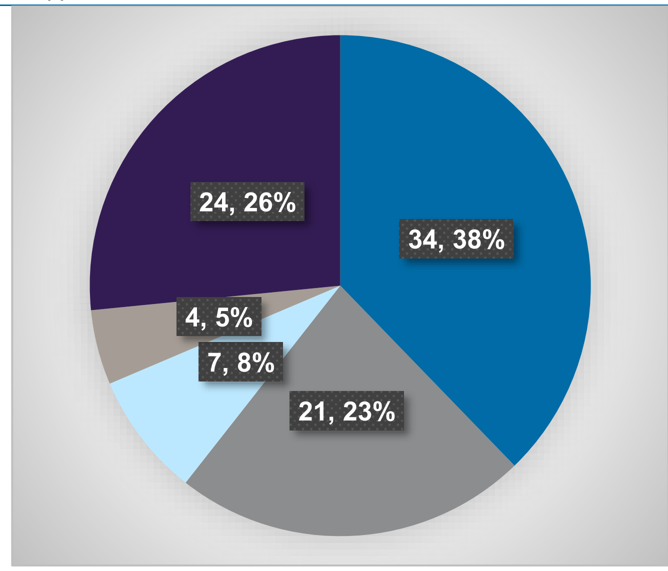
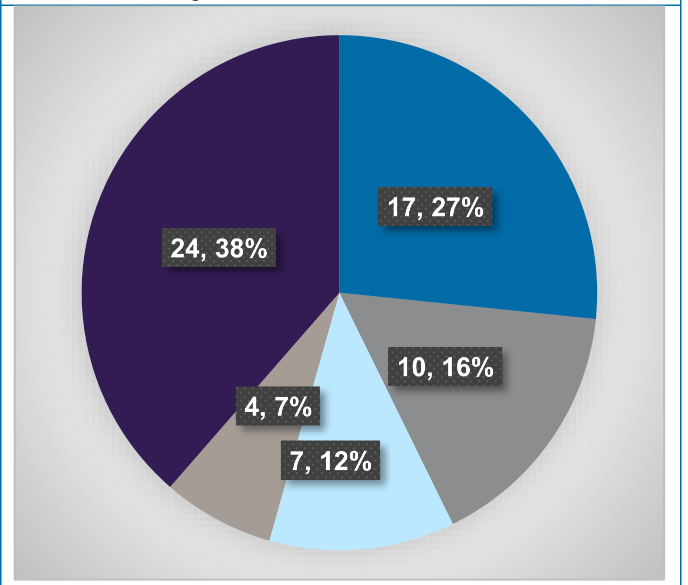
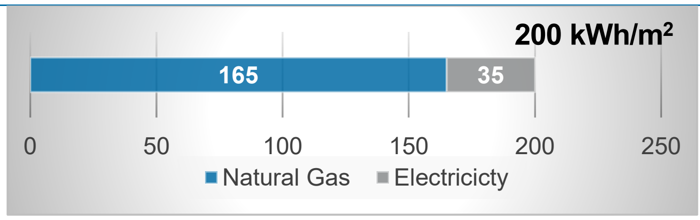
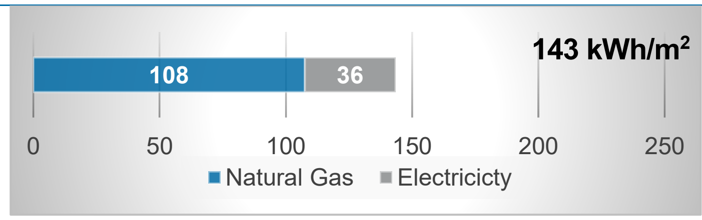
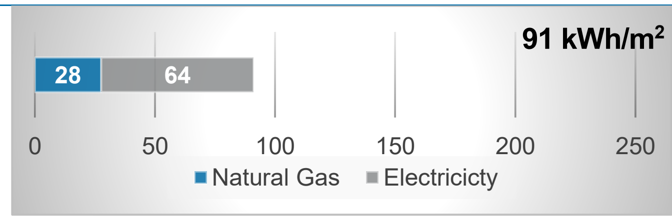
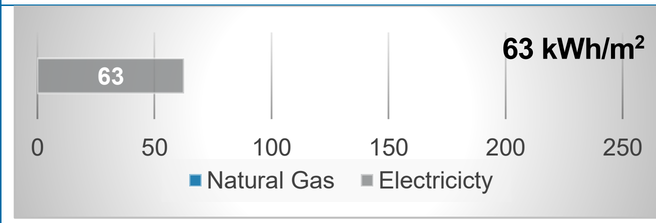
Figure 3.2.1 - Energy demand assessment (same as Figure 1.4.1)

Referring to Figure 3.2.1:

- The Baseline energy is based on the existing utility consumption (gas and electric) for 2019.
- The Cost Baseline is the estimated energy consumption for the underwritten cost baseline refurbishment. This is a fossil fuelled heat strategy via replacement boilers.
- Scenario 2 is the recommended refurbishment strategy excluding wall insulation. This is predominantly (~80%) fossil fuel free.

The table below illustrates the energy use, the split between electricity and natural gas fuel use as well as the carbon impact in 2035. Scenario 3 performs the best, from an operational carbon emission perspective where an all-electric strategy provides heat and hot water. For this scenario, the priority is to reduce unwanted uncontrolled infiltration through sealing any gaps in the fabric. The replacement window performance to prevent air leakage, with sash windows, needs to be carefully considered.

<table>
<tr><th></th><th>Base Costed Scenario</th><th>Scenario 1</th><th>Scenario 2</th><th>Scenario 3</th></tr>
<tr><td>Description</td><td>Fabric Works: New Windows, New Insulated Roof
Air Tightness Target: - Assumed ~3
Energy Centre: Boilers with flow and return (F&R) temperature 63/30°C
Ventilation (Regulations): Centralised Roof Extract
Ventilation (Comfort): Windows
Apartment: Heat Interface Unit, piped to radiators, sanitaryware & appliances</td><td>Fabric Works: New Windows, New Insulated Roof
Air Tightness Target: 3
Energy Centre: Boilers with flow and return (F&R) temperature 63/30°C
Ventilation (Regulations): Localised MVHR
Ventilation (Comfort): Windows
Apartment: - Heat Interface Unit, piped to radiators, sanitaryware & appliances</td><td>Fabric Works: - New Windows & Insulated Roof, Walls Insulated
Air Tightness Target: - 1
Energy Centre: - Air Source Heat Pumps & Boilers, F&R temperature 63/30°C
Ventilation (Regulations): - Localised MVHR
Ventilation (Comfort): - Windows
Apartment: - Heat Interface Unit, piped to radiators, sanitaryware & appliances</td><td>Fabric Works: - New Windows & Insulated Roof, Walls Insulated
Air Tightness Target: - 1
Energy Centre: - Heat Pumps (borehole water & air source), F&R temperature 20/25°C ~2,000m² Roof photovoltaic panels
Ventilation (Regulations): - Localised MVHR
Ventilation (Comfort): - Windows
Apartment: - Water to Water Heat Pump, piped to radiators + How Water Storage</td></tr>
<tr><td>Energy End Use kWh/m²

2019 Baseline = 291</td><td></td><td></td><td></td><td></td></tr>
<tr><td>Fuel Use kWh/m²</td><td></td><td></td><td></td><td></td></tr>
<tr><td>Today's Fuel Cost</td><td>£544,000</td><td>£457,000</td><td>£540,000</td><td>£486,000</td></tr>
<tr><td></td><td colspan="4">Today's terms using the utility bill tariff data for 2019 with fuel prices 12.85p/kWh Electric, 2.765p/kWh Natural Gas (Electric approximately proportioned day / night tariff) and Apartment Area @ 60,000m² - rounded to the nearest £1,000</td></tr>
<tr><td>Carbon kgCO₂e/m² (2035)

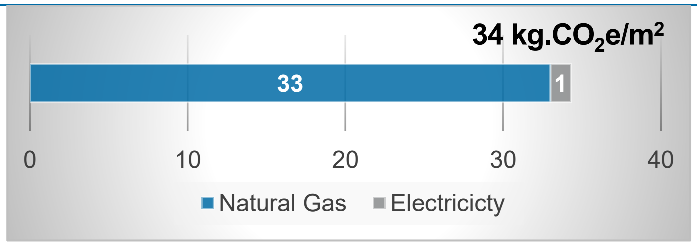
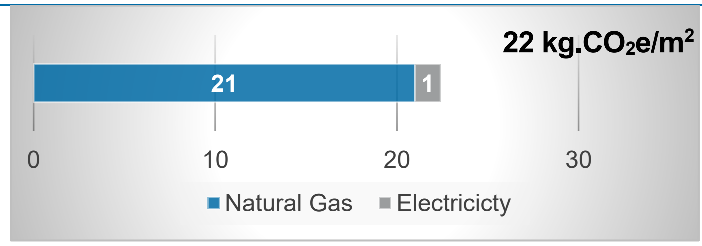
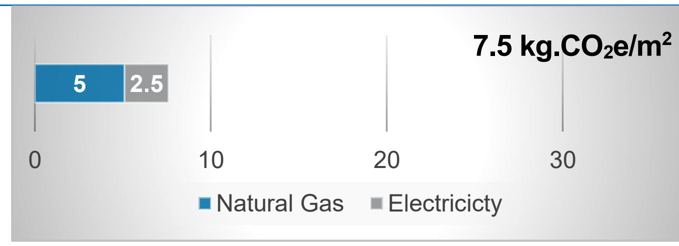
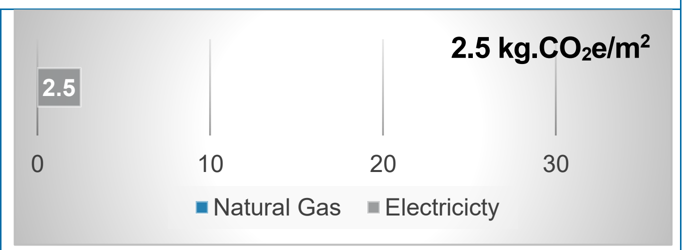
2019 Baseline = 48.5</td><td></td><td></td><td></td><td></td></tr>
<tr><td></td><td colspan="4">The carbon emission conversion factors are based on 0.02 for electricity and 0.2 for fossil fuel. Source – Department for Business, Energy & Industrial Strategy tables for reporting green-house gas emissions as last revised in March 2019.</td></tr>
</table>

Table 3.2.1 - Energy by end use and fuel source, and carbon impact in 2035.

	Base Costed Scenario	Scenario 1	Scenario 2	Scenario 3
Description	Fabric Works: - New Windows, New Insulated Roof Air Tightness Target: - Assumed ~3 Energy Centre: - Boilers with flow and return (F&R) temperature 63/30°C Ventilation (Regulations): - Centralised Roof Extract Ventilation (Comfort): - Windows Apartment: - Heat Interface Unit, piped to radiators, sanitaryware & appliances	Fabric Works: - New Windows, New Insulated Roof Air Tightness Target: - 3 Energy Centre: - Boilers with flow and return (F&R) temperature 63/30°C Ventilation (Regulations): - Localised MVHR Ventilation (Comfort): - Windows Apartment: - Heat Interface Unit, piped to radiators, sanitaryware & appliances	Fabric Works: - New Windows & Insulated Roof, Walls Insulated Air Tightness Target: - 1 Energy Centre: - Air Source Heat Pumps & Boilers, F&R temperature 63/30°C Ventilation (Regulations): - Localised MVHR Ventilation (Comfort): - Windows Apartment: - Heat Interface Unit, piped to radiators, sanitaryware & appliances	Fabric Works: - New Windows & Insulated Roof, Walls Insulated Air Tightness Target: - 1 Energy Centre: - Heat Pumps (borehole water & air source), F&R temperature 20/25°C ~2,000m^2 Roof photovoltaic panels Ventilation (Regulations): - Localised MVHR Ventilation (Comfort): - Windows Apartment: - Water to Water Heat Pump, piped to radiators + How Water Storage
Total Annual Carbon Emissions	**2,085,000 kg.CO^2**	**1,404,000 kg.CO^2**	**528,000 kg.CO^2**	**189,000 kg.CO^2**
25 Year Carbon Emissions	**52,125,000 kg.CO^2**	**35,100,000 kg.CO^2**	**13,200,000 kg.CO^2**	**4,725,000 kg.CO^2**
Total 25 years Cost	**£79,154,243**	**£89,091,589**	**£98,647,872**	**£97,094,871**
	*Total 25 years cost = CAPEX + 25*OPEX, with OPEX = sum of [Annual Fuel Costs (based on 2035 cost from Cundall) + Annual Maintenance + Annual Carbon Offsetting costs (at an offsetting cost of £35/tonne)] less Annual RHI Grants.*			
Total Yearly Average Cost	**£546,235**	**£426,645**	**£415,800**	**£160,432** **(increasing to £243,156 with local MVHR)**
EPC Rating	**Not Assessed**	**Mainly EPC - C Band (69-81)**	**~50% EPC B and ~50% EPC C (77-83)**	**~90% EPC B and ~10% EPC (79-85)**
BREEAM	**Good**	**Very Good**	**Excellent**	**Outstanding**
WELL	**Silver**	**Gold**	**Gold**	**Gold**
Baseline maintenance figures have been assumed same as Scenario 1. Solar panels, triple glazing and water source heat pump are not included in scenario 2 but can be updated should scenario 2 include these.				

Table 3.2.2 - 25 Year Projections as provided by Longevity and received 14/01/21 with further detail received 21/01/21.

The below table received from Hollis 14th January 2021 provides a summary of the capital cost impact associated with the three Scenarios, for Duncan House.

Option Analysis - Allowances within each tab	Costs			
	Allowance	Change	% Change	Estimated uplift across the development
Original Cost Plan Allowance	£5,038,335.79			
Option 1	£6,032,727.25	£994,391.47	20%	£12,927,089.07
Option 2	£6,768,643.74	£1,730,307.95	34%	£22,494,003.39
Option 3	£7,096,466.66	£2,058,130.87	41%	£26,755,701.35

Additional options high level using Step 2 as the base scheme	Costs			
	Allowance	Change	% Change	Estimated uplift across the development
Original Cost Plan Allowance	£5,038,335.79			
Omit centralised MVHR system for localised MVHR	£6,695,967.20	£1,657,631.41	33%	£21,549,208.34

Table 3.2.3 Duncan House CapEx associated with the three energy scenarios (by Hollis).

These costs do not include VAT or inflation. These costs are broken down further for each scenario in the appendices.

The below table focusses on the operational cost impact associated with the three Scenarios for all apartment houses. Fuel cost has been provided based on 2020 and 2035 projections and is associated with all fuel use with the apartments (used in the apartment directly or through the energy centre fuel use). The 'Future Risk' is a rating to graphically demonstrate how each Scenario is or is not ready for the future net zero scenario in 2050 where regulations will favour all electric based systems; fossil fuel use will be taxed; investment and attraction to tenants may be impacted as well as the availability of natural gas, noting that the replacement 'hydrogen' infrastructure is uncertain.

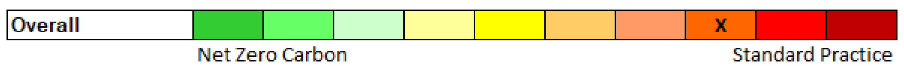
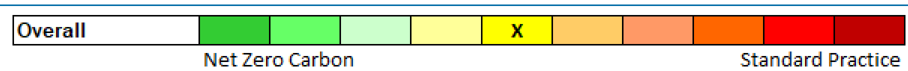
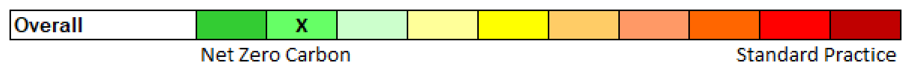
	Scenario 1	Scenario 2	Scenario 3
Description	Fabric Works: - New Windows, New Insulated Roof Air Tightness Target: - 3 Energy Centre: - Boilers with flow and return (F&R) temperature 63/30°C Ventilation (Regulations): - Centralised Roof MVHR Ventilation (Comfort): - Windows Apartment: - Heat Interface Unit, piped to radiators, sanitaryware & appliances	Fabric Works: - New Windows, New Insulated Roof, Insulation to External Walls Air Tightness Target: - 1 Energy Centre: - Air Source Heat Pumps & Boilers, F&R temperature 63/30°C Ventilation (Regulations): - Centralised Roof MVHR Ventilation (Comfort): - Windows Apartment: - Heat Interface Unit, piped to radiators, sanitaryware & appliances	Fabric Works: - New Windows, New Insulated Roof, Insulation to External Walls Air Tightness Target: - 1 Energy Centre: - Heat Pumps (borehole water & air source), F&R temperature 20/25°C ~2,000m^2 Roof photovoltaic panels Ventilation (Regulations): - Centralised Roof MVHR Ventilation (Comfort): - Windows Apartment: - Water to Water Heat Pump, piped to radiators + How Water Storage
Fuel Cost 2020	**£522,000 (54% Landlord – 46% Tenant)**	**£580,100 (59% Landlord – 41% Tenant)**	**£514,800 (33% Landlord – 67% Tenant)**
	2020 Utility Cost based – Department for Business, Energy & Industrial Strategy tables for retail fuel prices – 13.7p/kWh Electric, 3.52 p/kWh Natural Gas (Central band for commercial / public sector value) – Apartment area @ 60,000m^2 *Landlord / Tenant split assumes heat from energy centre is by the landlord.*		
Fuel Cost 2035	**£559,100 (55% Landlord – 45% Tenant)**	**£615,700 (60% Landlord – 40% Tenant)**	**£544,900 (33% Landlord – 67% Tenant)**
	2035 Utility Cost based – Department for Business, Energy & Industrial Strategy tables for retail fuel prices – 14.5p/kWh Electric, 3.83 p/kWh Natural Gas (Central band for commercial / public sector value) – Apartment area @ 60,000m^2		
RHI Grant Payment / year	**£0**	**£52,100** Air source heat pumps ~50% annual heat @ 2.79p/kWh (Consumer Price Index - CPI)	**£166,000** Air source heat pumps ~33% annual heat @ 2.79p/kWh CPI Boreholes and WW heat pump ~33% annual heat @ 2.248p/kWh (blended Tier tariff) Apartment WW heat pump ~33% annual heat @ 3.9085p/kWh (blended Tier tariff)
	Based on current tariff table. Note - Commercial RHI will result in Domestic RHI not being permitted together. Commercial RHI is planned to be scrapped by the government for applications after 31st March 2021. Accreditation can only be granted once an eligible installation has been first commissioned. Heat pumps cannot be used for cooling. The RHI is paid to the person carrying out the application. For Dolphin Square this is likely to be AXA for Scenario 2.		
Maintenance Cost / year	**£70,000**	**£80,000**	**£140,000**
	Boilers are low maintenance cost and therefore the figures provided will be extra over to maintain the MVHRs / HIUs / Heat-Pumps		
Legionella Risk	No stored water, therefore, legionella risk is low	No stored water, therefore, legionella risk is low	Stored water within apartments. Routine inspection / testing / maintenance required.
Future Risk			
Programme Impact	+ 7 Weeks	+ 10 Weeks	+ 10 Weeks
	Programme impacts noted are each an addition to the base case not a cumulative addition on each scenario.		

Table 3.2.4 - Operational costs associated with the three energy scenarios.

4.0

Site Services Infrastructure

4.0 Site Services Infrastructure

4.1 Existing Power Supply

4.1.1 Existing Services Infrastructure

Figure 4.1.1 - Existing electrical infrastructure.

The Distribution Network Operator (DNO) responsible for electrical supplies to site is UK Power Networks (UKPN). The site is presently supplied by 2 No. DNO-owned and operated sub-stations.

The north sub-station is located within the basement (room No. 26) and is supplied from the HV network located in Chichester Street. The sub-station contains 2 No. 800 kVA transformers which supply 2 No. existing Landlord switchboards (room No. 29) as well as metered supplies for the health club which is located in the basement of Rodney House, retail units and the apartments in Rodney, Duncan, Beatty, Hood and Keyes Houses on the north side of site.

The south sub-station is located within the basement (room No. 91a) and is supplied from the HV network located in Grosvenor Road and contains 2 No. 800 kVA transformers feeding 3 No. existing Landlord switchboards (room No. 91), as well as metered supplies for the Landlord service and the apartments located in Collingwood, Frobisher, Howard, Nelson, Grenville, Drake, Hawkins and Raleigh Houses on the south side of site.

The DNO have confirmed the Landlord current allowance is 1,100 kVA which is higher than then record capacity from the billing data provided by the site of 600 kVA. The Landlord system consists of 7 No. shipper meter which all have different functions and supplies different areas. The apartment installations are independent from Landlord installation due to being supplied via a sperate site owned and operated LV switchboard 1 No. per substation.

4.1.2 Proposed Services Infrastructure

Preliminary load calculations are based on the proposed decarbonisation of the heating installation and the energy strategy scenario 2 which is assumed to be the worst-case scenario consist of the use of heat pumps as part of the heating solution and the provision of 10 No. twin 22 kW electric vehicle chargers (EVCs) indicate the need for an additional 5.45 MVA of electrical capacity being required.

As such, a new additional 6 MVA 11 kV High Voltage connection will be required from the Regional electricity Company UKPN for the Landlord's installation. An application for a new connection has been submitted and we are presently awaiting the DNO's formal response, note the performance of the DNO is identified as a major risk item moving forward to the next RIBA stage.

Note this 'additional capacity' is for the Landlord's new heating installation and improvements only. The existing 'House Private Network and Landlord's supplies will all be retained and updated, as necessary.

The new UKPN connection is to supply expandable Landlord and operated HV switchboards which will ultimately supply 4 No. 1.25 MVA transformers (one for each energy centre) and 1 No. 800 kVA transformer for Landlord system including EVCs. The new HV switch room, sub-station and LV switch room are to be located in the existing car park for ease of access for the DNO and to enable ease of connection to site equipment on both north and south sides from transformers. It should be noted that the changes will result in the owning and operating HV assets and as such there will be additional cost associated with this and a need for suitably-trained personnel.

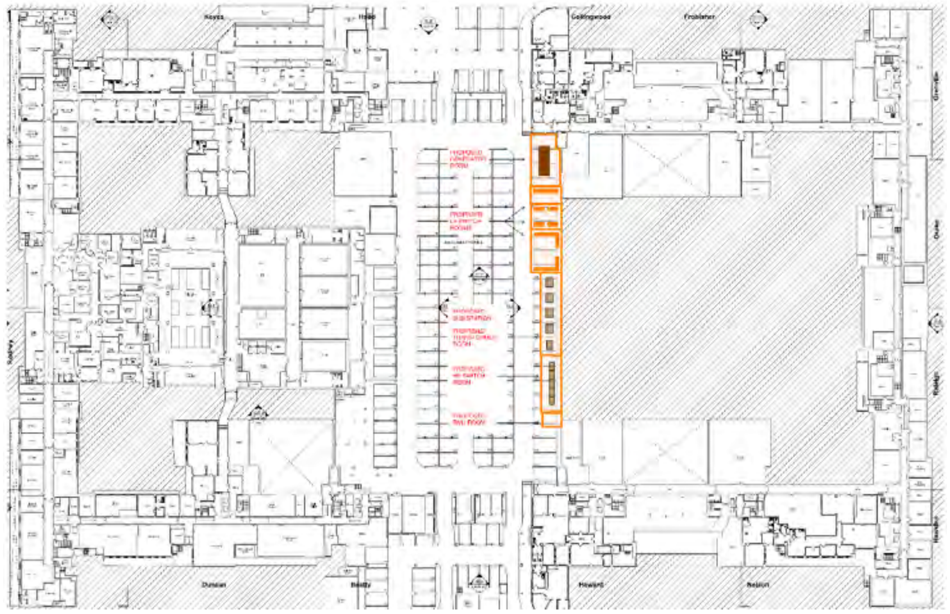


Figure 4.1.2 - Proposed electrical infrastructure at basement 1 level.

The initial phasing of the new Landlord supplies is based on the Client's refurbishment works phasing plan and are detailed within the phasing drawings.

It is assumed the apartments will continue to be supplied from the existing north and south sub-stations. The work associated with the apartment is detailed within section 6.3.3.

It is assumed that the electrical infrastructure to the apartments will need to be updated as a result of its age and condition, with additional electrical risers.

As a result of the scale of work required, considerations for use of iDNO for contestable works should be explored during RIBA stage 3 and once the DNO have formally responded to the upgrade request.

4.2 Gas Supply

The existing natural gas supply feeds the 3 main mechanical plant rooms at basement level in the Keyes, Howard and Collingwood plant rooms. Each have 4 No. gas-fired boilers providing heat energy for the apartment space heating and heating of the central basement calorifiers.

The existing gas load is predominantly taken up for the site heating and hot water generation and billed to Collingwood House. The site has a separate incoming gas billing arrangement for the Dolphin Brasserie.

The main incoming gas pipe is 300 mm, and the meter room is in Keyes House, which has sub meters for all three main mechanical plant rooms. A separate gas meter room is in Rodney House presumably for the Dolphin Brasserie.

It is the intention to greatly reduce the reliance on gas for space heating and hot water as part of the improvements to the space. Pending the level of thermal intervention, we suggest that some of the gas energy would need to be retained for the colder months. Remaining gas-fired boilers will be checked for compatibility with alternate fuel sources such as hydrogen, should this become viable in the future.

4.3 Wholesome Water Supplies

New Supplies

Currently the site has no connection for water supplies from the local Thames Water (TW) utility water supply network. Water for human consumption, ablutions and hot water generation is delivered from the 4 No. raw water boreholes onsite. Under the refurbishment works an application and submission will be made to TW for a series of wholesome water supplies delivered from the local authority network to serve the Dolphin Square development. The new wholesome water supplies will be provided with branch connections serving fire hydrants within the estate's ground floor concourse areas in suitable locations serving local brigade firefighting tenders.

The new supplies will be a major undertaking involving dialogue with TW on service connections, trench works to avoid the site's existing utility infrastructure and approved metering strategy for the site's revenue meters.

The strategy for the new supplies consists of 5 No. wholesome water supplies to serve new cold water storage break tanks located within the basement footprint serving the developments apartments, spa and swimming pool facility.

The new water supplies will be subject to a water services infrastructure charge levied by Thames Water.

The new supplies terminate within the basement water tank rooms with TW revenue meters, reverse rinse filter and spool piece to facilitate future commercial apartments meters. From the meter locations, water supplies extend to serve basement wholesome cold water, soft cold water storage tanks and packaged booster sets.

Figure 4.3.1 - Plan view of borehole locations.

4.4 Foul, Waste Drainage

The existing drainage outfalls to the estate's external drainage network in conjunction with the 4 No. connections to the local authority sewers are retained, inspected via CCTV, jet cleaned and repaired where required. For further detail of the proposed works refer to the project's civil engineer stage report.

4.5 Telecoms/Communications

All telecommunications connections and equipment installations are to be arranged by the appointed ICT specialist.

4.5.1 Existing Services Infrastructure

The existing supply consist of Fibre-to-the-local cabinet (FTTC) and copper-based network to the supply points. The site consists of 3 No. connection points from the BT/Openreach underground infrastructure and an assumed 1 No. connection from Virgin Media on the south site (still to be confirmed).

The main connection to the BT/Openreach consists of 1 No. connection point from north of site and 2 No. connection points from south.

4.5.2 Proposed Services Infrastructure

Aside from retaining the existing telecommunication copper infrastructure, an upgrade to the existing network is proposed to a fibre optic-based network (subject to the cost implications of providing a fibre optic incoming connection directly to site). Incoming fibre optic cables from BT/Openreach and Virgin Media to terminate in data cabinets. Main fibre optic cables then supply the Houses through telecommunication cabinets located at the existing roof tank room in each of the Houses. All cabling would be upgraded to fibre optic to provide a Fibre-to-the-premises (FTTP) infrastructure. Works are to be phased as part of the site refurbishment phasing plan.

Telephone lines are required for the project completion which are currently envisaged to be for the following:

- BMS system.
- Security systems.
- Lift (BS EN81 compliance).

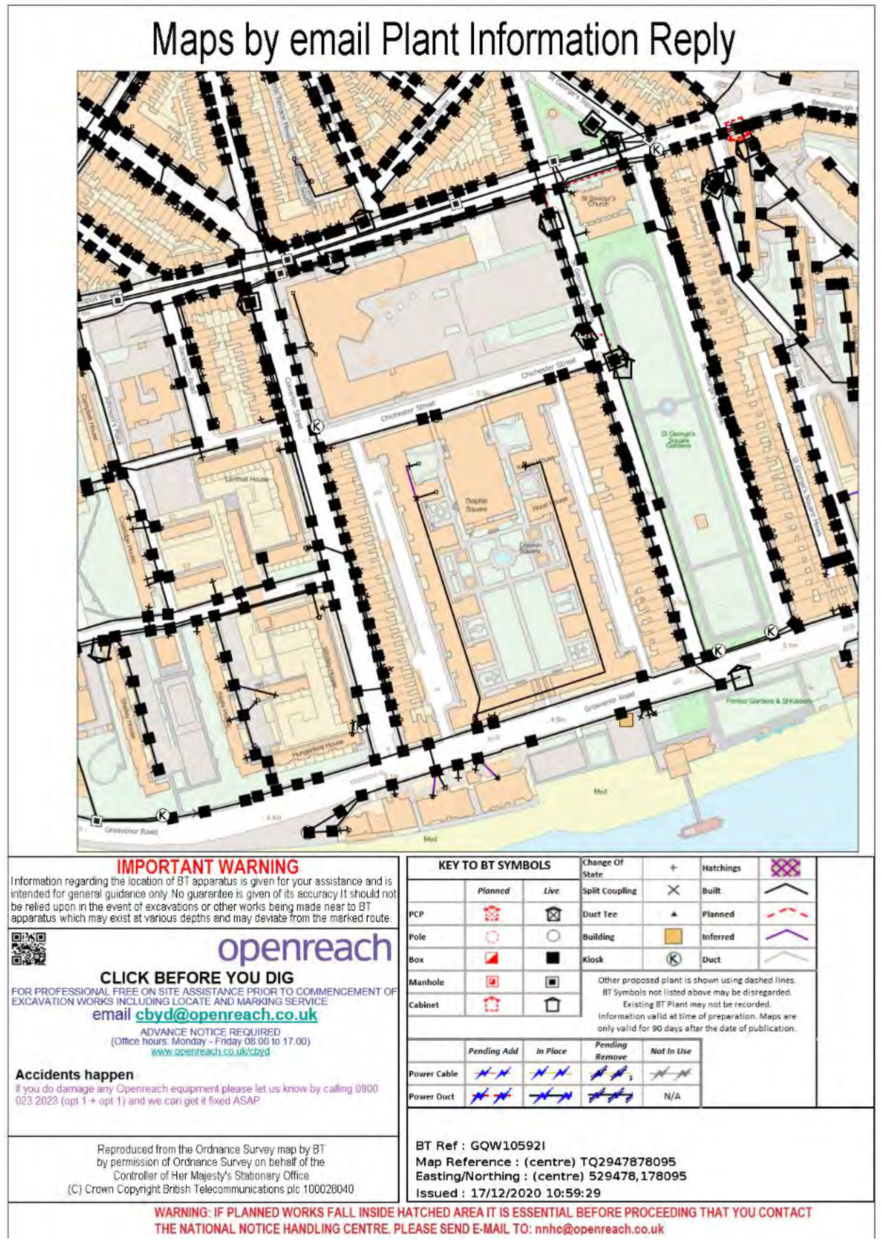


Figure 4.5.1 - BT infrastructure plan.

5.0

Stripping Out and Demolitions

5.0 Stripping Out and Demolitions

5.1 Mechanical Stripping Out

The existing heating system is split into three plant rooms which serve the following areas:

Keyes Plant Room – Hood, Keyes, Rodney, Duncan and Beatty Houses.

Howard Plant Room – Howard, Nelson, Hawkins and Rayleigh Houses.

Collingwood Plant Room – Collingwood, Frobisher, Grenville and Drake Houses.

Other refrigerant-based standalone plant, both direct expansion (DX) and variable refrigerant flow (VRF), serve a number of ancillary areas. From a heating perspective the Keyes plant room cannot be taken fully offline until refurbishment of Hood House is completed, following which the Keyes plant room could be stripped out and repurposed for either future plant or another use.

During the isolation and removal of each House system, it will be imperative that existing feeds to the House to be stripped out will be looped out and diverted as necessary to maintain the low temperature hot water (LTHW) to the adjacent Houses still reliant on the existing plant. Pending the condition and position of the existing valve sets this could include possible freezing of pipework and / or draining and re-filling of systems to get necessary diversions in place. This will depend to a large extent on how many Houses could be empty at the same time which we currently estimate to be two. Should a greater number of Houses be available then the process of looping out the pipework and possible temporary connections could be reviewed.

Stripping out of mechanical risers generally will require extensive new builderswork to be afforded to the risers as the existing access is insufficient to gain safe access. The same level of access will be needed for the future installation of all building services systems, and their maintenance thereafter.

The sample of apartment existing ventilation systems surveyed are in a very poor condition and generally not providing meaningful ventilation to the apartments, if at all in some cases. The extract systems are linked at roof level via a central plenum which is compromised in many areas. We would propose that the extract fans continue to run up until the point the planned roof works commence adjacent to any particular fan chamber. If the new local MVHR systems are installed and functional before the planned roof works, then the roof improvements could have some flexibility in the programme, but as the ventilation system is performing so badly, we do not think that there would be too much of a difference should the roof fans be taken offline while still serving an occupied block. This could be easily verified by a simple commissioning exercise with the fans running and then turned off to establish if the existing systems are providing meaningful ventilation.

The mechanical plant at the rear of Rodney House is largely redundant or in need of replacement. It is proposed that this will be replaced and pending the agreed lobby/entrance arrangements, new distribution and terminal units will be provided. The swimming pool ventilation plant has no heat recovery systems in place, and we would propose that the central plant and distribution is replaced. The water treatment plant accessed from the car park should also be replaced.

5.2 Public Health Stripping Out

5.2.1 Hot and Cold Water Services

The apartment Houses are served via 3 No. plant rooms, removal/isolation of domestic water services requires careful consideration and planning to align strip out and removal of the water services with the phased construction programme.

The removal of redundant domestic water services will be undertaken on a House-by-House refurbishment phase noting adjacent Houses served from the same plant rooms will require to be maintained online to the basement and sub-basement water storage tanks and hot water calorifiers to serve the occupied apartments.

The refurbishment water services design strategy, plant location and pipework distribution will be cognisant of the requirement to maintain water supplies through the refurbishment works.

Strip out and removal will typically consist of basement calorifiers, associated pipework, pumps, booster sets, rising water mains, roof distribution pipework and roof tanks.

5.2.2 Above Ground Drainage

The apartment Houses are served via accessible and non-accessible pipework risers. The existing above ground sanitation located within the floor risers will be stripped out and removed from site. At basement level both sanitary and rainwater pipework connect a series of combined drainage outfalls generally sited at high level basement 1. Redundant soil vent and rainwater stack are to be carefully removed to prevent damage to the site's outfalls which will be retained for use.

Strip out and removal will typically consist of apartment soil and anti-siphon riser pipework, roof rainwater pipework, apartment terrace connecting surface water drainage and roof located vent pipes/rainwater outlets.

Services will be removed in a phased operation to meet the projects construction programme and where required local modifications to foul water and surface water drainage installations to allow removal of redundant sections whilst maintain live services.

5.3 Electrical Stripping Out

5.3.1 Landlord Installation

All existing power, telecoms and lighting, including controls are dated and not in line with present standards or best practices. A qualified person should inspect, test, and ensure the systems are safe to work on before any removals are undertaken. All works around the DNO's substations will need to be clearly identified to the relevant persons before being undertaken.

While there has been some refurbishment works on site, much of the electrical distribution system is over 30 years old and is at the end of its serviceable life and as such is in need of replacement. Due to the life of the equipment, a multitude of colours may be found within the cabling – qualified personnel are to isolate and make the supplies safe before any works are to be undertaken.

Some of the lighting installation was recently refurbished. However, it was noticed that most of the lighting is either dated or in poor condition and would not comply with latest regulations, standards or best practice. It is recommended that the lighting installation and associated cabling/controls is replaced as part of any proposed refurbishment.

The fire alarm installation is being reviewed by the fire engineer who will provide their recommendation on the refurbishment of the system. However, it is assumed that it will be replaced with a new installation in line with the majority of the electrical installation.

There is an existing standby generator on site which is believed to supplying emergency lighting within the Houses. The generator is obsolete and is to be stripped out at the end of the works. Qualified personnel are required to safely isolate, test and decommission the generator.

As part of the proposed refurbishment all electrical services will be stripped out in a phased manner in line with the phasing strategy. The comms servers are to be stripped back to the point of supply and following the Client's site refurbishment phasing plan.

5.3.2 Apartment Installation

All power, telecoms and lighting, including controls and installations within apartments are dated and not in line with present standards and best practices. It is recommended that all installations are updated as part of the proposed refurbishment.

Different voltages and cable conductor colouring will exist within the system due to the range of installation dates present.

The existing floor-by-floor arrangement of metering for the apartments will be continued. The existing installation does not comply with current standards. Additionally, maintenance issues have been reported on site due to the compact sizes of the apartment risers. There have also been historical problems with the busbars including local fire.

Our recommendation is to continue with a rising busbar to serve apartments, the busbar will be located within a new electrical riser which is appropriately sized for the distribution equipment and group metering required.

The fire alarm installation is being reviewed by the fire engineer who will provide their recommendation on the refurbishment of the system. However, it is assumed the existing battery detectors will be replaced as part of the proposed works.

As part of the proposed refurbishment all electrical services will be stripped out in a phased manner. The servers are to be stripped back to the point of supply and following the Client's site refurbishment phasing plan.

5.4 Demolitions

An exercise has been completed to identify potential risers in Duncan House to be stripped-out and repurposed for the installation of new mechanical and public health services. This exercise also highlighted that some risers may need to be enlarged to accommodate the required services, including domestic and softened cold water services, rainwater pipework, soil vent pipework, LTHW pipework and – if a centralised MVHR approach is opted for – supply and extract ventilation ductwork (refer to Section 7.4).

The extent of the demolition and enlargement works will be greater and affect a larger quantity of risers if a centralised MVHR approach is adopted.

6.0

Summary of Main Plant and Service Distribution

6.0 Summary of Main Plant and Service Distribution

6.1 Mechanical

6.1.1 Heating Services

Current heating plant consisting of 12 gas-fired boilers and 8 hot water calorifiers will be replaced with new heat generating plant located in basement level energy centres.

A new heating or ambient loop will be installed to circulate water in horizontal pipework, at basement level or otherwise, to each House block, where new vertical pipework installed in mechanical risers will connect each apartment to the loop. The interface for these connections between each apartment and the Landlord circuit will either be a heat interface unit (HIU) or water source heat pump (WSHP) depending on the energy scenario chosen.

It is also proposed that each of the Houses is hydraulically separated from the main heat / ambient loop via a plate heat exchanger.

The new heating plant will either reduce or remove the site's current dependency on gas supply according to one of the three energy scenarios proposed:

Scenario 1: Reducing the quantity of heat required across the site through improvements to the building fabric, ventilation provision and increasing Tenants' control over their space heating and domestic hot water (DHW) provisions, to subsequently reduce the number and/or size of new gas-fired boilers relative to the existing plant. The heating plant maintains a low temperature hot water (LTHW) loop that supplies heat to the apartments via a heat interface unit (HIU).

Scenario 2: As per scenario 1, with further building fabric and ventilation improvements and therefore a further reduction in the demand for heat. The introduction of sustainable heating plant (air source heat pumps) will operate in a bivalent system alongside gas-fired boilers, reducing the number and/or size of the boilers further. As per scenario 1, the plant maintains an LTHW loop that supplies heat to the apartments via an HIU.

Scenario 3: New sustainable heating plant (heat pumps and photovoltaics) completely removes natural gas as a heat source for the site. The heating plant maintains a water loop at ambient temperature (~20°C), which connects to a WSHP located inside each apartment. The WSHP uses heat from the ambient loop to provide hot water for consumption and space heating. The WSHP is installed in lieu of an HIU and can also use the ambient loop to provide cooling to the apartment with a fan coil unit type solution as opposed to radiators.

Buffer vessels will be installed as part of the new energy centres to allow heating plant to be more efficiently sized or oversized pipework at basement level to offer more system volume, whilst ensuring that peak simultaneous demands for heating and DHW can still be met by the system. The loop will be driven by circulation pumps that are also installed as part of the new energy centres.

Consideration will be given to the energy centres to have the option of being linked so that capacity from either energy centre can support the other, should devices be taken out of service for any reason. For scenarios 1 and 2, consideration will be given to the boilers being installed on a temporary mobile platform in the car park, complete with a flue dilution system. This would enable new heating plant to operate during the phased construction process and then subsequently be moved into the existing heating plantrooms at B2 level once existing plant in these areas have been decommissioned. This would reduce the amount of new plant space required at B1 level.

The space heating and DHW circuits are hydraulically separated by heat exchangers located in the HIU/WSHP. For scenarios 1 and 2, plate heat exchangers can provide further hydraulic separation between the basement-level heating loop and the vertical pipework in each House block to allow any faults to be more easily isolated, reducing the extent of any downtime.

The LTHW circuit from the energy centre(s) will distribute at B1 level to each House and interface with the House LTHW circuits via a heat exchanger.

The LTHW circuit of each House will split and distribute vertically via a number of mechanical risers from B1 to the top residential floor, where a bypass loop then returns back down the riser to B1 level.

From the risers, LTHW pipework will distribute horizontally at each level to each apartment, where it will interface with either an HIU or WSHP. Risers adjacent to apartments will be utilised where possible to minimise the number of instances where pipework will need to distribute across corridors.

The centralised ventilation option will utilise a number of AHUs on the roof of each House to supply and extract air to/from the apartments. Each AHU will connect to vertical supply and extract ductwork in mechanical riser(s). From the risers, ductwork will distribute horizontally at each level into each apartment. Air will be supplied to living rooms and/or bedrooms and extracted from kitchens and bathrooms. Horizontal ductwork will be distributed within ceiling voids/bulkheads in the apartments. Risers adjacent to apartments will be utilised where possible to minimise the number of instances where pipework will need to distribute across corridors.

6.1.2 Cooling Services

It is anticipated that front of house, amenity space and the like will have mechanical cooling via packaged VRF systems or similar which could extend to staff offices and other non-apartment ancillary spaces. An option for mechanical cooling of the apartments has been reviewed in line with the pending overheating assessment. This could be potentially facilitated by an ambient loop type system which connects to fan coil units in the apartment which have integral water cooled heat pumps within the FCU casing, which can operate in heating or cooling modes. Alternate means of domestic hot water provision would need to be considered with an ambient loop approach which could include hot water storage with electrical heating in the absence of heat interface units, which is problematic due to the absence of space to accommodate hot water storage especially in the smaller apartments.

6.1.3 Ventilation Services

Strategies for both centralised ventilation and individual apartment ventilation are presented in Section 7.4. For the centralised ventilation strategy, primary ventilation plant (air handling units) would be located on the roof of each House block to serve the apartments of that House, with top-down vertical distribution of supply and extract air via ducts in mechanical risers, connecting horizontally onto adjacent apartments. For individual ventilation on an apartment-by-apartment basis, mechanical ventilation heat recovery (MVHR) units are located inside each apartment, containing all ventilation provision to within Tenant areas.

The swimming pool hall will be ventilated using a new, dedicated air handling unit with heat recovery, located in a new plant enclosure located above and adjacent to the swimming pool hall.

New ventilation plant will serve the lobby and common amenity areas separate to the ventilation provision for the apartments.

6.2 Public Health

Scenario 1: Basement cold water storage tank rooms housing modular wholesome water tanks with adjacent packaged booster sets deliver boosted wholesome water supplies to roof level distribution networks serving existing apartment risers housing new water supplies. From the boosted water supplies, branch connections via data output meters serve each apartment bathroom WHBs, WCs, kitchen sink and white goods. A domestic sprinkler branch supply with backflow protection will be provided from the boosted cold water main serving each apartment via a flow control valve activated through the apartments fire alarm system to ceiling or wall mounted water sprinklers.

To maintain the current softened water quality for hot water a packaged soft water plant located in the basement plant rooms will deliver softened water to a storage tank and packaged booster set. From the booster set soft cold will be delivered to roof level distribution pipework serving the apartment risers. New soft cold water supplies from the riser will be taken via branch connections with data output meters to serve each apartment heat interface unit (HIU). As part of the projects reduced energy strategy domestic hot water will be delivered at 50-55°C to bathroom showers, baths, WHBs and kitchen sinks. Temperature control will be provided locally at showers and baths via Scheme II thermostatic mixing valves.

Scenario 2: The low temperature hot water solution as described within the mechanical services options provide primary circuits for the generation of domestic hot water via HIU as described under scenario 1.

Scenario 3: The ambient loop solution as described within the mechanical services options provide primary circuits for the generation of domestic hot water via low content storage vessels with integral electric water immersion heaters to raise and maintain water at 60°C.

6.2.1 Main Domestic Cold Water Distribution Routes

The new basement 1 located cold water storage plant rooms utilise current storage or repurposed back of house areas. The tank rooms house water storage tanks sized on apartment bedroom occupancy for wholesome and soft water. Wholesome cold water booster sets suitable for both drinking water and domestic sprinklers and soft water distribution will be housed in the tank rooms.

Water services for washdown, vehicle valet and landscape irrigation will be served via a category 5 water packaged break tank and booster pump units.

For the phased works associated with the apartment refurbishment the water services strategy developed permits the retention of existing water supplies for local isolation and strip out where the new works are required to be undertaken.

The stage 2 report considers an option for maintaining cold water storage temperatures below 20°C. To main a safe and pleasant delivery temperature to the apartments the wholesome cold water distribution circuits incorporates a cold water return, circulating water from the apartment risers to a pressurised sealed vessel located within the house tank rooms. The vessel will be linked to a water-to-water plate heat exchanger and chiller to maintain system distribution water at a temperature between 10 - 20°C.

The cold water storage tank contents are maintained by the regular turnover of wholesome water in the reduced capacity tanks combined with providing fresh air ventilation of the tank plantrooms.

The boosted cold water rising mains are delivered to roof levels via independent (non-apartment) risers. The externally roof located boosted cold pipework will be supported on raised rail system complete with frost protection tape, thermal insulation wrapped with a UV stable solar reflecting waterproof membrane. The pipework delivers the boosted water supplies to the existing and new apartment risers in a top to bottom arrangement with return circulation pipework at the base of each wholesome cold water riser returning to the basement plant rooms chilled water plate heat exchanger to maintain system water temperatures below 20°C.

Apartment heat interface units (HIU) generate domestic hot water for ablution purposes, larger apartment containing 2 bathrooms or bathroom and en-suite, HIU units will provide additional storage to cater for the larger hot water load required.

A further option considered is the generation of the apartment domestic hot water from an ambient primary hot water loop. Domestic water will be generated via minimum hot water storage vessel served from the ambient loop circuit with additional electrical energy input to raise hot water temperatures to the acceptable level. Architectural apartment layouts require the additional consideration for provision of space to house the hot water vessels which under the HIU arrangement are less of an impact in terms of required storage space.

6.2.2 Main Above Ground Drainage Routes and Sewer Outfalls

The MEP refurbishment works removes existing apartment foul, wastewater drainage and ventilation stacks. Foul and wastewater stacks have been installed in a mixture of cast iron, galvanised mild steel, copper and uPVC where apartment upgrades have taken place, with a number of anti-siphon pipes disconnected from the primary soil waste stacks.

At basement level 1 a series of combined foul and surface water sewer outfalls discharge through the retaining wall connecting to the estate's external drainage network, discharging off site to the Thames Water drainage sewers. Sketch drawing DSQ-CDL-ZZ-B1-P-SK-00991 details the internal suspended drainage at basement 1 serving upper apartment floors. The drainage discharge strategy in the absence of site record information is based on a site visual survey.

The existing outfalls are to be retained, inspected via CCTV and tested. Where the camera survey and test identifies defects with the drainage outfalls the defective section shall be replaced or repaired and tested to current standards and good working practices. The overall foul wastewater discharge from apartments to the drainage infrastructure will remain similar in terms of discharge therefore drainage pipework capacities suitable. A further review of drainage discharges will be undertaken at the next stage.

Within the existing apartment service risers, the drainage soil, waste and antisiphon stacks will be removed and replaced with new lightweight cast iron or prefabricated galvanised steel pipework and components to serve the apartment bathrooms and kitchens. Stacks are to be positioned within the service risers to afford ease of access for maintenance personnel and permit the apartment drainage to be installed without the introduction of unnecessary bends and branches reducing the risk of discharge blockages from the apartments' bathrooms, en-suites and kitchens.

Soil vent stacks rise through the mechanical service duct discharging to atmosphere at roof level, terminating at atmosphere to avoid opening windows and or ventilation plant air intake louvres.

6.2.3 Surface Water Drainage

The internal drainage installation is of a combined arrangement with roof surface water drained via gully outlets to rainwater stacks located in apartment service ducts draining down through the house blocks to basement. Surface water pipework connect the suspended primary drainage installation via trapped branch arrangements. The combined drainage strategy will be maintained under the apartment refurbishment works.

6.3 Electrical

6.3.1 General

The electrical infrastructure is to be replaced as a result of age, condition and increase in electrical requirements resulting from the decarbonisation of the site's energy sources.

6.3.2 Landlord Installation

The provision of a new 11kV HV connection to site.

The provision of a new expandable HV switchboards design to be extended with each phase and located in the existing car park as denoted in Section 9.0.

The provision of new north and south LV switchboards, a life safety LV switchboard as well as 4 No. energy centre LV switchboards.

The provision of a new life safety generator including flue dilution system.

The provision of new final-circuit distribution boards and panel boards as required by the installation.

6.3.3 Apartments Installation

The existing north and south DNO sub-stations are to be retained and supply the apartment installations (subject to the DNO confirmation).

4 No. apartment LV switchboards, two supplied from each sub-station. The apartment LV switchboards are to supply rising busbars or group metering rooms for the apartments.

The existing risers contain rising busbars. In terms of space allowance, the existing busbar age and the size of the risers, these will result in issues in the long term and there have also been historical issues with the installation including fires.

The following options are available with regard to the apartment installations:

Option 1 – Retain existing arrangement using existing electrical risers

This proposal would reuse the existing apartment risers. The existing busbars and associated infrastructure would need to be replaced and upgraded with new systems to accommodate the increase in electrical load. The replaced busbars would need to be of a low profile to enable it to fit within the existing space. However, this will still result in spatial compromises which may not be acceptable. We do not believe this to be a viable solution at present given that the customer has already highlighted space and maintenance issues which will be worsened by changes in busbar arrangements.

This option is not recommended.

Option 2 – New electrical riser for new rising busbar and associated group metering room on each floor

This option provides a new electrical riser to accommodate the increased rated busbar, tap-offs, Ryfield panel, isolators and metering at floor-level. The existing electrical risers would then be converted and reused for the distribution of Landlord electrical services and ancillary electrical wiring i.e. fire alarms, telecoms, data, etc.

We have reviewed this option and the new riser space indicated by GRID and believe this to be the most viable solution. Option 2 is the recommended solution proposed by Cundall at RIBA stage 2.

Option 3 – Relocate group metering point to the basement.

This option would require a new cable riser. While the cable riser is likely to be smaller than the other options the large volume of cables will be difficult to manage within the basement as a result of the circa 1200 individual apartment supplies being distributed. This solution will require large parts of the basement to be converted into group metering rooms.

This option is not recommended.

6.4 Electrical Main Service Distribution Routes

6.4.1 General

The general distribution strategy of the electrical equipment will be installed to complement the building and the electrical network as described in Section 9.0.

All building services will be concealed and distributed horizontally within ceiling voids. Changes in direction of electrical containment above plasterboard ceilings will be minimised. Vertical distribution routes will be via dedicated landlord riser shafts that form part of the cores. The MEP Contractor will be responsible for the coordination of all mechanical, electrical, and public health services. The MEP Contractor will provide lockable and suitably fire rated hatches of an appropriate size in plasterboard ceilings for access to maintainable items of plant or components that form part of the electrical services.

Where services are exposed, particular attention will be paid to the design, installation standard, and quality of finish and coordination with other services and other elements of the building design. The finish to exposed services and surface penetrations will be agreed with the Architect and Client.

Where services penetrate fire compartment divisions, all required fire stopping/ fire dampers and proprietary support frames, etc, will be provided. The rating of the fire stopping will be equivalent to the compartment being penetrated.

Position and install all items of plant and services in accordance with the electrical services materials and workmanship specification and relevant suppliers and manufacturers recommendations to support future maintenance.

6.4.2 Landlords Services

The distribution strategy for the Landlord's system has been illustrated on the stage 2 drawings shown in Appendix A of this report.

Existing services are being removed and upgraded with new services. All new services will be routed via the basement at high level towards the vertical risers or vertical openings to ground floor risers for distribution to the rest of site. Consideration for cost, safety and access/maintenance requirements for this routing method and any alternative routing methods (i.e. trenching, etc.) to be allowed for this project.

Depending on which option is selected for the apartment LV distribution make a difference on the connection between the existing site transformers to the apartments.

The preferred option 2, will require new sub-mains routed within the basement, connecting to rising busbar end feeds located on the ground floor within the new electrical riser. The rising busbar will supply a new group metering arrangement on each floor. There will be new apartment supplies leaving the new group metering rooms, routed along the corridors at high level to supply the apartments, serving new consumer units within each apartment.

6.5 Apartment Services

There are a number of MEP services that are required to be distributed within each House to serve the apartments.

These services include:

- Internal lighting and emergency lighting.
- Small power.
- Fire detection, fire alarm sounders and associated wiring.
- Wholesome water supplies.
- Softened water supplies.
- Ventilation ductwork.
- LV electric cabling.
- BMS and energy management systems.
- Local extract ventilation systems (LEV).
- Telecommunications.
- Security and access control.

These services emanate from the main apartment consumer unit, location of this within each apartment is to be agreed at the next stage.

6.6 Plant Access / Maintenance / Plant Replacement

A strategy for access to plant, maintenance and replacement is being developed and has been considered in these proposals. Generally, the current thinking is to try to avoid roof mounted plant that has elevated levels of risk and complexity for access. Having localised MVHR systems to each apartment will mitigate the need for roof mounted ventilation equipment apart from mechanical smoke ventilation should that be included in the final scheme.

New heat generation plant, domestic water plant and electrical sub stations and LV panels and any other larger items will need to be located in such a manner that the initial installation and subsequent maintenance and eventual unit replacement can be done in such a manner as to mitigate risk and minimise manual handling as far as practical. This will include but not limited to having smaller modules of heat pumps as opposed to larger units requiring onerous lifting equipment and the like, gas boilers which can have the option of being broken down and reassembled, and sectional water tanks and modular LV panels.

New sub stations by nature of their design need 24/7 vehicle access to them and locating them in the car park would be a natural suggestion to facilitate this basic requirement, which would also serve to aid their replacement should the need arise.

The majority of the central MEP plant is proposed to be located at basement level. As there is good vehicle access by virtue of the car park, this will materially aid the installation and future plant replacement strategy.

Access to the existing risers is extremely poor and non-existent in some cases. Increased access will be needed for their safe removal and to carry out remedial works to the risers (fire stopping etc). For the safe installation of new MEP services, and just as importantly the subsequent maintenance, modification and eventual replacement of them, permanent access of sufficient size will be needed to all risers on all levels.

Ancillary MEP devices such as heat interface units, energy and water meters, electrical consumer units and apartment MVHRs will also need suitable access for inspection and maintenance and not rely on destructive access to service and inspect them.

These proposals will be further developed at the next stage RIBA stage 3.

6.7 General Mounting Heights

Equipment will be installed in accordance with the following mounting heights and the measurement indicated will be the distance between the finished floor level and the bottom edge of each unit to comply with Part M of the Building Regulations:

Item	Mounting Height (mm)
Lighting switches (general)	1200 mm to top of light switch
Socket outlets (general)	450 mm to bottom of socket outlet
Socket outlets / connection units (above worktops)	150 mm (above worktop)
Socket outlets (plantroom areas)	600 mm above finished floor level
Fire alarm detectors (integral sounder)	Ceiling mounted
Isolators	1100 mm
Switched connection unit	1100 mm
Call points	1200 mm

Table 6.7.1 Mounting heights.

6.8 Metering Strategy

The Landlord installation will be provided with the ability to meter energy in accordance with the requirements of Building Regulations and MID directives where being used for financial transactions and billing.

Provide the building with energy monitoring software, to monitor the energy usage throughout the extension. This should include the provision of 'out-of-range' alarms.

The end energy consuming uses to be identifiable to building users either through labelling or data outputs.

This system will monitor the energy usage throughout the building, based on the following strategy:

All statutory authority meters will be provided in the respective intake rooms (gas, electricity and water).

Sub-metering of all distribution boards to comply with Part L and the general requirements of CIBSE TM 39. All energy meters will be located on the outgoing circuit on the switchboards or integrated in distribution boards as required.

Separately meter the following major energy consuming systems:

- Electric space heating
- Electric domestic hot water heating
- Ventilation, i.e. fans (major, including fans in air handling units)
- Water

- Pumps
- Lighting
- Small power
- Lifts

Locate energy meters in areas of the building that allows for easy access to facilitate regular energy monitoring and readers by the building occupant/facilities manager. Typically, in plant, main distribution, or control rooms where the building energy management system (BEMS) is installed.

Each apartment is to be individually metered as follows:

Electrical Consumption: Electrical MID/shipper meter located with group metering room/ electrical riser on each floor supplying individual apartments. MID/ shipper meters are assumed to be smart meter in line with latest guidance. Apartment to be provided with local metering and remote graphical displace to indicate local consumption.

Heating Consumption: Local MID compliant heat meter to be provide at the heat interface unit without put to enable connection to bill package.

Water Consumption: Local MID compliant water meter to be provide at the heat interface unit without put to enable connection to Landlord bill package, this will cover both the softened water supply to the HIU and raw wholesome water to cold water outlets

6.9 Design Life

The new engineering systems will be designed with materials, components and techniques that are readily available, reliable and maintainable so that, provided the building is maintained in accordance with good practice and the guidelines and recommendations contained in the operation and maintenance manuals.

The following economic life factors are extracted from the guide to ownership, operation and maintenance of building services published by CIBSE (Guide M). We propose that the M&E design is progressed on the basis of selecting plant which should achieve these economic life factors:

Refrigerant Based Cooling Systems	10-15 years
Galvanised ductwork	25-35 years
Centrifugal fans	15-20 years
Pipework	25-45 years
Insulation	25-30 years
Pumps	15-20 years
Air handling units (AHUs)	15 years (excluding component parts replacement)
BMS operating system	10 years (refer to Guide M for specific deviations)
Switchgear and distribution equipment	20-25 years
Lighting control and man. system	15-20 years
Cabling	25-35 years
Luminaires	20 years (excluding external luminaires)
Access control system	12-17 years
Fire detection and alarm system	17-23 years
Lifts	20 years (excluding component parts replacement)

The above figures should be considered when undertaking the Planned Preventative Maintenance (PPM) strategy for the finished building installations.

Wherever practicable all plant and materials will be from suppliers established and operating in the UK.

6.10 Spares

Include for spares, tools and accessories applicable to the works as part of this Section of the Works, as necessary to enable the installations forming a part of this Section of the Works to be fully maintained during the defects liability period and thereafter in accordance with the manufacturers recommendations. In addition, the spares as listed below, and included elsewhere in this specification, shall be provided immediately prior to, or at handover of the works to the Client.

- Spare set of all disposable filters for air handling units (AHUs), however, not for 'washable' type
- Spare domestic hot water return pump
- 1% of all luminaires
- 1% of all accessories
- 1% of all MCB/RCDs

6.11 Building User Guide

A building user guide shall be provided for the 'facility' works and will be appropriate to all users of the building. This includes general users such as staff as well as non-technical facilities and building management.

The guide will cover all functions and uses of the building, ensuring the building users are able to use the building effectively. Where relevant the document must describe the facilities to be shared and how access to them will be arranged for potential users.

The aim of this guide is to ensure that the provision of guidance for the non-technical building user, so they can access, understand and operate the building efficiently and in a manner in keeping with the original design intent. This guide therefore will provide information to the following:

- The building occupants/staff.
- The technical facilities management team/building manager.
- Other building users e.g. visitors/community users.

Cover the following information within this guide:

- An overview of the building and the environmental strategy e.g. energy/water/waste efficiency policy/strategy and how users should engage with/deliver it.
- An overview of building services and access to controls (where to find them, what they control, and how to operate them effectively and efficiently).
- Pre-arrival information for potential visitors e.g. access and security procedures/provisions.
- Any safety and emergency information/instructions.
- All building related operational procedures specific to the building type/operation.
- All building related training information/links.
- An outline of provisions of and access to transport facilities e.g. public transport, cyclist facilities, pedestrian routes etc.
- An outline of provision of an access to local amenities.
- Any re-fit, refurbishment and maintenance arrangements/considerations.

7.0

Mechanical Services

7.0 Mechanical Services

7.1 Scope of Works

This section provides a preliminary assessment of heating strategies and plant sources, including conventional sources (gas-fired boilers) and sustainable sources such as air source heat pumps and open loop borehole water heat pumps.

The energy strategy will be developed based on a central heating system using a number of centralised heating plantrooms that are installed to come online in line with the project programme. The strategy will be based on the further development of one the three energy scenarios presented both here and in the Energy Feasibility Study (DSQ-CDL-XX-XX-RP-SY-70201). This will include further detailed assessment of the heat sources presented in this section.

Heating system technologies within the apartment (heat interface units, water source heat pumps) and their feasibility of integration into the central heating system have also been assessed. Additionally, the feasibility of new mechanical provisions to each apartment (cooling and continuous ventilation) as part of the energy strategy have been studied.

Provisions for ventilation, heating and cooling for the lobby and common amenity areas are also discussed and proposals for these areas will be developed at the next design stage.

7.2 Heating Services

New energy centres will supply heat to a central Landlord heating loop at basement 1 level, from which pipework distributes horizontally to each of the Houses. Rising flow and return pipework in each House will facilitate the connection of each apartment into this heating system. The heat supplied to each apartment is used for both space heating (radiators) and domestic hot water. The heating plant, heating temperatures and means of hydraulic separation between each central plant, each House and each individual apartment will be as described by one of the three energy scenarios.

Where required, heating to common amenities and reception areas will be provided either by a common low temperature hot water (LTHW) heating loop (separate to a similar system serving the apartments) or by dedicated variable refrigerant flow (VRF) systems.`

Figure 7.2.1 Example of a ceiling void-mounted horizontal fan coil unit. Warm air heating can be provided either by 4-pipe (chilled water and LTHW connections) or VRF variants.

Figure 7.2.2 Example of a cassette-style indoor unit, mounted flush with the ceiling finish. Warm air heating can be provided either by 4-pipe (chilled water and LTHW connections) or VRF variants.

Figure 7.2.3 Example of an outdoor VRF heat pump unit, which can connect to several indoor units to provide simultaneous heating and cooling to different zones via a refrigerant branch controller box.

7.2.1 Central Plant

7.2.1.1 Scenario 1

A new centralised, Landlord low temperature hot water (LTHW) heating loop is installed at basement 1 level. New gas-fired boilers will be installed to provide heat into the loop. Buffer vessels will be installed as part of the loop to enable more efficient sizing and utilisation of boilers and pumps whilst ensuring peak heating and hot water demands will be met. The boilers will operate with flow and return temperatures of 63°C/30°C, respectively. Compared to traditional boiler flow and return temperatures of 82°C/71°C, the temperatures proposed in this scenario will realise a number of benefits:

- Increased boiler efficiency as the lower return temperature enables heat recovery from the exhaust gases and the boilers to operate in condensing mode yielding better efficiency.
- Lower flow rate of hot water as a result of a larger temperature delta between flow and return.
- Smaller pipe sizes and circulating pumps as a result of a lower flow rate.
- Reduced heat losses during transmission as a result of both smaller pipe sizes and lower flow and return temperatures.
- Reduced heat losses in the buffer vessel as a result of lower flow temperature.

The boilers will be installed alongside circulating pumps and buffer vessels either in new boiler rooms at B1 level, or on a temporary mobile platform in the car park, complete with a flue dilution system, to be moved subsequently into existing B2 level plantrooms following existing plant coming offline and connected to new flues to follow the route of the existing flues.

From the heating loop, pipework will distribute horizontally (at basement 1 level or otherwise) to supply heat to a hydraulically separated circuit in each House via a plate heat exchanger.

From the plate heat exchanger, LTHW flow and return pipework will distribute vertically in a number of mechanical risers in each House. At each floor, horizontal LTHW pipework connects riser pipework to a heat interface unit (HIU) located in each apartment. The HIU contains two plate heat exchangers, each exchanging heat between the House LTHW circuit and one of the Apartment space heating or domestic hot water (DHW) circuits. Similar to the House plate heat exchangers providing hydraulic separation between the central heating loop and House LTHW circuits, the HIUs will provide hydraulic separation between the House LTHW circuits and the apartment circuits. The points of hydraulic separation reduce the extent of any loss of service in the instance of a fault or leak.

It is not recommended to proceed with energy scenario 1 at RIBA stage 3.

7.2.1.2 Scenario 2

As per scenario 1, a new central heating loop with LTHW buffer vessels is installed at basement 1 level. A combination of new gas-fired boilers and air source heat pumps (ASHP) are installed in series at this level to operate in a bivalent heating system. The proportion of heating provided by each of the two heat sources can be varied according to the external temperature and apartments' heating and DHW demands to maximise system efficiency.

The locations of the boilers will be as per the options described in scenario 1. The air source heat pumps will be installed in proximity to the car park entrances to ensure a supply of fresh air to the units. Installation can take place in a modular fashion such that the heat pump units come online gradually as demand of the new plant increases throughout the project phasing. Potential inclusion of water source heat pumps from the existing bore holes is also under consideration to work in conjunction with the air source heat pumps, the advantage being in colder months the water source heat pumps can potentially offer a higher grade of heat for a similar energy efficiency ratio reducing the need for gas boilers.

As with scenario 1, hydraulic separation is achieved between the central loop and House circuits by means plate heat exchangers, and between each apartment and its House's circuit by means of a heat interface unit.

Although the total heating duty required is lower for this scenario compared to scenario 1, the larger size of ASHPs relative to gas-fired boilers means overall this scenario is more spatially demanding in terms of central plant.

Energy scenario 2 is our preferred option as we progress to RIBA stage 3.

7.2.1.3 Scenario 3

A new centralised, Landlord ambient water loop is installed, with circulation temperatures of approximately 20°C. A more holistic approach can be taken to the composition of energy sources as a result of the low circulation temperature. Energy sources may include photovoltaics and open-loop water-to-water heat pumps that abstract water from the onsite boreholes.

In this scenario, water source heat pumps (WSHPs) are installed in lieu of an HIU which could both provide space heating and space cooling, which then treats the space via fan coil units with integral refrigeration circuits for a heating and cooling option or heating only via a water-to-water heat pump system connected to radiators with the heat pumps locked into heating mode only. This latter option does not take advantage of mid-season conditions where heating and cooling may take place on different solar elevations and/or where different set point temperatures are driving heating or cooling modes in different apartments.

Energy scenario 3 is pending the outcome of the overheating study, but at present is not going to be progressed at RIBA stage 3.

7.2.1.4 Combined Heat and Power

Combined heat and power (CHP) plant has been discussed for possible inclusion to provide both heat and electricity to the site. With a constant demand for heat in scenarios 1 and 2, this remains a possibility. CHP is reliant on gas as the primary fuel which is generally being discouraged as a heat source, and the reliability of CHP systems must be considered. This has been reviewed in the Cundall energy strategy in more detail.

At present, CHP is not going to be progressed at RIBA stage 3.

7.2.2 Apartment Heating and Domestic Hot Water

7.2.2.1 Heat Interface Units

For energy scenarios 1 and 2, heat for space heating and domestic hot water within the apartments is supplied via a heat interface unit, typically located in a hallway utility cupboard.

Direct HIUs use the primary (Landlord) side LTHW to directly feed the space heating circuit (radiators) and to provide heating for DHW via a plate heat exchanger. Indirect HIUs feature a second plate heat exchanger for the space heating circuit such that the primary side LTHW does not come into contact with neither the apartment space heating circuit nor DHW feed. It is proposed that the indirect-type HIUs are used to provide this complete hydraulic separation between Landlord and Apartments circuits.

The HIU will receive primary side LTHW at ~60°C, allowing for ~3°C parasitic losses during transmission from energy centre to HIU. Hot water will be generated instantaneously via the HIU DHW plate heat exchanger, removing the need for separate, centralised DHW plant. Instantaneous generation also allows for DHW to be supplied at a lower temperature (43-55 °C) than if the DHW was supplied for a storage tank (~60°C to control risk of Legionella), thus reducing the extent of hot and cold water mixing required and therefore reducing energy use. The HIU will be supplied with softened cold water from central plant, separate to the mains cold water supply for consumption (see Section 8.11). With this arrangement, the HIU has 6 pipework connections:

- Landlord LTHW in (flow)
- Landlord LTHW out (return)
- Landlord softened cold water in
- Apartments domestic hot water out
- Apartments LTHW out (space heating flow)
- Apartments LTHW in (space heating return)

HIUs can provide heat metering within the unit to allow the Landlord to bill the Tenant for the amount of heat used for space heating and DHW. Water meters can also be installed within the unit to allow billing for the usage of Landlord softened cold water for the purpose of DHW generation. The units can typically be configured to give priority to the DHW plate heat exchanger for the instances where there is simultaneous demand for space heating and DHW.

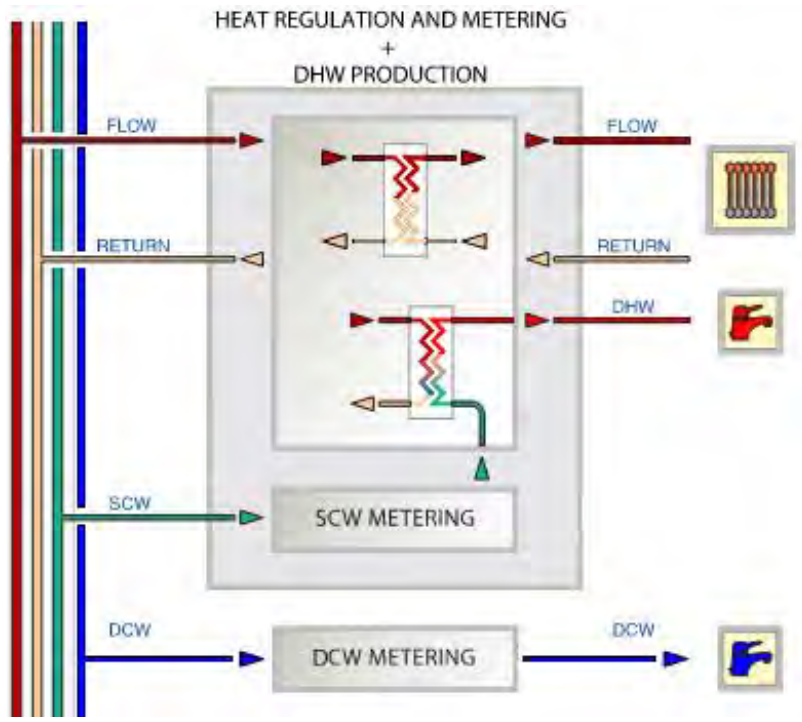


Figure 7.2.4 HIU schematic showing separate DCW provision.

For the majority of the apartments on site (with 1 bathroom), the instantaneous DHW capacity of many available HIU models will be sufficient to solely provide hot water. For a small number of larger apartments, with 2 or more bathrooms/en-suites and therefore a larger potential instantaneous DHW demand, HIUs with either integrated or hot water storage tanks may be required, subject to further detailed design.

HIUs are typically wall-mounted, with piped connections located either at the top or bottom of the unit, or sometimes a combination of the two. As such, access is required above and/or below the unit for the installation of pipework. The images below show three examples of indirect heat interfaces units.

Figure 7.2.5 Caleffi SATK32107 (630 H x 490 W x 245 D). Up to 86 kW DHW and 15 kW space heating. Installation is reversible to allow piped connections to be located at the top if required.

Figure 7.2.6 Evinox ModuSat XR-ECO 70 (625 H x 467 W x 315 D). Up to 70 kW DHW and 3-8 kW heating.

Figure 7.2.7 Caleffi SATK60103HE (590 H x 570 W x 110 D). Up to 28 kW DHW and 15 kW heating. This is a wall-mounted unit that can be recessed into the wall. This unit would only be able to meet the DHW demand of a studio apartment with a lowered DHW temperature of ~45°C.

These three examples demonstrate that despite the wide range of DHW duties available across HIU models, the variation in physical dimensions is more limited.

Heat interface units are recommended as part of the RIBA stage 3 apartments and heating design.

7.2.2.2 Water Source Heat Pumps

For scenario 3, a water source heat pump (WSHP) is installed in lieu of a HIU inside the apartment for DHW and space heating provision. The ambient energy loop on the primary side of the WSHP would also allow cooling to be provided to the apartments during the summer months if connected to fan coils.

WSHPs typically come with integrated hot water storage. In this scenario, the heat pump would heat the ambient condition water from the Landlord loop (~20°C) to the required temperature for localised hot water storage (~60°C). With integrated storage, the physical unit sizes of WSHPs are therefore much larger than for HIUs which would not be practical in the smallest apartments.

Figure 7.2.8 Daikin Altherma GEO 3 WSHP (1891 H x 597 W x 666 D). Integrated 180 litre hot water storage tank. Heating and hot water, and heating, cooling and hot water options.

The viability of the use of WSHPs and an ambient loop is pending the outcome of the geotechnical survey, but at present it is recommended to progress to RIBA stage 3 using HIUs instead of WSHPs.

7.2.2.3 Radiators

The 104 apartments in Duncan House have been grouped into 24 different apartment types, based on floor area, window orientation and number of bedrooms, such that the apartments in a single group have similar heating and DHW loads. One apartment from each group – 24 No. in total – has been modelled in the software package Cymap to calculate the steady state heat losses and gains for each of the three energy scenarios.

Based on energy scenario 1, peak gross heat losses for the sampled apartments ranged from 1.5 kW to 5.9 kW with corresponding net heat losses (assuming 80% heat recovery from the MVHR unit) of 0.9 kW to 3.8 kW. Whilst this sample is only representative of Duncan House, the range of heat loss values fall well within the capabilities of most HIUs. For scenarios 2 and 3, the heat loss values are lower.

It is recommended that the space heating circuits for the apartments are designed to use lower flow/return temperatures compared to a traditional 82°C/71°C circuit to reduce energy consumption and improve overall heating plant efficiency. A radiator sizing exercise has been carried out for apartment Dun405, based on a temperature scheme of 50°C/30°C, for the 4 No. permutations arising from energy scenarios 1 and 2 and ventilation being either extract only or MVHR with 80% heat recovery (refer to DSQ-CDL-P-04-SK-M-01041). A flow temperature of 50°C gives a good approach temperature delta with respect to the primary flow temperature (Δ10°C to a 60°C primary flow). This exercise sized radiators based on standard single, double and triple panel convectors (refer to DSQ-CDL-P-XX-SH-M-90200). A fifth set of radiator selections were carried out for energy scenario 2 with MVHR, using column radiators instead of standard panel types. The images below demonstrate an increase in radiator size for column style radiators.

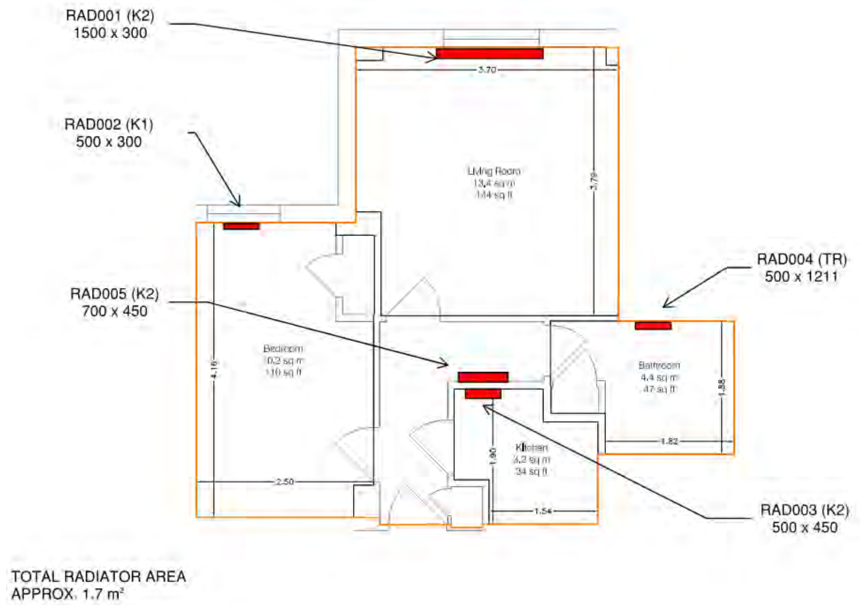


Figure 7.2.9 Radiator layout for apartment Dun405, based on heating loads for energy scenario 2, using standard single (K1) and double (K2) panel convector radiators and towel rails (TR). Total radiator face area 1.7 m².

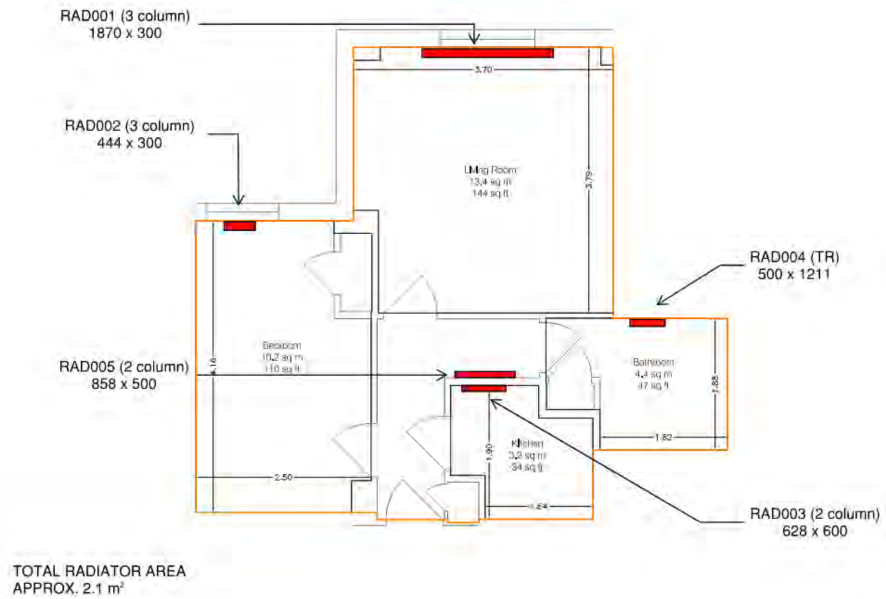


Figure 7.2.10 Radiator layout for Dun405, based on heating loads for energy scenario 2, using column style radiators (2 or 3 columns) and towel rails (TR). Total radiator face area 2.1 m².

Based on the space heating flow/return temperature used for this exercise, the further reduction in heating loads between energy scenarios 2 and 3 was not significant enough to yield a material reduction in radiator sizes.

Both options are practical and achievable and have been discussed with the Architect, who have expressed a preference to proceed with column style radiators as shown in Figure 7.2.10.

7.3 Cooling Services

7.3.1 Lobby and Amenities

Where required, cooling will be provided to the lobby area and common amenities (gym, squash courts, etc.) using VRF systems that can facilitate both heating and cooling simultaneously across multiple zones. Indoor units in each zone connect to a common outdoor unit via a refrigerant branch controller box, with independent temperature control available to each zone.

Alternatively, cooling can be provided from a common chilled water (CHW) loop, connecting to either 2-pipe (CHW cooling only) or 4-pipe (CHW cooling and LTHW heating) indoor units such as those in shown in Section 7.2. **However, our recommendation is that a VRF-based solution is progressed for these areas as part of RIBA stage 3.**

7.3.2 Apartments

Outlined in Section 7.2.2.2, a scenario 3 ambient water loop can facilitate both heating and cooling of the apartments. The simultaneous heating of some apartments and cooling of others is also possible. **Determination of whether apartment cooling is recommended is subject to the results of the overheating assessment.**

7.4 Ventilation Services

7.4.1 Option 1 – Extract Only

A like-for-like replacement; the kitchen and bathroom extracts and extract risers are replaced/refurbished to meet Building Regulations Part F intermittent extract ventilation requirements. This option includes no provision for the recovery of heat from the extracted air and would, of the three options, induce the greatest amount of infiltrated, untempered air from outside when the extract fans are operating due to the air imbalance. **This option is not recommended for the following reasons:**

- A higher heating duty would be required in each apartment due to 1) a greater amount of heat being lost in the extracted air and 2) a greater amount of cold air entering the apartment via infiltration, and therefore requiring heating.
- Noting their already larger-than-usual sizes to work with the lowered primary LTHW temperatures, radiator sizes would need to be larger than if supply and extract ventilation were provided. For some apartment rooms, this may require multiple radiators and/or limit the range of radiator styles available due to the higher output requirements. Alternatively, a higher primary LTHW flow temperature would be required to prevent further increases to radiator size, however this will increase the size/quantity of central heating plant and reduce their efficiency.

7.4.2 Option 2 – Centralised MVHR

A centralised Landlord system consisting of a number of air handling units (AHU) located on the roof of each House block provides supply and extract ventilation to the apartments in that House. Air is distributed to the apartments via mechanical risers from which horizontal ductwork distributes the air to the apartments adjacent to the riser (typically 2 No. apartments per riser, per floor).

Refer to sketches DSQ-CDL-P-RF-SK-M-02001_4 for examples of AHU roof locations and access requirements for Duncan House.

Figure 7.4.1 AHU example. Nuaire Boxer Packaged Solution. 3 No. B07T units would be sufficient to ventilate all Duncan House apartments (each 2700 L x 1330 W x 1492 H, 781 kg).

The air handling units include a heat recovery device (e.g. mixing box, thermal wheel) to recover at least 80% of the heat from the extract airstream (refer to energy scenarios), which is then used to temper (preheat) the incoming fresh air from outside at roof level. Such units are also referred to as MVHR units, albeit much larger than those described in Section 7.4.3. A summer bypass of the heat recovery device is included to prevent further heating of already-warm air from outside. Typical specific fan power (SFP) values for this type of unit would be in the range of 1.6-2.0 W/l/s, subject to values of air flow rate and external static pressure.

Within the apartments, horizontal supply ductwork from an adjacent riser branches-out and terminates in the bedrooms and/or living room, where the supply air will diffuse via grilles in the ceiling bulkhead. Horizontal extract ductwork will extract air from kitchens and bathrooms/en-suites back to the riser to return to the AHU. In the areas containing ductwork, a lowered ceiling will be required to allow for the ducts to be installed within the ceiling void.

As this option uses the same ventilation system to serve multiple apartments, where ductwork enters/leaves an apartment, fire/smoke dampers will need to be installed to reduce the risk of smoke spread from the apartment of fire origin (refer to DSQ-CDL-XX-XX-RP-FE-55220). To comply with the installation requirements of the dampers, the supply and extract ducts from/to the riser need to be well-spaced apart, which increases the required riser sizes. Therefore, it is likely that most mechanical risers will need demolition and rebuilding works carried out if this option is chosen. For Duncan House, riser duct sizes in the risers may be up to 400 mm x 400 mm. Ducts within the apartment for the majority will be 204 mm x 60 mm rectangular or ⌀150 mm / ⌀160 mm. A small number of the largest apartments may require larger ducts, such as 200 x 100 mm or ⌀200 mm (the largest ventilation requirement is 56 l/s supply and extract for apartment Key706). Transformations between rectangular and circular ducts may be required, dependent on unit selection and spatial constraints – this is subject to detailed design.

A centralised ventilation strategy will also require consideration to be given to sound transfer paths between apartments. Suitable crosstalk attenuation measures will be necessary (refer to DSQ-CDL-XX-XX-RP-AS-45221).

The option of demand-based ventilation also requires the addition of variable air volume boxes and complex pressure controls linked back to the central plant.

This option contains most of the maintenance requirements (e.g. filter changes) to within Landlord areas and keeps the number of AHUs down, likely to below 50. With the AHUs located on the roof, the only air intake/exhaust points are also at roof level so no penetrations through the façade are required for termination points. There is also greater flexibility in the placement of air intake and exhaust points at roof level, so short-circuiting of air (where stale exhaust air is drawn straight back into the fresh air intake) is less likely. AHUs generally have more flexibility in air filtration options and higher-grade filtration is more readily available.

On balance, this option is not recommended to be included as part of the RIBA stage 3 design.

7.4.3 Option 3 – Individual MVHR

Each apartment is fitted with its own mechanical ventilation heat recovery unit (MHVR), installed either in a ceiling void or in a utility cupboard. In each apartment, an MVHR unit provides mechanical supply and extract ventilation to the apartment, with ductwork terminating at louvres/air bricks in the façade/window frame detail on both fresh air intake and extract air ducts. Care needs to be taken to ensure the intake and exhaust points are sufficiently distanced from each other to prevent air short-circuiting where possible.

The MVHR unit includes a heat recovery device that recovers at least 80% of the heat from the extract air stream to preheat the fresh air intake, and a summer bypass like in Option 1. Individual MVHR units are more energy efficient than AHUs: typical specific fan power values for this type of unit would be in the range of 0.6-1.0 W/l/s, subject to values of air flow rate and external static pressure.

This option is more spatially demanding within the apartment due to the local unit installation and has a far greater number of units (>1200) compared to option 2 and will also require regular maintenance access to each property for filter changes or filter cleaning unless carried out by the Tenants. Available filtration options are more limited with typically only lower-grade filtration options available as an integral part of the unit. Some manufacturers offer higher grade filters (e.g. activated carbon) that are installed external to the unit as an inline duct component. Their inclusion could be better determined with an air quality appraisal.

There are, however, several benefits to adopting an individual MVHR approach:

- It negates the need for fire/smoke dampers and crosstalk attenuators due to full isolation of the ventilation system from adjacent apartments.
- No ducts are required in the mechanical risers, reducing the extent of works required to the mechanical risers.
- The Tenant has greater control over the ventilation provision.
- Individual MVHR units have lower SFP values and therefore greater energy efficiency.
- Central systems will have complex control and commissioning procedures
- Central systems have more onerous obligations on the Landlord team
- Billing for the central systems is complex if to be done accurately.
- Individual MVHRs are energised from the Tenants' power supply

It is therefore recommended that this ventilation option is pursued in the subsequent stages of design.

Figure 7.4.2 Example of a low profile MVHR unit for ceiling void installations.

Figure 7.4.3 Example of a wall-mountable vertical MVHR unit for utility cupboard installations.

For ceiling void MVHR units, a removable ceiling panel approximately equal to the length and width of the unit + ~300 mm in each dimension is required for installation access and filter changes. A condensate drainage connection is also required in the ceiling with a route for the drainage to run into a soil vent pipe. For a utility cupboard installation, the area above the unit needs to be clear for vertical ductwork to rise and turn into the ceiling void, and a clearance below (approx. 400 mm minimum) is also required for a condensate drainage connection.

Assuming apartments with no more than 2 bedrooms have only one bathroom, 90% of the apartments in the complex would require no greater than 21 l/s supply and extract air. Below are examples of suitable air bricks for this flow rate:

Figure 7.4.4 Titon Q Plus (213.5 W x 64.5 H x 58 D)

Figure 7.4.5 Vent-Axia low resistance air brick (212 W x 67 H x 58 D)

Figure 7.4.6 Cast Iron Air Brick Company L9 air brick (225 W x 225 H x 42 D)

Ducts are typically 204 mm x 60 mm rectangular or ⌀150 mm / ⌀160 mm circular. As with option 2, a small number of larger apartments may require slightly larger ducts than these sizes. The fresh air inlet is typically afforded thermal insulation to mitigate condensation forming on the duct surface.

8.0

Public Health Services

8.0 Public Health Services

The public health services strategy which are proposed for the refurbishment works are outlined within the following sections. These sections are to be read in conjunction with the sketch strategy drawings contained within the appendices.

8.1 B1 Sub-structure and B2 Foul Water Drainage

Basement 1 foul water discharge to a series of external inspection chambers located on a private drainage network discharging off site to the local TW sewer via 4 primary sewer outfalls. B1 car park drainage and B2 plant room drainage discharge to a series of structural drainage sumps with pumped discharges rising to the suspended B1 drainage installation. The detailing and scope of works required for substructure drainage will be provided by the projects civil engineer.

8.2 B1 Suspended Combined Drainage Installation

The DSQ estates team hold limited as built information in respect of the above ground drainage installations. A non-intrusive survey has been undertaken to establish the drainage strategy for the apartment/House blocks and reviewed in conjunction with the HTS drainage report and drawings as issued in August 2018. The upper floor apartments are served in drainage terms via a series of mechanical, plumbing service ducts typically with bathrooms and kitchens generally sited adjacent to risers.

Figure 8.2.1 Typical upper floor drainage to B1 suspended drain.

Under the refurbishment phased works existing drainage stacks will be removed for the installation of new prefabricated soil waste and ventilation stacks incorporating low level branch and boss connections serving WCs, baths, basins and showers. Access doors on stacks to be located to provide maintenance personnel the opportunity to maintains or clear stack blockages without hinderance from adjacent mechanical services within the pipework riser.

At basement level 1 the intent under the refurbishment works is to retain the combined drainage outfalls discharging to the external drain networks. The suspended drainage will undergo a CCTV survey to establish the potential level of scale, internal condition and identify where pipework requires remedial work or replacement.

New basement 1 plant rooms requiring floor gullies or drain down provision will be achieved by the installation of local floor mounted or sub structured formed sumps with their pumped rising mains connecting to the replaced B1 suspended drainage.

New branch connections will be provided on the B1 suspended drainage to serve surface water drainage stacks serving apartment roof areas

8.3 Upper Floor Apartment Foul and Water Drainage

Existing mechanical, plumbing services have been installed in such a manner which affords little scope for maintaining both drainage and domestic water services difficult. Under the proposed refurbishment works pipework and duct work to be located to provide maximum access for services maintenance

Figure 8.3.1 Typical apartment service riser installation

The issues experienced by the site's estates team are blockages and obstructions within the drainage installations, along with the lack of good access proves a difficult task leading destructive access to clear foul, waste drainage stacks, perform maintenance and repair of plumbing installations.

The replacement of the drainage pipework presents an opportunity to consider offsite prefabrication of the soil, wastewater and anti-siphon stacks for installation in existing and new pipework risers incorporating conveniently placed access pipes, WC branch and wastewater boss connections to serve the apartments bathroom and kitchen sanitary fittings and white goods appliances.

Condensate drainage, pressure temperature relief drainage from apartment appliances and domestic sprinkler test valve discharge to soil or wastewater stacks via waterless trap arrangement and tundish.

The anti-siphon pipework reduces the risk of induced siphonage and assists with the quiet operation of water seal within sanitary traps under a secondary ventilated configuration. Pipework penetration through fire rated floors and walls will be provided with a suitable fire stop arrangement compatible with fabric or wall construction fire rating. The above ground sanitation installations pass down through the House service riser and secondary ducts connection a combined suspended drainage installation at B1.

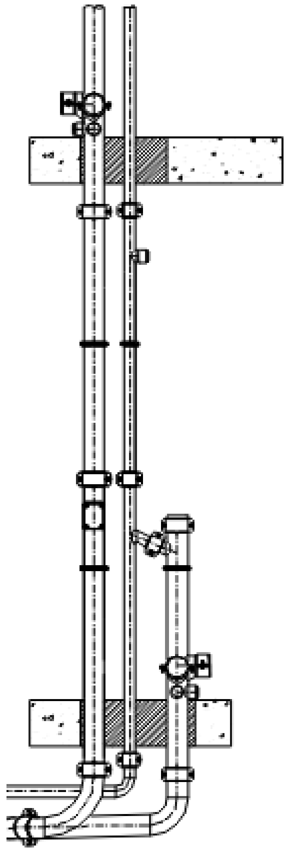


Figure 8.3.2 Typical offsite prefabricated drainage pipework

Previous survey and condition reports undertaken on the underground drainage systems indicate internal pipework has a high level of scale and encrusted deposits reducing hydraulic performance of the system. Based on underground drainage system condition the report assume similar conditions prevail within suspended drainage system at B1. The basement drainage pipework under House block phasing works will be replaced with a lightweight cast iron system combined drainage to the existing outfall exiting to external drainage at the basement retaining wall locations.

Figure 8.3.3 Typical combined drain outfall to external drainage

The new suspended drainage with accessible branch arrangements serves the new apartment foul and wastewater drainage stacks dropping from the upper apartment floor service risers and secondary ducts with suitable rodding access incorporated into the horizontal pipework routes to provide further maintenance access.

Figure 8.3.4 Typical lightweight cast iron drainage

8.4 Surface Water Drainage

Surface water drainage from the apartment roof levels is conveyed to the basement combined drainage installation via outlets generally located adjacent to the roof service distribution duct.

Figure 8.4.1 Existing roof outlets

Figure 8.4.2 existing roof area with ponding

The images indicate ponding of surface water in areas adjacent to the existing outlets suggesting poor or non-existent roof falls aligned with small surface area rainwater outlets.

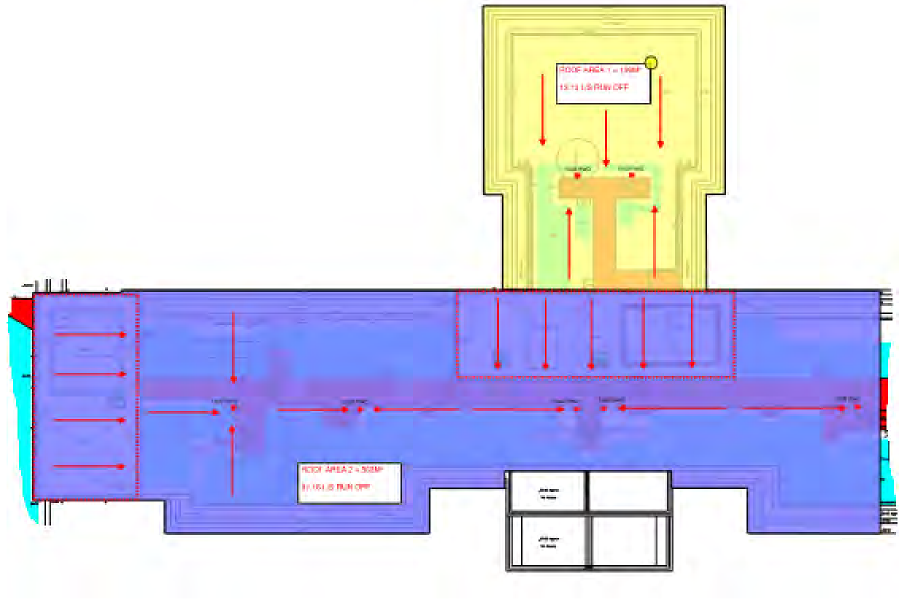


Figure 8.4.3 Indicative House block rainwater drainage strategy

Surface water drainage of apartment external balconies appears to be an arrangement of upper balconies joint gully and external pipework discharging onto the lower level balconies with the lowest floor gully connecting to an internal rainwater pipe at kitchen locations

Figure 8.4.4 Typical external balcony drainage

At this stage it is unknown if under the constraints of the London Plan a requirement to reduce surface water discharge from site as part of the project planning conditions.

Typically, this is achieved by on site surface water attenuation in the form of basement, lower floor storage tanks or roof mounted attenuation modular crates or blue roof. Dolphin Square incorporates 2 No. substructure borehole water storage reservoirs providing an opportunity to be repurposed once decommissioned to attenuate from the site's catchment areas surface water. The attenuated stored water would be pumped out to the B1 outfall at an agreed discharge rate thus meeting the London Plan criteria if implemented.

8.5 Borehole Cold Water Supply

The site is currently served by 4 No. private boreholes delivering raw water to sub-basement 2 No. cold water storage reservoirs. Under the refurbishment works new water supplies will be requested to serve the site via 5 No. bulk water supplies from the Thames Water utility network. Boreholes will be decommissioned in a phased programme to ensure water supplies are maintained until the TW connections are brought online.

8.6 Water Metering Strategy

The current arrangement for billing of water services is via apartments service charge arrangements, under the replacement works the developments management team have requested the option for individual apartments water metering with direct billing via TW.

TW adopt a metering hierarchy and strategy in terms of options available to developers and customers imposing a direct impact on the water services distribution strategy and apartments metering.

For existing developments, the TW metering strategy covering 'Large apartment Houses (more than 3 floors or 12 apartments)' the policy document states an approved arrangement is via bulk meter at the point of supply.

Further dialogue will be undertaken with TW's network engineers to develop at the next stage the acceptable approved metering arrangement.

The 5 No. new incoming wholesome water supplies served from the Thames Water's network terminate within the House block plant rooms with reverse rinse filter, TW revenue meter and water treatment unit

The option to log apartments' domestic water consumption with data output to the BMS will be via secondary (Landlord's) water meters with pulse output.

8.7 New Thames Water Connections

The strategy that will be presented to TW is the requisition of 5 No. branch supplies extended onto the Dolphin Square development with isolation valves and non-revenue meter located at the site boundaries within accessible valve/meter chambers, the branch supplies extended under the phased work programme in utility service trenches with branch connections serving external fire hydrants extending further to enter basement B1. Internally the branch supplies continue, terminating in new House block plant rooms with reverse rinse filter and TW revenue/billing meter with pulse output for data logging to the development building management system (BMS)

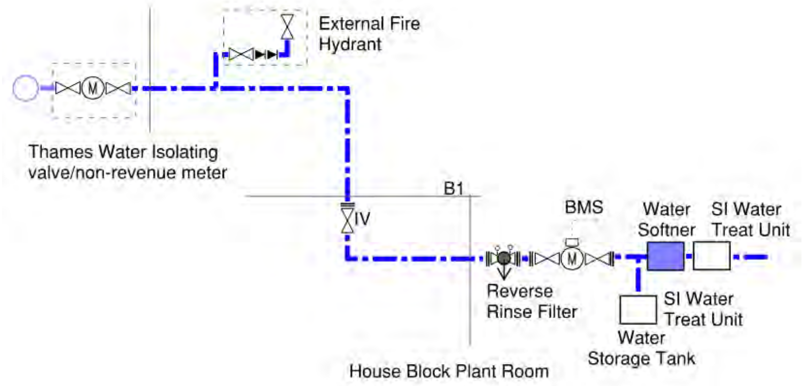


Figure 8.7.1 Typical Incoming Water Schematic

The 5 No. new wholesome water supplies consist of 3 No. served via the Chichester St trunk water main and 2 No. via the Grosvenor St trunk water main.

The new water supplies in addition to connection cost levied by TW will be subject to a water infrastructure charge rated based on the number of apartments served from the TW water network.

Discussions with TW commence in detail at the next stage to agree design detail of the new supplies, submit new connection application, supporting documentation and finalisation of water metering strategy allowing TW to produce their quotation for the new supplies to meet the projects phased works programme.

The plant room located meters are to be arranged providing 24-hour access to TW.

8.8 Boosted Wholesome Cold Water

A Water Safety Design & Delivery Plan developed with the projects Water Safety Group & stakeholders identifying associated risks with domestic water services and control measures required & incorporated into the design will be utilised in the development of the projects water services design.

Each House block and its associated apartments will be served from new tank rooms located at basement B1, each tank room contains the incoming water supply silver ionisation water treatments unit, reverse rinse filter, wholesome cold water storage tank, soft cold water tank and packaged booster set. Plant will be arranged to ensure maintenance can be undertaken without hinderance. Water storage tanks will be located away from potential heat source to reduce the risk of elevating stored water temperatures beyond desired control levels. Booster pumps with variable speed motors will be configured as duty, duty assist with auto-changeover to provide even wear of pumps. The packaged booster pumps control panel provides a digital read display, hand controls for manual operation, soft start operation with volt free contacts for BMS output. Cold water storage tanks incorporate high level content detection and alarm with pump cut out for prevention of dry pump operation. Tanks incorporate external content sight gauges and temperature gauges to provide visual display for tank water conditions. Plant rooms containing the stored water tanks, booster sets, and softening plant will be mechanically ventilated to relive temperature build of the internal ambient space.

The reverse rinse filter ensures a continuous supply of filtered water delivered to the wholesome cold water storage tank and soft water unit. The filter prevents the ingress of foreign bodies and reduces the probability of corrosion within the water systems

Figure 8.8.1 Example of Reverse Rinse Filter

Wholesome water fed downstream of the filter serves the House blocks cold water storage tank and soft water plant via the TW revenue meter. A further metered branch water supplies serve the House block packaged soft water plant, storage tank and booster set with each branch supply incorporating a House block silver ionisation water treatment unit, in terms of the soft water plant the copper/silver ionisation will be located downstream of the softener.

The copper/silver ionisation water treatment is a recent and effective method for the control of waterborne pathogens and highly effective in the termination of bacteria, non-corrosive to the pipework installation and components. The water treatment distributes active copper and, silver ions throughout the water system and biofilms ensuring the whole of the water for a large system become effectively treated.

The safe to handle system carries no COSSH issues, non-toxic to maintenance personnel and the environment offering an alternative to other treatment regimes.

Figure 8.8.2 Typical Copper/ Silver Ionisation unit

Storage volumes will be assessed on apartment type, i.e. studio, 1 bed etc. Stored in modular section GRP tanks, serving a packaged cold water booster set. To maintain stored cold water temperatures to an acceptable level for both taste and its condition in terms of microbiological quality a packaged chilled water plate exchanger with circulation system incorporated into the wholesome water installation to control content temperatures at 10°-15°C.

A boosted primary wholesome water distribution service delivered from the basement B1 plant rooms rising within a service duct to House block roof levels.

The replacement of the cold water services distribution pipework presents an opportunity to consider offsite prefabrication of the wholesome and soft water installations.

Figure 8.8.3 Prefabricated boosted water supplies

New cold water service pipework installed in the existing MEP service risers incorporate at the head of each boosted riser anti-vacuum valves to allow the entrainment of air into the pipework system if in the event of pump failure systems vacuums develop leading to potential ‘cold shock’ of damage to the installation due dynamic head which may result in flooding and water damage.

The strategy for distributing water supplies at House block roof levels provides the flexibility to install the primary pipework from basement plant rooms at an early stage, incorporate valved branch services for later works to apartment Houses under the phased works programme whilst maintaining existing water supplies.

The pipework continues to distribute externally at roof level located on a raised bracket system with a series of branch supplies down feeding the apartment MEP service risers. External water pipework installations incorporate a trace heat tape for frost protection system applied with a fire rated insulation highly resistant to moisture penetration, vapour seal barrier jacket and applied with a UV stable solar reflecting bonded polyisobutylene fully solvent welded weatherproof outer coating will be applied to external cold water service distribution pipework.

To offset heat gain to the externally located wholesome water distribution circuits through summer months at the base of each apartment cold water down supply a pipework circuit returning wholesome water supplies to the cold water storage chilled water plate heat exchanger to maintain system distribution temperatures between 10°-15°C delivering to the apartment an acceptable drinking water regime.

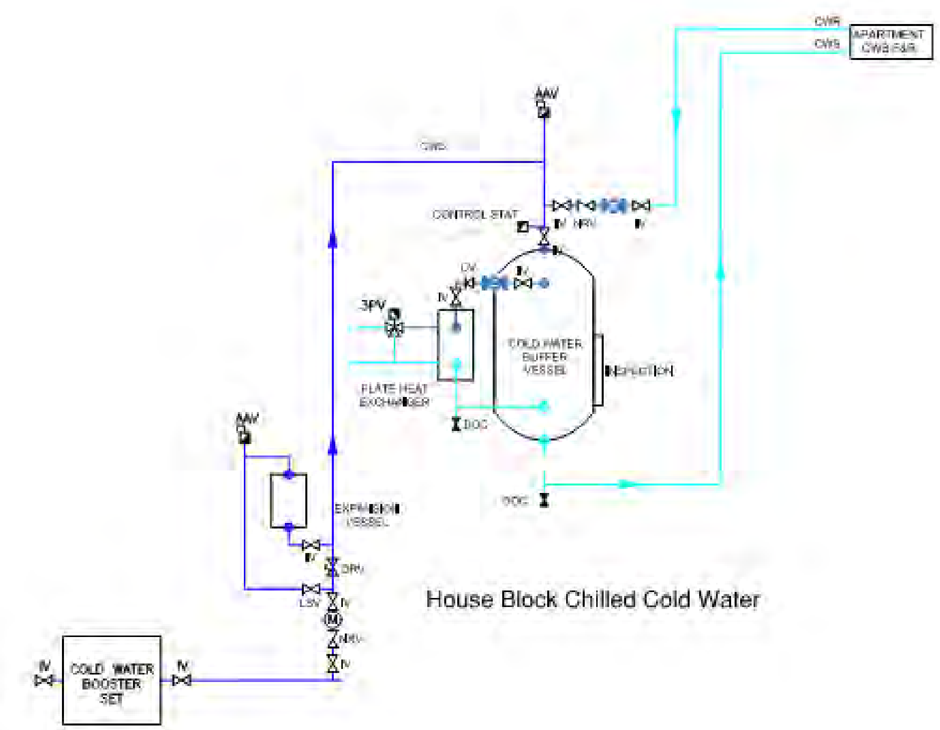


Figure 8.8.4 Wholesome Water Temperature Control Schematic

8.9 Domestic Sprinklers

The stage 2 report recognises an aspiration for incorporation of domestic sprinklers within apartments. To accommodate domestic sprinklers under the guidance of BS 9251 options are available dependant on category of risk, for the Dolphin Square development a category rating of 2 is considered appropriate.

The incorporation of domestic sprinklers would adopt the shared water supply solution, the arrangement of stored water for both wholesome water consumption and domestic sprinkler requires the effective stored volume for water consumption is greater or equal to the calculated sprinkler fire supply. Preliminary calculations undertaken confirm domestic cold water storage volumes for the House blocks provide adequate supply to meet the design criteria contained under BS9251 for domestic sprinklers

A domestic sprinkler branch apartment connection incorporating an approved backflow arrangement provided from the domestic wholesome water supply installation with a priority demand valve allowing for isolation domestic supply to the apartment under fire condition and energised by the apartments fire detection system is the considered arrangement at this stage. The wholesome cold water booster set acts as the primary water flow and pressure generator sized with sufficient capacity to ensure the conditions required under the guide are met.

The stage 2 fire strategy report suggests options for the incorporation of domestic sprinklers within the apartments. The introduction of apartment sprinklers impacts significantly on the architecture and ceiling void zones to accommodate the sprinkler pipework and heads, alongside the mechanical & electrical services. This will require a further lowering of ceiling heights beyond those currently developed within the architectural proposals and concern has been raised by GRID regarding the viability of their inclusion.

For the purposes of Building Regulations the works are considered a ‘material alteration’ and as such where an aspect of the design does not comply with the current requirements, there is no requirement to meet the new requirements, provided that the situation is made no more unsatisfactory than before. However, further measures may be required based on the outcome of the fire risk assessment process under the Regulatory Reform (Fire Safety) Order 2005.

Refer to RIBA stage 2 fire strategy report DSQ-CDL-XX-XX-RP-FE-55220.

8.10 Boosted Soft Cold Water

Under current conditions hot water generators located within the B2 plant rooms are served with cold water via the Dolphin Square soft water plant. Under the proposed MEP replacement works the large hot water vessels and soft water plant will be decommissioned and removed as the site works progress.

To maintain the soft hot water condition serving each apartment a packaged soft water plant located in each House block plant room produces a conditioned water delivered to soft cold water storage tank. A boosted primary soft water distribution service delivered from the basement B1 plant rooms rising within a service duct to House block roof levels adjacent to the wholesome cold water installation. Plant will be arranged to ensure maintenance can be undertaken without hinderance; water storage tanks located away from potential heat source to reduce the risk of elevating stored water temperatures beyond desired control levels. Booster pumps with variable speed motors will be configured as duty, duty assist with auto-changeover to provide even wear of pumps. The packaged booster pumps control panel provides a digital read display, hand controls for manual operation, soft start operation with volt free contacts for BMS output. Cold water storage tanks incorporate high level content detection and alarm with pump cut out for prevention of dry pump operation. Suitable drainage provision will be required to accommodate backwash discharge from the softening plant. Cold water storage tanks incorporate external content sight and temperature gauges to provide visual display for tank water conditions. Plant rooms containing the stored water tanks, booster sets, and softening plant will be mechanically ventilated to relive temperature build of the internal ambient space.

The strategy for distributing water supplies at House block roof levels provides the flexibility to install the primary pipework from basement plant rooms at an early stage, incorporate valved branch services for later works to apartment Houses under the phased works programme whilst maintaining existing water supplies.

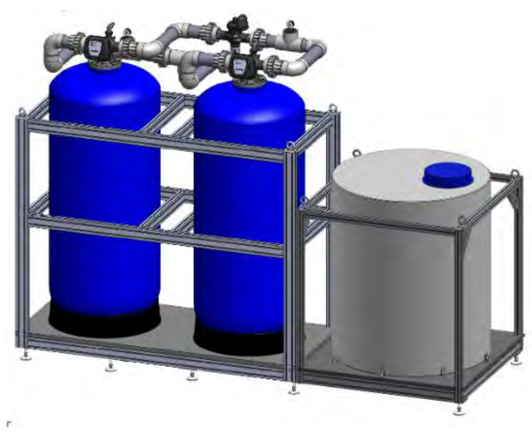


Figure 8.10.1 Typical Ion exchange softening plant

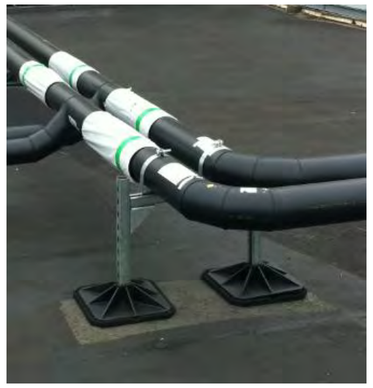


Figure 8.10.2 Typical frost protected, external water distribution pipework

The pipework continues to distribute externally at roof level located on a raised bracket system with a series of branch supplies down feeding the apartment MEP service risers. External water pipework installations incorporate a trace heat tape for frost protection system applied with a fire rated insulation highly resistant to moisture penetration, vapour seal barrier jacket and applied with a UV stable solar reflecting bonded polyisobutylene fully solvent welded weatherproof outer coating will be applied to external cold water service distribution pipework. From the soft water down service branch connections delivered to each apartment serves the heat interface unit domestic cold water connection point.

8.11 Apartment Domestic Water Services

8.11.1 Wholesome Cold Water

Delivered to each apartment via a Landlord MID water meter a temperature controlled cold water supply for consumption serves the apartments kitchen sink and bathrooms, en-suite wash hand basins providing a pleasant, tempered drinking water supply. Filtration of the water supply will be undertaken with each House block tank room, negating local filter installation and responsibility of replacement or the cleaning of cartridges placed upon the apartments.

8.11.2 Soft Cold Water

Delivered to each apartment via Landlord MID water meter a soft water cold supply extends to serve the apartments Heat Interface Unit cold water connection, baths and shower cold water connections, soft water is not intended to be provided at points used for consumption.

8.11.3 Soft Hot Water

The apartment with its soft cold water supply serving the HIU generates hot water instantaneously, delivering hot water to baths, showers and kitchen sinks, temperature control of the domestic water will be provided at baths, shower and wash hand basin via scheme II thermostatic control devices.

8.11.4 Category 5 Water Services

Across the development cold water supplies for wash down provision within bin stores, vehicle valet stations and external landscapes areas will be required, for water compliance water will provided by Cat 5 water supplies incorporating the sufficient backflow arrangement. Within House block tanks a dedicated cold-water storage/break tank with type-A air gap and booster set arranged in a duty/standby configuration distributes a protected water supply to the required washdown and irrigation hose points. Cat 5 water supplies may also be afforded to the roof area should photovoltaic panels be part of the scheme or needed for roof / gully washing down

8.11.5 Back of House Drainage and Domestic Water Services

Dolphin Square has within its ground B1 and B2 floor areas male/female toilet accommodation, staff breakout space/canteen, laundries along with other support areas. This stage 2 report recognises that the support areas are to be retained during the MEP replacement works. This requires for temporary works to be considered in conjunction with phased public health services replacement and will be developed under the next stage.

8.12 Legionella Control

8.12.1 Cold Water Installations

The development of the domestic water design, arrangement, plant selected considers the risk assessment and control of Legionella bacteria within water systems. The system will be designed in accordance with HSG274 Part 2: "The control of legionella bacteria in hot and cold water systems", current Water Regulations 1999 and industry best practices.

The risk assessment for plant focusses on the quantity of water, volumes stored, along with the encouragement of turnover of water at the daily demand to maintain stored water temperatures and quality.

The storage tanks draw off pipework configuration will be designed to ensure 'crossflow' of water across both compartments where tank divisions are fitted to mitigate risk of water storage compartments acting as the 'slave' for water supply, allowing the remaining compartment to stagnate with a reduction in water quality.

Storage tanks incorporating high and low level thermometers to each compartment with signal output to the BMS. Externally tank located visual temperature gauges for maintenance personnel visual inspection. Delayed action fill valves promoting a large flow of fresh water input to tanks, generating pipework velocities for agitation of internal pipework walls to reduce the build-up of biofilms.

Tank rooms provided with mechanical ventilation alleviating high ambient space temperature, ensure heat generating or emitting plant are not sited within the tank rooms. Encapsulated insulation to tank modular panels, avoiding the application of latter applied thermal panels which once removed or damaged under removal may not be fitted correctly.

Temperature control of pipework distribution systems, arrange pipework to promote good flow patterns, avoid dead legs at infrequently used points. Locate water services away for hot water or heating pipework installation to prevent thermal gain. The oversizing of pipework distribution systems leads to low pipework velocities, calculation of the installation requires consideration to ensure system velocities provide agitation to internal pipework to reduce the build-up of biofilm.

The incorporation of water cooling equipment to offset thermal gain to cold water pipework via internal ambient spaces within service ducts, transfer zones and external location. Incorporate within the pipework, system sentinel points for water temperature monitoring equipment with signal output to the BMS

All pipework thermally insulated with an appropriate product specification for the location installed, i.e. metal clad in plant rooms providing a level of protection to the outer layers of thermal insulation, or where exposed to ambient conditions.

Water treatment measures offering enhanced water condition control and the correct and appropriate use of WRAS approved equipment, pipework, and fittings.

8.12.2 Hot Water Installations

The temperature control of domestic water is typically manged at the storage vessel generating water at 60-65°C, distribution of hot water requires maintaining to ensure water is delivered at 55°C at the point of use and achieved either via secondary hot water returns circuits with thermal balancing or the use of a thermostatically controlled hot water heat maintain tape.

The avoidance of deadlegs at infrequent points are achieved by careful layout of pipework distribution system to ensure hot water flow. Incorporate within the pipework, system sentinel points water temperature monitoring equipment with signal output to the BMS

All pipework thermally insulated with an appropriate product specification for the location installed, i.e. metal clad in plant rooms providing a level of protection to the outer layers of thermal insulation, or where exposed to ambient conditions.

Within apartments, the recommendation is for hot water to be generated by HIUs as part of the Scenario 2 energy strategy.

8.13 Water Service Installation Project Management

A Water Safety Design & Delivery Plan developed with the projects Water Safety Group & stakeholders identifying associated risks with domestic water services and control measures incorporated into the design will be utilised at RIBA stage 3.

Upon the handover of the domestic water services installation, the site's duty holder will develop a project water safety management plan, consisting, but not exhaustive of:

The Water Safety Management Plan sets out the estates facility proposals to control the risk and management from legionella. The plan should include:

- Appoint named *responsible competent person(s)* for carrying out the assessment and managing its implementation.
- the safe and correct operation of the system.
- what control methods and other precautions will be needed.
- the checks that will be carried out on the control scheme and how often these checks will be carried out.

Control Measures may include but not exhaustive of:

- ensuring that the release of water spray is properly controlled.
- avoiding water temperatures and conditions that favour the growth of legionella and other micro-organisms.
- ensuring water cannot stagnate anywhere in the system by keeping pipe lengths as short as possible or by removing redundant pipework.
- avoiding materials that encourage the growth of legionella.
- keeping the system and the water in it clean.
- treating water to either kill legionella (and other micro-organisms) or limit their ability to grow.

Check Measures may include but not exhaustive of:

- Regular disinfecting and cleaning of plant, tanks, and pipework
- Regular flushing of sentinel taps
- Sampling and testing for legionella in high risk areas
- Taking water temperatures from taps

Where a risk is identified the significant findings of the assessment will be recorded. It is essential that the effectiveness of any control measures is monitored. The assessment should be reviewed at every 2 years or following any system change which would negate the findings of any previous assessment.

Manage the risk

- Appoint or identify the '*responsible competent person(s)'* for the company.
- Such a person should be trained and competent. He / she will be aware of potential sources and the risks they represent, measures to be adopted, including precautions to be taken for the protection of people concerned and their significance and the measures to be taken to ensure that the controls remain effective.
- Management and communication procedures should be periodically reviewed as appropriate.
- The responsible person will also have the responsibility to ensure that work/ treatments carried out by contractors is to the appropriate standards.

Record Keeping

- The Responsible Person will record the following: -
- The person or persons responsible for conducting the risk assessment and for managing and implementing the written scheme.
- The significant findings of the risk assessment.
- The written scheme will describe how the risk is to be controlled and the implementation of the scheme.
- The results of all tests, inspections, etc, and details of the state of operation of the system.
- Records to be retained for 5 years.

9.0

Electrical Services

9.0 Electrical Services

9.1 Scope of Works

Design, supply, installation, testing and commissioning of all materials, plant and equipment necessary for the complete electrical services installation.

Provide the following electrical services design and installation:

- Incoming Electrical Supply
- Mains and Sub-Mains Distribution
- Containment systems
- Small Power Supplies
- Internal Lighting
- Emergency Lighting
- External Lighting
- Fire Alarms
- Access Control Systems including CCTV
- Security Systems
- Facilities for disabled persons
- Telephone and Data Wireways
- Mechanical Services Wiring
- Earthing and Bonding
- Lightning Protection
- Hearing induction loops
- Tv aerial systems

The electrical services which are proposed for the development are outlined within the following sections. These sections should be read in conjunction with the drawings contained within the appendices.

9.2 High Voltage Distribution

9.2.1 Existing High Voltage System

The existing HV installation consists of 2 No. DNO owned switch rooms located in the north and south areas of the building. The north sub-station is located within the basement of Rodney House (room No. 26) and is supplied from the DNO HV network located in Chichester Street.

The south sub-station is located within the basement of Raleigh House (room No. 91a) and supplied from the DNO HV network located in Grosvenor Road.

Both substations house 2 No. transformers in each which consisting of 800 kVA totalling 4 No. transformers with a total building transformer capacity of 3.2 MVA.

All existing HV supplies are fed by the DNO from the nearby HV substation, Ebury Bridge. Both north and south supplies are fed from the same HV ring main as confirmed by UKPN dated 15/12/2020.

The existing supplies currently feed the apartment and Landlord supplies however, these are to be isolated, made safe and re-configured to feed the apartments only. See low voltage section for further details. The apartments are currently occupied so all works must adhere to the site phasing strategy developed by the client to ensure any disruption is minimised. Refer to Appendix A for MEP phasing sketches of site.

9.2.2 Proposed High Voltage System

A new DNO substation will be provided within the basement located in the carpark area of the building, refer to MEP services drawings and sketches in Appendix A for full location details. This new substation will be supplied by UKPN from Moreton Street Main substation and a diverse HV ring main as confirmed dated 13/01/2021.

A maximum demand has been completed to determine the size of supply required for the new system, this is summarised below:

- Spare capacity allowance 10%
- Diversified Max Demand Including Future Capacity 6 MVA (2 No. 3MVA supplies)

The new system will consist of a HV ring main unit situated within the new proposed RMU room. This will feed 2 No. HV expandable switches located within the proposed HV switch room which will then feed the new HV shipper meter located in the metering room. The HV switches will then feed the 5 No. Transformers located in the new substation. The metering and switch arrangement will be installed in new fire rated enclosures to the requirements of the DNO.

Figure 9.2.1: Typical HV Switch (left), dry cast resin transformer with housing (right) and MIDEL Oil transformer (bottom).

The 5 No. new transformers will consist of 4 No. transfers at 1,250 kVA which will feed the energy centres and 1 No. 800 kVA to feed the Landlord system. There are currently two proposed options for the new transformers, as follows:

- Option 1 - Dry Cast resin

Dry cast resin transformers use no oil, are eco-friendly, require lower maintenance and are a more compact design. This option would be suitable if there is enough head space within the proposed transformer room.

- Option 2 – MIDEL

MIDEL filled transformer have a lower fire risk, use biodegradable liquid and have an excellent moisture tolerance.

The site has issues with flooding, so measures need to be put in place to protect the HV and LV switchgear from any potential flood risk.

At present, Cundall recommend that MIDEL transformers are used due to the inherent risk of flooding and the benefits that they bring.

The overall performance objectives of the new HV system is to provide an efficient and resilient distribution system that delivers electrical power to the relevant parts of the projects as denoted by the MEP layouts. The HV infrastructure will be transformed down to a site wide low voltage distribution system in line with the following voltage bands:

- Site high voltage (HV): 11,000V (11kV)
- Site low voltage (LV): 400V (TP&N), 230V (SP&N).

The new HV supply and RMU units will be owned and operated by the DNO (UKPN), while the HV switches and transformers will be owned by site. Correspondence / applications have been made with UKPN to discuss the requirements of the newly proposed HV supplies and transformers.

9.3 Low Voltage Distribution

9.3.1 Existing Low Voltage System

The site is presently supplied by 2 No. DNO-owned and operated sub-stations.

The north sub-station is located within the basement of Rodney House (room No. 26) and is supplied from the HV network as described. This sub-station contains 2 No. existing Landlord switchboards (room No. 29) for the apartments in the north side of the site as well as metered supplies for the health club.

The south sub-station is located within the basement of Raleigh House (room No. 91a) and is supplied from the HV network as described. This substation contains 3 No. existing Landlord switchboards (room No. 91), as well as metered supplies for the Landlord services and the apartments located on the south side of site.

9.3.2 Proposed Low Voltage System

It is proposed for the existing DNO north and south to be retained and utilised to supply the apartments only.

It is proposed that a new electrical riser serving a new rising busbar and associated group metering room will be provided on each floor. This option provides a new electrical riser to accommodate the increased rated busbar, tap-offs, Ryfield panel, isolators and metering at floor-level. The existing electrical risers would then be converted and reused for the distribution of Landlord electrical services and ancillary electrical wiring i.e. fire alarms, telecoms, data, etc.

A new sub-main cable will be provided from the isolator to an apartment consumer unit via a new dedicated cable route along the corridor.

The Landlord installation is to be removed from the existing DNO sub-station in accordance with the phasing plan and will be supplied via a new dedicated 6 MVA supply (2 No. 3MVA) as denoted in the HV section.

The Landlord installation will consist of new expandable HV switchboards, new substation and new LV switchboards.

New main floor mounted front access ACB / MCCB LV switchboards are to be provided, with dedicated LV switchboard provided for each transformer. The LV switchboards are to be located adjacent to sub-station within their own dedicated fire rated enclosure. As a result of the limited height it is assumed the switchboard will be designed to accommodate top-entry busbar incomer from the new Landlord transformers.

The LV switchgear/ equipment will include spares to accommodate additional devices in the event they are needed. Space for power factor correction (PFC) is to be provided to ensure PFC can be installed post-completion should the load power factor full outside expected standards.

Figure 9.3.1: Typical U-shaped LV switchboard

9.4 Low Voltage Distribution – Secondary Supplies

9.4.1 Existing Secondary Supplies

The site presently includes a small 72.5 kVA standby generator to support emergency lighting within the blocks under loss of grid condition. The generator age means it is past its service life.

9.4.2 Proposed Secondary Supplies

It is proposed that a new standby generator is to be installed to supply the life safety system under loss of grid condition. It is assumed secondary supplies (subject to the final fire strategy) will be required for the following systems:

Terminology	Description
Life safety supplies	Smoke extract and ventilation Firefighting lifts Main staircase Fire alarms system Cold water boosters

Table 9.4.1 Life safety systems.

The current proposed size for the generator is 550 kVA with a 600 L fuel tank considering the inclusion of all the above elements. This is subject to confirmation of the scope of life safety elements and formally agreeing on the fire strategy in stage 3.

The generator set is to supply an Automatic Transfer Switch (ATS) which supplies 1 No. essential LV switchboard. In case of a mains failure, the generator set would start and supply the life-safety loads.

A diverse cable route to be provided directly from the non-essential LV switchboard board to the life-safety loads via local-to-load automatic transfer switches. Refer to the proposed landlord schematic for details.

It is proposed the standby generator are to be installed within the basement, and we are presently investigating the use of flue dilution system for the exhaust to prevent the need to extract at roof level. This is to be confirmed with the local council emissions requirements and fire requirements for site at stage 3.

Confirmation of ventilation, fire and acoustic requirements to the generator room to be confirmed as part of stage 3 design.

It should be noted that should sprinklers be required, then a fire sprinkler system will be provided with an electric pump, an electric jockey pump and either a diesel fire pump or stand-by generator. The sprinkler installation does not necessarily therefore require a separate standby generator.

Uninterruptable Power Supplies (UPS) are to be provided to each Landlord comms room to supply the data cabinets which is responsible for ELV and security systems on site. This is subject to final smart building strategy confirmation.

Figure 9.4.1: Typical examples of standby generator (left) and UPS (right).

9.4.3 Summary of HV and LV

The electrical arrangement of the system is indicated below:

By	Equipment	Description	Dimensions	Weight
Distribution Network Operator – UKPN	Ring Main Unit RMU and HV air insulated switchgear (AIS)	Ring Main Unit, HV air insulated switchgear and relay protection unit close coupled to transformers to provide customer isolation of the power supply to the substation without the need to call out DNO.	RMU: 1.5 m x 1.2 m x 1.6 m approx. HV Switches: Up to 800 mm wide by 1,590 mm deep by 2,800 mm high per switch subject to selected equipment.	Up to 2,000 kg subject to selected equipment.
Site owned by DSQ or by iDNO	Transformers	4 No. 1.25 MVA and 1 No. 800kVA dry cast resin transformer with house or MIDEL transformer	Up to 2,150 mm wide by 1,170 mm deep by 2,480 mm high per transformer subject to selected equipment.	2,010-3,260 kg per transformer subject to selected equipment.
	Main LV Switchboard for non-essential loads	Form 4 type 6 U-shaped front access cubicle type main LV switchboard with integral incoming and outgoing protective	TBC	5,000 kg per switchboard subject to selected equipment.

By	Equipment	Description	Dimensions	Weight
		devices, power factor correction (TBC) and metering.		
	4 No. Energy Centre LV switchboards and 1 No. Life-safety switchboard (essential supplies)	Form 4 type 6 front access cubicle type main LV switchboards with integral incoming and outgoing protective devices, power factor correction (TBC) and metering	TBC	3,000 kg per switchboard subject to selected equipment. TBC
	4 No. LV Apartment LV switchboards	Form 4 type 6 front access cubicle type main LV switchboards with integral incoming and outgoing protective devices.	TBC	TBC
	Standby Generator	1 No. 550 kVA Generator	4800 mm x 1450 mm x 2432 mm (L x W x H)	Approx. 5300 kg dry weight

Table 9.4.2 Summary of HV and LV arrangements.

9.5 General LV Power

9.5.1 General

The installation will be designed and installed in accordance with the recommendations of:

CIBSE Guides and Technical Memoranda

Building Regulations.

CIBSE Guides and Technical Memoranda.

British Standards.

British Council for Offices Guide to Best Practice in the Specification of Offices

BSRIA Guides

Local and Statutory Authority Requirements

IET Wiring Regulations (BS 7671) – 18th Edition

Utility Supply Authority Regulations and Guidelines

Figure 9.5.1: Typical examples of panel boards (left) and final circuit distribution boards (right) for Landlord system use.

9.5.2 Landlord System

Floor mounted front access switchboards will be located within the LV switch rooms. The main switchboards will incorporate surge protection.

From the main LV switchboard electrical power supplies will be distributed at high-level using multi-core armoured sub-main cabling to sub-distribution panel board located within the group meter rooms.

Sub-distribution panel boards will be provided to supply power to final circuit distribution boards.

All sub-main panel boards will require metering. The panels will be manufactured with CTs and wiring looms to facilitate the re-use of these meters in t All distribution boards will be installed in lockable spaces i.e. risers / cupboards/ rooms. Where these areas require access by other persons than maintenance contractors, then a lockable distribution board is required with 2 No. keys. During the installation process and after the distribution boards have been made live the MEP Contractor will operate a permit to work system.

Split load distribution boards will have an integral meter compartment for the metering. Lighting and power circuits in all instances will be wired to corresponding distribution boards.

All mechanical plant will also be fed via dedicated distribution boards.

Final circuit distribution boards will be provided to supply lighting, small power and ancillary services. Generally, each distribution board will be provided with 25% spare capacity.

With the exception of local extract ventilation, DX cooling or the swimming pool installation of the majority of mechanical services, such as heat pump, hot water, circulation pumps etc. will be supplied via energy centre LV distribution system consisting of LV switch board local panel board, final circuit mechanical control centres (MCCs) as required.

All distribution boards and MCCs will be individually metered to comply with Building Regulations Part L requirements.

Sub-distribution boards and final circuit distribution boards will be located to provide a general provision of electrical power with allowance for addition and alteration. locations will be chosen that maintain accessibility to the electrical services, whilst not reducing flexibility or usage of production equipment.

Sockets outlets and miscellaneous small power accessories will be installed at locations throughout the facility and as detailed in the room data sheets and on the MEP layouts which will be developed in line with the client requirements at stage 3 design.

In the general office areas, accessories will be recessed into walls and wall finishes or provided via dado trunking.

Final circuit distribution boards will be provided to supply lighting, small power and ancillary services. Generally, each distribution board will be provided with 25% spare capacity.

Sockets will be provided along walkways / corridors for the benefit of the cleaning staff and will be suitably labelled.

Cables used within the building will be zero halogen (LS0H or LSHF) and routed within trunking or non-ventilated and lidded cable ladders and trays where practicable.

Fire bags will be installed in trunking and enclosed trays / ladders at each fire compartment boundary and at maximum 20 m intervals. Exposed cables will be flame retardant.

Based on the proposed arrangement for the provision of power to the apartment, the existing risers within each apartment block is to stripped-out and re-purposed as Landlord risers.

These risers are to consist of new local TPN LV final circuit distribution board as well as fire alarm, security and telecommunication cabling/equipment to and will be extended as required to enable the installation of the proposed equipment comply with present practice.

Final circuit distribution board are to be located such that it provides power to 3 No. floors and include network-enabled components and meters for monitoring by BMS.

Electrical accessories are to be screwless design such as MK Dimension range and are assumed to be synthetic finish to match architectural design

Figure 9.5.2 Typical examples of sockets with screwless design and USB charging.

All ancillary power supplies that may require dedicated power supplies will be fed back to the relevant landlord system. This is not limited but could include:

- Smoke Vent Panels / Dampers (primary and battery supplies)
- Motorised Smoke Vent Windows, louvres and extract plant (primary and battery supplies)
- Overheating ventilation extract fans
- Core smoke vent fans
- Car park mechanically assisted ventilation fans (dual supply)
- BEMS equipment and front end controls
- BEMS outstation panels
- Motorised Valves
- Motorised smoke dampers and fire dampers
- Gas, water, heat, and energy Meters
- Water Heaters in cleaners' sinks
- Roller shutter/gate to car park
- Fire detection and alarm panels
- CCTV equipment and powered cameras
- Access Control Equipment including intercoms
- Integrated Reception System (IRS) receiving and distribution equipment
- Fans
- Trace Heating fused connection units
- Car park petrol interceptor/ attenuation tank alarm panel
- Irrigation system for the garden landscaping

9.5.3 Apartment Systems

The final apartments installation will be dependent on the site requirement and metering and whilst there is a desire to retain the existing arrangement the following factor which may impact this:

Maintainability

The present risers are small and contain a number of services. Onsite contractors have reported issues with maintainability and where existing busbars have been replaced (due to the fire) it has been difficult sourcing a product that will fit.

Age of Equipment

The age of the installation means a lot of the equipment could be at the end of its serviceable life and as such would need to be replaced. This would increase difficulty with maintenance issues as a result of increase in size of the equipment.

Anticipated Increase in Electrical Demand

Energy scenario 2 may increase the electrical load in each apartment should local hot water generation be required.

Following discussions with the DNO, we would recommend option 2 in Section 6.3.3, the installation to be modified to provide a new electrical riser with new rising busbar and floor by floor group metering. This option has minimal impact on the existing basement arrangement, and provides the lowest cost solution

The new group metering rooms / electrical riser will be located on each floor and be vertically stacked. New local isolators are to be installed after each cut out/shipping meters as the main point of customer isolation.

New double stacked SPN metal Consumer Units Honeywell Metalclad CP are to be installed in compliance with all relevant standards. The minimum width anticipated for a consumer unit is 450 mm. Final locations and space requirements are to be coordinated with the architect and will be confirmed at stage 3. The consumer units are to be provided with surge protection, RCD and AFDD protection in line with BS7671 recommendations.

Smart wireless energy check meters are to be provided in the apartments to indicate electricity consumption.

Figure 9.5.3 Typical examples of consumer units (left) and smart energy monitors (right).

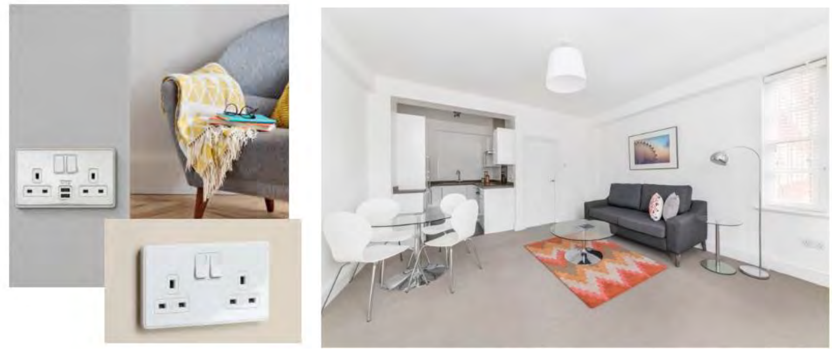
Local cabling within apartment is to be LSZH 6242B (twin and earth), with cable routed to minimise chasing as a result of present wall constriction. Where possible circuits are to be limited to radial and run in skirting boards trunking.

Figure 9.5.4 Typical examples of skirting for final circuit cabling.

Where cables have to run from skirting board or routed down the wall, cabling and associated chases will be coved with metal capping and plastered over.

It is presently assumed that 1 No. socket outlet per apartment will include USB charger point, location to be confirmed within stage 3.

Faceplates are to be installed on recessed back boxes to give a flush installation. Typical backbox require 35 mm recessed within a wall because of this and typical wall construction Intumescent Putty Pad are to be installed to help maintain fire and acoustic performance at these locations.



9.6 Electric Vehicle Charging (EVC) Facilities

22kW twin electric vehicle chargers (EVCs) such as the Menekes Amedio are to be installed on site to comply with the concurrent engineering standards and City of London's sustainability guidelines for use of EVCs.

The charging stations will be as follows:

- An estimate of 10no. twin rapid charge EVCs based on charging mode 3 as detailed by IEC 61851– minimum rating 22kW
- To be installed in the existing car park and be supplied from the new non-essential LV switchboard in the proposed Landlord LV switch room.
- Each changing station is to be capable of supply 2F parking bays.

A dedicated TT earthing system is to be provided for the EVCs. Installation to fully comply with the latest BS 7671 standard and relevant Electricity regulations.

Figure 9.6.1 Typical example of EVC charger.

Typical specification for a smart EVC:

- SMART charging technology / IOT enabled
- RFID/barcode/keypad connectivity via Bluetooth.
- Network connectivity via WIFI and/or fixed cable
- Shuttered T2 sockets (untethered)
- Supply voltage 380-415V AC (3 Phase)
- Suitable for indoor or outdoor fitment.
- Twin T2 sockets – charge two vehicles simultaneously.

9.7 General Lighting

9.7.1 Lighting – Lighting Design Parameters

This section of the report provides the descriptions of the lighting system. The performance objective for the lighting system is to provide an energy efficient lighting scheme to achieve appropriate functional and task lighting levels, appropriate colour rendering and to minimise glare within the development.

Luminaires will be selected to complement the building architecture and interior design.

The illumination for each building is to be based on maintained levels at 24-month cleaning cycles with a uniformity ratio as denoted in the relevant sections above.

The installation shall be designed and installed in accordance with the recommendations of:

- Building Regulations.
- CIBSE Guides and Technical Memoranda.
- British Standards.
- BCO Guidelines.

The lighting is to be designed with the principles of WELL standard, refer to Appendix G for further details.

9.7.2 Lighting – Landlord

The lighting design will be driven by the architectural concept and the proposed ceiling design.

It is assumed there will be no ceiling within the plant areas, riser and other functional areas such as the basement area, etc.

Within office areas lighting is to be provided with high quality LED luminaires, which will be utilised to provide an installation to conform to the requirements of the CIBSE Code for Lighting and CIBSE Lighting Guides LG3 and LG7, together with BCO Guides and the apartment /Houses which will be based on CIBSE SLL Lighting Guide 9: Lighting for Communal Residential Buildings.

Lighting within office areas are to be selected based on ceiling type selected for the area. This shall allow illumination of the walls and soffit within each area whilst also providing a uniform lighting level on the working plane and limiting glare on workstations or display screens.

Circulation, core areas and back of house spaces are to be provided with LED luminaires suspended, surface mounted or recessed fittings as appropriate to the ceiling design and reflecting the architectural design.

The reflectance of the surfaces within all areas but specifically the offices shall be in accordance with the relevant standards, e.g. CIBSE LG7 and CIBSE LG11.

Meeting rooms, office areas and any other spaces where video conferencing facilities may be used will have adequate cylindrical illuminance such that good facial recognition is achieved. Luminaires with appropriate optics and at considered mounting heights shall be used where this is required.

The gym, sport facility, spa swimming pool and restaurant area are to be provided with LED luminaires and use a mixture of functional and feature luminaires based on the architectural design.

9.7.2.1 Lighting Controls – Landlord

Within all Landlord areas (with natural light), lighting controls shall include a daylight linked lighting control system. The system shall modulate the output of luminaries in perimeter zones against incoming daylight using light sensors integrated within individual luminaires.

Lighting controls will be via integral presence detection and daylight linked dimming. Luminaires will operate in zones such that any detection by one luminaire will trigger a signal to switch on remaining luminaires in that zone. Luminaires shall regulate in accordance with the amount of ambient day light and shall maintain pre-set levels. The system shall be zoned in linear arrays away from the predominantly glazed façade and shall also be zoned to provide out of hours circulation route lighting for security personnel.

Circadian rhythm lighting control is to be provided in all operational space with little or no direct access to daylight.

Where circadian rhythm lighting control is provided it will be possible override the pre-set lighting scheme. A control plate will be provided to each room that has tuneable white fittings

All facilities of system shall have the ability to be isolated if required.

Within all stair cores and toilet facilities luminaires shall be switched using passive infra-red occupancy detectors (PIRs) or microware detectors

Within all changing facilities luminaires shall be dimmed using passive infra-red (PIRs) or microware detectors.

All plant areas shall be provided with conventional local manual switching.

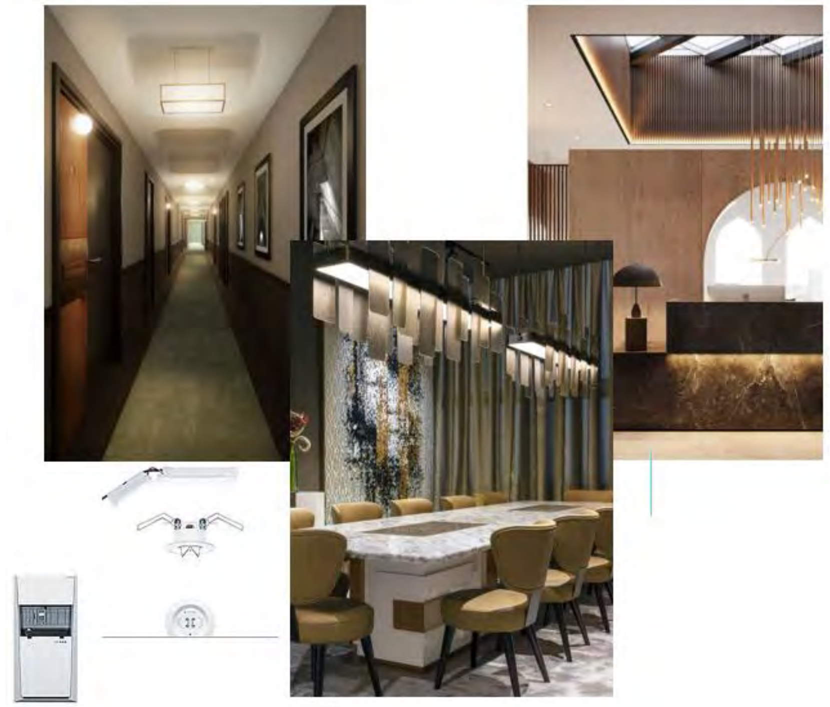


Figure 9.7.1 Typical examples of architectural lighting options within corridors.

Figure 9.7.2 Typical examples of luminaires for the apartments.

9.7.3 General Lighting – Apartments

The existing lighting scheme consists of domestic style luminaires utilising a mixture of plug in lamps manually switched via local light switches. The installation is to be replaced as part of the proposed apartment refurbishment.

Where existing Tenants are to return to the property post refurbishment, existing pendant luminaire are to be retained and re-lamped.

Figure 9.7.3 Typical existing apartment with pendant lighting.

For all other apartments, general area lighting is to be provided via new pendant based luminaire with E27 LED lamps.

Where pendants are not currently existing and there are no cable ways, lighting will be provided by floor or table standing luminaires to avoid chasing walls within the apartment.

Figure 9.7.4 Examples of general apartment lighting.

Within bathroom and kitchens where new ceiling is to be installed new IP44 downlighters are to be installed.

Figure 9.7.5 Typical examples of spotlight luminaires for the kitchens.

Feature lighting consisting of linear-tape is to be utilised under kitchen cupboards to provide illuminance on the kitchen counters.

Figure 9.7.6 Typical example of LED tape for the kitchens.

9.7.3.1 Lighting Controls – Apartments

To avoid chasing the wall, it is proposed that wireless technologies are used for controls.

- **Option 1 – Wireless.** Basic wireless lighting control systems offers the same functionality as wired manual switches. The best technologies typically use EnOcean protocol. Self-powered switches which transmit to local receivers and plug in devices will be used to switch both ceiling and floor standing luminaire, respectively. This style of wireless controls has minimal maintenance and are to be powered via Piezo. Devices such as the MK Echo range come with 10-year warranty and match the electrical accessories range being proposed for the general sockets.

Figure 9.7.7 Typical examples of simple wireless lighting control equipment.

- **Option 2 – Smart.** Smart lighting control system such as Lurton RA2 enable control by local wireless switches device as well via computer or smart phones. They can also be integrated with other technologies such as RING security system, Sano, Honeywell Home, Alexa, apple home kit and Google assist via the control hub. Smart systems can also offer more complex sensor and enable daylight dimming. The disadvantage with this type of system is the sensor and switches that are typically battery operated and require the hub to be connected to the internet for the full functionality to be operational.

Figure 9.7.8 Typical examples of smart wireless lighting control equipment.

We would recommend option 1, the basic wireless system.

9.7.4 Emergency Lighting – General

The design and installations shall comply with BS5266. Emergency lighting shall be provided as a combination of:

- Centralised emergency lighting supplied via central battery system to Landlord system.
- Illuminated exit signs to be provided indicating exit routes from the building in line with the fire strategy.

The system will utilise a monitoring system with group monitoring of all luminaires and the contractor will be deemed to have allowed for the DALI control cabling and hardware to enable this. This system offers centralised testing and reporting via web-based feedback.

Emergency lighting is not expected to be provided within the apartments.

A minimum of 1 lux will be provided along the centre line of all escape routes. Emergency lighting shall also be provided externally to all final escape doors, and along external paths running alongside the building. Emergency lighting shall also be provided to:

- Exit doors from rooms into escape routes and out of the building
- Changes of direction and intersections in escape routes
- Changes of level
- External to final exits
- Near firefighting equipment (extinguishers, hose reels, etc.)
- Fire alarm system manual call points
- Near distribution boards and switchgear
- Along external paths which run adjacent to the building

Emergency luminaires will use dedicated LED lamps.

Emergency lighting and exit signs will provide a 3 hour duration on mains failure and shall have a maximum recharge period of 24 hours from complete discharge.

Exist signs will be maintained sustained operation.

Emergency exit signs, stand-alone emergency fittings will be selected to compliment the architectural design.

Exterior emergency luminaire will be provided at each exit point

Emergency lighting will be achieved by one of the following options:

- Option 1 - Fitted with NiMH (nickel metal hydride) batteries
- Option 2 - Supplied via small central battery system.

Small DC based central battery system with centralized monitoring system offer lower operational cost than standard installation and are recommend if the increase capital cost can be accommodated with the budget.

Options for both systems are to be explored as part of the stage 3 design.

9.7.5 External Lighting

New external lighting will be designed in accordance with BS EN 12464-2 and CIBSE SLL Guide LG6 2016: CIBSE SLL Code for Lighting and be based on an assumed environmental zone of E3 (small town centres or urban location). The external lighting will also be designed in accordance with BS 5489-1.

All external lighting (except for safety or security lighting) will incorporate a time clock with photocell override and dimming controls. They will also have the capability to be automatically switched off between 23:00 and 07:00 if required.

The average initial luminous efficacy of the external fittings within the construction zone will not be less than 70 luminaire lumens per Circuit Watt and all external light fittings will be automatically controlled for prevention of operation during daylight.

The lighting within the Moroccan garden and other external areas will be selected and designed to complement the landscape plan, refer to Appendix D for possible concepts and details.

9.8 Security Systems

9.8.1 General

Electrical security systems - CCTV, door access control, intruder alarms - will be provided to support the overall approach to security within the facility.

The details of the proposed security system will be dependent based on the client security requirement and smart building brief which will developed during stage 3.

9.8.1.1 CCTV

A new CCTV will be provided under the construction project, its extent and coverage are still to be confirmed by the client and as such will be developed during stage 3

9.8.1.2 Access Control

A new access control will be provided under the construction project its extent and coverage are still to be confirmed by the client and as such will be developed during stage 3.

Video intercom will be provided on the entrance of each block, the intercom is to be linked to each apartment to enable two-way communication and the operation of the main doors for guess.

9.8.1.3 Intruder Alarm.

The security requires are still to be confirmed by the client but even the open nature of the site and the need for 24 hour access it is assume intruder alarms system will not be required throughout the development.

9.9 Fire Detection and Alarm

9.9.1 General

The existing fire alarm installation is to be replaced with a new analogue addressable point to point fire alarm system to meet BS.5839, to support the overall fire strategy for the development.

The installation will be designed and installed in accordance with the recommendations of:

- Building Regulations.
- British Standards, including BS 5839 (2002): Fire Detection and alarms for Buildings
- Local Fire Brigade.
- Local Authority.

A fully automatic analogue addressable fire detection and alarm system will be installed throughout the entire facility.

The system will provide an efficient means of detecting and giving warning in the event of a fire and will be designed to a category detailed within the fire strategy report.

Figure 9.9.1 Typical examples of fire alarm equipment.

The main fire detection panels will be located at the main reception, with repeater panels situated within the lobby of each apartment block and security office.

Cabling for the site wide fire detection and alarm system will be contained above ground and affiliated to cable trays, basket systems or clipped to the building structure and fabric.

The fire alarm system will operate on a Peer to Peer basis (not master and slave) and will have be open protocol. Integral battery backup of 72 hours duration followed by 30 minutes of alarm upon loss of supply will be provided.

The fire alarm system will be interfaced with the lifts and the card access system. In the event of fire alarm activation, nonfirefighting lifts will descend to the ground floor and cease operation with the doors fully opened. The card access alarm control will release controlled doors, but this system will be supplemented by a break glass and internal button release.

The Fire Alarm system will monitor the sprinkler alarm and flow switches (should a sprinkler system be installed) and will interface with the Mechanical Plant via the MCC panels.

General detection will be via point type optical smoke and heat detectors.

Sounders will be used to provide an audible alarm of 65 dB(A) in the offices and a sound level of either 65 dB (A) or 10dB(A) above the background noise level in production and plant areas.

Supplementary facilities for the hard of hearing will also be provided in accordance with the requirements of the Building Regulations.

Void detection will be provided as necessary and in compliance with the latest standards and regulations.

9.9.2 Landlords

New analogue addressable fire detection and alarm system to be provided throughout.

New panel will be located within apartment block main lobby, main reception, and security office.

All apartment blocks and Landlord panel linked via commination link. Purpose of communication link to be determined by fire strategy.

Consideration will be given to self-test system with stage 3.

Figure 9.9.2 Typical examples of fire alarm equipment.

9.9.3 Apartments

Looped power detector with integral sounder within each apartment to remove risk and maintenance associated with standalone apartments system.

The safety switch within apartment to silent alarm under false alarm condition and testing.

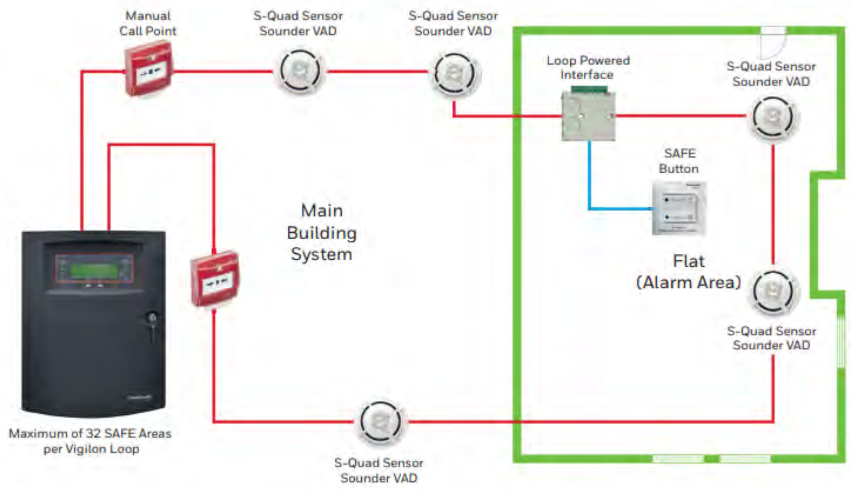


Figure 9.9.3 Typical example of a fire alarm system.

Figure 9.9.4 Typical example of a fire alarm test button.

Heat detector will be provided within the kitchen areas while circulation and living space will be protected by smoke detectors.

The proposed arrangement will also enable the site manager or fire brigade to evacuate the apartment block if required.

9.10 Containment

Provide a comprehensive containment system to serve all areas of the building. Provide separate containment for the following systems:

- LV Sub-mains
- Lighting and small power
- Fire alarm
- Data

Containment systems to consist of galvanised steel cable trays, baskets and conduits and be concealed where reasonably practicable.

Where denoted within this stage 2 report some cables are to be concealed behind skirting, where this is applicable all containment must be withing dedicated wiring zones.

All sub-main cabling to be XLPE/SWA/LSZH multicore cables on galvanised steel cable tray.

Extra low voltage (ELV) cabling associated with services such as fire alarm, security, BEMS etc. to be LSZH multicore 'flexible' cabling on steel cable basket and/or in solid / flexible steel conduits.

All HV cables will be to DNO requirements on galvanised heavy duty cable ladder.

All containment systems within comms rooms will be aluminium to minimise zinc whiskers.

All services in plantrooms, switch rooms and comms rooms to be surface mounted.

All external plant, equipment, and services to be IP65 rated as a minimum.

Any unused space in the mechanical risers of the apartments will be investigated as part of stage 3 design as to route sub-main cables vertically through them rather than horizontally within the corridors.

Figure 9.9.5 Typical examples of containment.

9.11 Earthing and Bonding

All relevant metal construction elements including structural steelwork and water pipes will be earthed and bonded as required by BS7671: Requirement for electrical installation. The installation will be designed and installed in accordance with the recommendations of:

Building Regulations.

CIBSE Guides and Technical Memoranda.

British Standards.

A complete earthing and bonding installation shall be provided to comply with the BS 7671 and the Electricity Regulations.

A main earth bar will be provided adjacent to the main LV switchboard within the substation room.

Additional earth connections / ground termination networks will be provided for production equipment where required and for the main communications room.

9.12 Lightning Protection

Existing lighting protection system is to be tested and repaired.

The existing system to protect the building fabric against damage from a lightning strike.

The installation will be designed and installed in accordance with the recommendations of:

Building Regulations.

British Standards, including:

BS EN 62305: 2011 Protection Against Lightning

A lightning protection system consisting of an air termination and roof network, eaves conductor, down-conductors and earth terminals will be provided fully in accordance with British Standards.

9.13 Structured Cabling / Comms

9.13.1 General

A dedicated server room or main IT room will be required in the basement. Cables from the server room will supply 800 mm x 1000 mm 42 U IT cabinets in existing tank rooms on the roof of each block. The cabinets will be provided with glass doors to front and rear. The cabinets can sit side by side. For space planning purposes assume the room is 3.0 m x 3.6 m internal.

The rooms need to be air-conditioned. The cabinets may contain integral fans for air circulation across the units. The cabinets and AC will be provided within the contract.

Within the main IT room, one cabinet will manage all the structured cabling UTP Cat 6 together with fibre and associated fibre switches. The roof cabinets will be for Landlord system only. All cabinets, patch panels and fibre terminations are in the contract. Switches and active equipment all by client specialist.

All ethernet cabling shall be UTP Category 6 cabling, star wired form the server room structured cabling cabinet or the distributed cabinets.

All data outlets will be within 90 m of the switch otherwise dedicated switched will need to be provided locally.

All distributed cabinets will be connected back to the main server room via fibre, the fibre and associated containment must be included in the main contract. These units could be wall mounted units, typically 12U high. Size for planning 600 mm x 800 mm.

EV chargers all require data points, assume one point per power outlet. The electrical design is based upon 13 number twin EVC chargers so assume 26 data points associated, all data points in external grade UTP terminating in the EVC charger themselves.

Wireless Access Points (WAPs) will be required on site and will be supplied via the roof cabinets to each floor in each block. Client specialist to undertake a WAP survey and confirm all.

9.13.2 Landlord

New Landlord system to be provided to the latest standards.

Communications strategy and required equipment will be part of the smart building consultants brief.

Allowance is made for data cabinets and cabling as mentioned in the previous section to supply Landlord system.

CCTV, access control and security systems will be all supplied via the Landlord's communication infrastructure.

At this point, space allowance is provided for data cabinets in the roof of each block as mentioned in the previous section.

Dedicated data cabinets to supply the café area, swimming pool and gym will be located on the ground floor in proximity of these areas.

9.13.3 Apartments

It is assumed existing incoming telecommunication infrastructure to be updated such that each apartment is provided with both copper and fibre optic based broadband connection

It is assumed local connectivity within the apartment will be provided via apartments' broadband provider wireless access point.

A new communal TV aerial system will be provided to distribute FreeSat, digital television and radio broadcast services via terrestrial and satellite platforms. The installation is to include antennae at roof level with amplifier/ switches and other components distributed through the building

The system will be based on conventional co-axial cable system.

As an alternative, a dedicated service provider is also to provide fibre optic infrastructure, internet connection and TV provision and manage asset (i.e. Glide) – subject to confirmation.

9.14 Disabled Refuge

A disabled refuge will be provided on site. Locations to be adjacent to escape stairs in accordance with Building regulations Part M.

Final details to be determined at the next stage.

9.15 Induction Loop System

Induction loop systems will be provided as required and requested by Client.

9.16 AV Requirements

Details of AV requirement with the Landlord areas are yet to be determined and as such will be determined in stage 3.

9.17 Disabled Alarm Systems

Disabled alarm system to be provided complying with Part M of the building regulations.

Equipment in compliance with BS8300.

Where disabled refuges exist, call systems are to be provided complying with BS5839-9.

9.18 Photovoltaic Installation (Energy Scenario 3)

Under scenario 3 of the energy assessment a photovoltaic system will be installed, refer to the energy strategy for further details.

If option 3 is used a full photovoltaic system will be installed on the roof, location to be confirmed at stage 3.

The MEP Contractor will be responsible for the full design, installation, testing and commissioning of the system to maximise efficiency and output within the minimal area on the roofs to ensure a balance of the area for obtaining all the performance criteria for all contractual aspects i.e. green/brown roof, safe access, planning, etc and anything else the client decides.

A generation meter on each connection to the local Landlord's LV distribution board. The meters are to be Modbus and provide signal to the BEMS for the monitor and log of the daily, weekly and monthly kWh. The BEMS will provide a display device of the combined total for all PV connections to in an IP65 enclosure in the podium area.

The LV distribution is to meet BS 7671, BS EN 62446, ENA ER G59 and Microgeneration Certification Scheme's Guide to the Installation of Photovoltaic Systems (MIS 3002).

The panels, containment and cabling with its switchgear and inverters are all to be coordinated with the roof membrane, green/brown roof installation, access routes including the man safe system and all other plant.

Labelling will be provided to all PV connection points, across the LV distribution and main incoming LV disconnection points, to alert operators of the constant live PV system.

9.18.1 Modelling and Access

The panels should be limited to a maximum of 15-degree tilt (subject to wind loading modelling) to allow for a frame with ballast. The panels and their frames, containment, switchgear and inverters are not to be fixed into the waterproofing membrane of the roof.

A daylight shadow modelling exercise is to be completed taking into account for the existing buildings and the buildings in the close vicinity that are under to ensure the proposed system will work to the full extent.

Appendices

Appendix A Sketches, Drawings and Schedules

The sketches, drawings and schedules listed in the following are attached to this report.

Sketch/Drawing/Schedule Number	Sketch/Drawing/Schedule Title
Mechanical	
DSQ-CDL-P-04-SK-M-01041	Dun405 Radiator Sizing
DSQ-CDL-P-RF-SK-M-02001	Duncan House Mechanical Roof Plant – Option 1a
DSQ-CDL-P-RF-SK-M-02002	Duncan House Mechanical Roof Plant – Option 1b
DSQ-CDL-P-RF-SK-M-02003	Duncan House Mechanical Roof Plant – Option 1c
DSQ-CDL-P-RF-SK-M-02004	Duncan House Mechanical Roof Plant – Option 2
DSQ-CDL-P-XX-SH-M-90200	Dun405 Radiator Schedule
Electrical	
DSQ-CDL-P-XX-SK-E-09001	Duncan House - Option 3 Group Metering Arrangement
DSQ-CDL-Z-XX-SK-E-09004	Proposed Electrical Risers Locations Option 2 Arrangement
DSQ-CDL-Z-XX-SK-E-09005	Proposed Electrical Risers Locations Option 3 Arrangement
DSQ-CDL-P-RF-SK-E-02001	Duncan House Electrical Roof Plant
DSQ-CDL-Z-XX-DR-E-15001	Existing HV/LV Schematic - North Sheet 1 of 2
DSQ-CDL-Z-XX-DR-E-15002	Existing HV/LV Schematic – South Sheet 2 of 2
DSQ-CDL-Z-XX-DR-E-15003	Proposed Apartment HV/LV Schematic Sheet 1 of 2 Option 2 Arrangement
DSQ-CDL-Z-XX-DR-E-15004	Proposed Apartment HV/LV Schematic Sheet 2 of 2 Option 3 Arrangement
DSQ-CDL-Z-XX-DR-E-15005	Proposed Landlord HV/LV Schematic
DSQ-CDL-P-05-SK-E-01052	Duncan House Typical Floor Electrical Services Distribution Sketch Option 2
DSQ-CDL-P-05-SK-E-01053	Duncan House Typical Floor Electrical Services Distribution Sketch Option 3
DSQ-CDL-P-05-SK-E-01054	Duncan House Typical Floor Electrical Services Containment Sketch Sheet 1 of 3
DSQ-CDL-P-05-SK-E-01055	Duncan House Typical Floor Electrical Services Containment Sketch Sheet 2 of 3
DSQ-CDL-P-05-SK-E-01056	Duncan House Typical Floor Electrical Services Containment Sketch Sheet 3 of 3
DSQ-CDL-Z-B1-SK-E-00991	Basement Electrical Containment Route Option 3 Arrangement
DSQ-CDL-Z-XX-DR-E-65001	Fire Alarm Schematic
DSQ-CDL-Z-XX-DR-E-45001	Structured Cabling Schematic
Public Health	

DSQ-CDL-Z-02-SK-P-01027	Domestic Water Services Level 02
DSQ-CDL-Z-B1-SK-P-00997	Basement 1 Domestic Water Services
DSQ-CDL-Z-B2-SK-P-00981	Basement 2 Existing Drainage
DSQ-CDL-Z-RF-SK-P-02001	Roof Domestic Water Services Year 2
DSQ-CDL-Z-RF-SK-P-02002	Roof Domestic Water Services Year 3
DSQ-CDL-Z-RF-SK-P-02003	Roof Domestic Water Services Year 4
DSQ-CDL-Z-RF-SK-P-02004	Roof Domestic Water Services Year 5
DSQ-CDL-Z-RF-SK-P-02005	Roof Domestic Water Services Year 6
DSQ-CDL-Z-RF-SK-P-02006	Roof Domestic Water Services Year 7
DSQ-CDL-Z-RF-SK-P-02007	Roof Domestic Water Services Year 8
DSQ-CDL-Z-RF-SK-P-02008	Existing Roof Surface Water Drainage Strategy
DSQ-CDL-Z-XX-SK-P-00991	Basement 1 Suspended Drainage
DSQ-CDL-Z-XX-SK-P-05007	Domestic Water Services Schematic
DSQ-CDL-Z-XX-SK-P-05008	Above Ground Drainage Schematic
DSQ-CDL-Z-XX-SK-P-09007	Existing Domestic Water Services
Combined MEP	
DSQ-CDL-P-05-SK-Z-01051	Dun504 MEP Proposals (Centralised MVHR)
DSQ-CDL-P-05-SK-Z-01052	Duncan House Typical Floor Riser Layout
DSQ-CDL-P-XX-SK-Z-09001	Duncan House Mechanical Riser Arrangements
DSQ-CDL-Z-XX-SK-Z-09002	B1 Level Proposed MEP Plant Locations – Existing
DSQ-CDL-Z-XX-SK-Z-09003	B1 Level Proposed MEP Plant Locations – Phase 1, Year 1
DSQ-CDL-Z-XX-SK-Z-09004	B1 Level Proposed MEP Plant Locations – Phase 1, Year 2
DSQ-CDL-Z-XX-SK-Z-09005	B1 Level Proposed MEP Plant Locations – Phase 1, Year 3
DSQ-CDL-Z-XX-SK-Z-09006	B1 Level Proposed MEP Plant Locations – Phase 2, Year 4
DSQ-CDL-Z-XX-SK-Z-09007	B1 Level Proposed MEP Plant Locations – Phase 2, Year 5
DSQ-CDL-Z-XX-SK-Z-09008	B1 Level Proposed MEP Plant Locations – Phase 3, Year 6
DSQ-CDL-Z-XX-SK-Z-09009	B1 Level Proposed MEP Plant Locations – Phase 3, Year 7
DSQ-CDL-Z-XX-SK-Z-09010	B1 Level Proposed MEP Plant Locations – Phase 4, Year 7
DSQ-CDL-Z-XX-SK-Z-09011	B1 Level Proposed MEP Plant Locations – Phase 4, Year 8
DSQ-CDL-Z-XX-SK-Z-09012	B1 Level Proposed MEP Plant Locations – Completion

DSQ-CDL-Z-XX-SK-Z-09013	Thornton Reynolds B1 Plant Space Comparison – Elec Option 2
DSQ-CDL-Z-XX-SK-Z-09014	Thornton Reynolds B1 Plant Space Comparison – Elec Option 3

Appendix B Mechanical Calculations

Heat Gains and Losses – Existing Fabric

This table summarises peak winter heat losses and peak summer heat gains for a sample of 24 apartments and 3 corridors in Duncan House, based on the current building fabric.

Apartment Type (Refer to DSQ-CDL-Z-XX-RD-M-20601)	No.	Apt. for Cymap	Fabric Loss (kW)	W/m2	Infiltration Loss (kW)	W/m2	Total Heat Loss (kW)	W/m2	Vent. Loss (kW)	W/m2	Total Heat Loss incl. Vent (kW)	W/m2	Total Heat Gain (kW)	W/m2	Vent. Gain (kW)	W/m2	Total Heat Gain incl. Vent (kW)	W/m2
1	2	Dun001	1.0	44	0.6	24	1.5	68	1.3	57	2.8	125	1.7	75	0.2	10	1.9	85
2	10	Dun711	1.0	39	0.6	24	1.6	64	1.3	50	2.9	113	2.5	97	0.2	9	2.7	106
24	1	Dun305	0.7	20	0.8	24	1.5	43	1.3	36	2.8	79	2.3	65	0.3	8	2.6	73
30	2	Dun901	2.2	57	0.9	25	3.1	82	1.5	40	4.6	122	4.3	114	0.1	3	4.4	116
37	13	Dun005	1.4	34	1.0	24	2.4	58	0.4	10	2.9	69	3.8	92	0.1	2	3.9	94
3	15	Dun405	1.0	28	0.9	24	1.8	52	1.3	35	3.1	87	3.1	86	0.3	8	3.4	94
4	2	Dun006	1.9	38	1.2	24	3.1	62	1.3	26	4.4	88	5.5	110	0.3	6	5.8	116
6	1	Dun804	1.9	43	1.1	24	3.0	67	1.3	28	4.3	96	5.1	113	0.3	7	5.4	120
46	8	Dun107	1.5	38	1.0	24	2.5	61	1.3	33	3.8	94	3.9	98	0.1	2	4.0	101
7	4	Dun909	2.7	55	1.2	24	3.9	79	1.4	29	5.3	108	4.5	91	0.1	2	4.6	93
9	1	Dun809	2.5	53	1.2	25	3.7	78	1.3	28	5.0	107	4.7	101	0.2	4	4.9	105
10	1	Dun808	2.6	57	1.1	25	3.8	82	1.3	29	5.1	110	3.8	81	0.2	4	4.0	86
11	8	Dun608	1.3	33	1.0	24	2.3	57	1.3	33	3.6	89	2.8	71	0.2	5	3.0	76
12	5	Dun401	1.6	36	1.1	24	2.7	59	1.2	27	3.9	87	4.5	100	0.3	7	4.8	107
13	7	Dun110	2.4	44	1.3	24	3.7	68	1.3	24	5.0	93	5.0	93	0.2	4	5.2	96
14	7	Dun202	1.4	29	1.2	24	2.6	53	1.3	26	3.9	79	5.0	101	0.3	6	5.3	107
15	3	Dun907	2.7	44	1.5	24	4.2	68	1.4	22	5.6	90	6.9	111	0.3	5	7.2	116
16	1	Dun007	2.4	36	1.6	24	4.1	59	1.5	22	5.6	82	6.9	101	0.3	4	7.2	105
17	8	Dun409	2.6	47	1.3	24	3.9	71	1.3	24	5.2	95	4.1	74	0.2	4	4.3	78
18	1	Dun905	4.9	64	1.9	25	6.7	89	1.4	18	8.1	107	6.4	85	0.3	4	6.7	89
19	1	Dun706	3.7	30	2.9	24	6.7	54	1.8	14	8.5	68	9.7	78	0.4	3	10.1	81
58	1	Dun811	4.2	34	3.0	24	7.3	58	1.8	15	9.1	73	10.3	82	0.2	2	10.5	84
20	1	Dun801	2.9	38	1.9	24	4.8	62	1.3	17	6.1	79	7.5	97	0.3	4	7.8	101
21	1	Dun210	5.0	44	2.8	24	7.8	67	2.6	23	10.4	90	8.8	76	0.4	4	9.2	80
Ground floor corridor	1	Dun00C	0.5	6	4.2	45	4.8	50	0.0	0	4.8	50	3.0	32	0.0	0	3.0	32
Mid floor corridors	8	Dun07C	-0.1	-2	2.7	45	2.6	44	0.0	0	2.6	44	1.4	25	0.0	0	1.4	25
9th floor corridor	1	Dun09C	0.8	13	2.8	46	3.6	59	0.0	0	3.6	59	2.5	40	0.0	0	2.5	40
Total (extrapolated for whole of DH)	**114**		**183**	**35**	**142**	**26**	**324**	**60**	**127**	**27**	**451**	**87**	**445**	**85**	**22**	**5**	**467**	**90**

All heat values include a 10% margin

Heat Gains and Losses – Scenario 1

This table summarises peak winter heat losses and peak summer heat gains for a sample of 24 apartments and 3 corridors in Duncan House, based on building fabric improvements as per energy scenario 1. Gross and net values of heat losses are shown to demonstrate the quantity of heat that can be recovered using MVHR (assumed 80% heat recovery efficiency).

Apartment Type (Refer to DSQ-CDL-Z-XX-RD-M-20601)	No.	Apt. for Cymap	Fabric Loss (kW)	W/m2	Infiltration Loss (kW)	W/m2	Subtotal (kW)	W/m2	*Vent. Loss (kW)*	W/m2	*Gross Loss (kW)*	W/m2	*MVHR Recovery (kW)*	*Net Loss (kW)*	W/m2	Total Heat Gain (kW)	W/m2	Vent. Gain (kW)	W/m2	Total Heat Gain incl. Vent (kW)	W/m2
1	2	Dun001	0.4	19	0.2	9	0.6	28	1.3	56	1.9	84	1.0	0.9	39	1.2	55	0.3	11	1.5	66
2	10	Dun711	0.4	16	0.2	9	0.6	24	1.3	50	1.9	74	1.0	0.9	34	1.8	71	0.2	9	2.1	80
24	1	Dun305	0.4	12	0.3	8	0.7	21	1.3	36	2.0	57	1.0	1.0	28	1.7	48	0.3	9	2.0	57
30	2	Dun901	0.8	20	0.3	8	1.1	28	1.5	39	2.6	67	1.2	1.4	36	3.2	84	0.1	3	3.3	86
37	9	Dun005	0.7	17	0.3	8	1.0	25	0.4	11	1.5	35	0.4	1.1	27	2.7	63	0.1	3	2.8	66
3	12	Dun405	0.6	16	0.3	8	0.9	24	1.3	36	2.1	60	1.0	1.1	31	2.2	62	0.3	8	2.5	70
4	2	Dun006	0.9	17	0.4	8	1.3	25	1.3	26	2.6	51	1.0	1.5	31	3.8	75	0.3	6	4.1	81
6	8	Dun804	0.8	18	0.4	8	1.2	27	1.3	28	2.5	55	1.0	1.5	33	3.5	78	0.3	7	3.8	85
46	8	Dun107	0.6	14	0.3	8	0.9	22	1.3	33	2.2	55	1.0	1.2	29	3.0	75	0.1	2	3.1	78
7	4	Dun909	1.2	24	0.4	8	1.6	33	1.4	27	3.0	60	1.1	1.9	38	3.4	69	0.1	2	3.5	71
9	1	Dun809	1.1	23	0.4	9	1.5	32	1.3	28	2.8	60	1.0	1.8	38	3.5	75	0.2	4	3.7	80
10	1	Dun808	1.2	26	0.4	9	1.6	34	1.3	28	2.9	63	1.0	1.9	40	2.9	62	0.2	5	3.1	68
11	8	Dun608	0.5	12	0.3	8	0.8	20	1.3	32	2.1	53	1.0	1.1	27	2.1	52	0.2	6	2.3	58
12	5	Dun401	0.5	12	0.4	8	0.9	20	1.2	28	2.2	48	1.0	1.2	26	3.5	77	0.3	7	3.8	84
13	7	Dun110	1.0	19	0.5	8	1.5	27	1.3	24	2.8	51	1.0	1.7	32	3.8	69	0.2	4	4.0	73
14	7	Dun202	0.6	13	0.4	8	1.0	21	1.3	26	2.3	47	1.0	1.3	26	3.5	70	0.3	6	3.8	76
15	3	Dun907	1.2	19	0.5	8	1.7	28	1.3	22	3.1	49	1.1	2.0	32	4.5	72	0.3	5	4.8	77
16	1	Dun007	1.1	17	0.6	8	1.7	25	1.5	22	3.2	47	1.2	2.0	29	4.7	69	0.3	4	5.0	73
17	8	Dun409	1.1	20	0.5	8	1.5	28	1.3	24	2.8	52	1.0	1.8	33	3.1	57	0.2	4	3.4	61
18	1	Dun905	2.2	29	0.6	8	2.8	37	1.3	18	4.2	55	1.1	3.1	41	4.6	61	0.3	4	4.9	65
19	1	Dun706	1.8	14	1.0	8	2.8	23	1.8	14	4.6	37	1.4	3.2	26	7.1	57	0.4	3	7.5	60
58	1	Dun811	1.8	14	1.1	8	2.8	22	1.8	14	4.6	37	1.4	3.2	25	7.5	60	0.3	2	7.8	62
20	1	Dun801	1.3	16	0.7	8	1.9	25	1.3	17	3.2	41	1.0	2.2	28	5.4	70	0.3	4	5.7	74
21	1	Dun210	2.3	20	1.0	8	3.3	28	2.6	23	5.9	51	2.1	3.8	33	6.6	57	0.4	4	7.0	61
Ground floor corridor	1	Dun00C	0.4	4	4.2	45	4.6	48	0.0	0	4.6	48	0.0	4.6	48	2.3	24	0.0	0	2.3	24
Mid floor corridors	8	Dun07C	-0.1	-2	2.7	45	2.6	44	0.0	0	2.6	44	0.0	2.6	44	1.2	20	0.0	0	1.2	20
9th floor corridor	1	Dun09C	0.0	0	2.8	46	2.8	46	0.0	0	2.8	46	0.0	2.8	46	1.5	24	0.0	0	1.5	24
Total (extrapolated for whole of DH)	**114**		**80**	**15**	**68**	**12**	**148**	**27**	**129**	**27**	**278**	**54**	**104**	**174**	**32**	**331**	**63**	**24**	**5**	**356**	**68**

All heat values include a 10% margin

Heat Gains and Losses – Scenario 2

This table summarises peak winter heat losses and peak summer heat gains for a sample of 24 apartments and 3 corridors in Duncan House, based on building fabric improvements as per energy scenario 2. Gross and net values of heat losses are shown to demonstrate the quantity of heat that can be recovered using MVHR (assumed 90% heat recovery efficiency).

Apartment Type (Refer to DSQ-CDL-Z-XX-RD-M-20601)	No.	Apt. for Cymap	Fabric Loss (kW)	*W/m2*	Infiltration Loss (kW)	*W/m2*	Subtotal (kW)	*W/m2*	*Vent. Loss (kW)*	*W/m2*	*Gross Loss (kW)*	*W/m2*	*MVHR Recovery (kW)*	*Net Loss (kW)*	*W/m2*	Total Heat Gain (kW)	*W/m2*	Vent. Gain (kW)	*W/m2*	Total Heat Gain incl. Vent (kW)	*W/m2*
1	2	Dun001	0.2	10	0.1	4	0.3	14	1.2	55	1.5	69	1.1	0.4	19	1.2	55	0.2	11	1.5	66
2	10	Dun711	0.2	9	0.1	4	0.3	13	1.3	50	1.6	63	1.2	0.5	18	1.9	72	0.2	9	2.1	81
24	1	Dun305	0.1	4	0.1	4	0.3	7	1.3	36	1.5	43	1.2	0.4	11	1.6	46	0.3	8	1.9	55
30	2	Dun901	0.4	12	0.1	4	0.6	15	1.5	39	2.1	54	1.3	0.7	19	3.3	86	0.1	3	3.4	89
37	13	Dun005	0.3	6	0.1	4	0.4	10	0.4	11	0.9	21	0.4	0.5	11	2.7	63	0.1	2	2.8	66
3	15	Dun405	0.2	5	0.1	4	0.3	9	1.3	36	1.6	45	1.1	0.4	12	2.1	60	0.3	8	2.4	69
4	2	Dun006	0.4	7	0.2	4	0.5	11	1.3	26	1.8	37	1.2	0.7	13	3.8	75	0.3	6	4.1	81
6	1	Dun804	0.4	9	0.2	4	0.6	13	1.3	29	1.9	41	1.2	0.7	16	3.6	79	0.3	7	3.9	85
46	8	Dun107	0.3	8	0.1	4	0.4	11	1.3	32	1.7	43	1.2	0.6	14	3.1	78	0.1	2	3.2	80
7	4	Dun909	0.6	11	0.2	4	0.7	15	1.3	27	2.1	42	1.2	0.9	18	3.5	71	0.1	2	3.6	73
9	1	Dun809	0.5	10	0.2	4	0.6	14	1.3	28	1.9	41	1.2	0.8	16	3.7	79	0.2	4	3.9	84
10	1	Dun808	0.7	14	0.2	4	0.8	18	1.3	28	2.1	46	1.2	1.0	21	3.0	64	0.2	5	3.2	69
11	8	Dun608	0.3	7	0.1	4	0.4	10	1.3	32	1.7	42	1.2	0.5	13	2.1	52	0.2	6	2.3	58
12	5	Dun401	0.3	7	0.2	4	0.5	11	1.3	28	1.7	38	1.1	0.6	14	3.5	78	0.3	7	3.9	85
13	7	Dun110	0.5	9	0.2	4	0.7	12	1.3	24	2.0	36	1.2	0.8	15	3.9	72	0.2	4	4.1	76
14	7	Dun202	0.3	6	0.2	4	0.5	9	1.3	26	1.7	35	1.2	0.6	12	3.5	70	0.3	6	3.8	76
15	3	Dun907	0.7	11	0.2	4	0.9	15	1.3	21	2.3	37	1.2	1.1	17	4.5	73	0.3	5	4.8	78
16	1	Dun007	0.5	7	0.2	4	0.7	11	1.5	22	2.2	32	1.3	0.9	13	4.7	69	0.3	4	5.0	73
17	8	Dun409	0.5	10	0.2	4	0.7	13	1.3	24	2.0	37	1.2	0.8	15	3.2	59	0.2	4	3.5	63
18	1	Dun905	1.0	14	0.3	4	1.3	17	1.3	18	2.6	35	1.2	1.4	19	4.8	64	0.3	4	5.1	68
19	1	Dun706	0.8	6	0.4	4	1.2	10	1.8	14	3.0	24	1.6	1.4	11	7.2	58	0.4	3	7.6	61
58	1	Dun811	0.9	7	0.5	4	1.3	11	1.8	14	3.1	25	1.6	1.5	12	7.7	61	0.3	2	7.9	63
20	1	Dun801	0.6	7	0.3	4	0.8	11	1.3	17	2.1	28	1.2	1.0	13	5.6	72	0.3	4	5.9	76
21	1	Dun210	1.0	9	0.4	4	1.4	12	2.6	22	4.0	35	2.3	1.7	14	6.8	59	0.4	4	7.3	63
Ground floor corridor	1	Dun00C	0.1	1	4.2	44	4.3	45	0.0	0	4.3	45	0.0	4.3	45	2.3	25	0.0	0	2.3	25
Mid floor corridors	8	Dun07C	-0.1	-2	2.7	45	2.6	44	0.0	0	2.6	44	0.0	2.6	44	1.2	20	0.0	0	1.2	20
9th floor corridor	1	Dun09C	0.0	0	2.8	46	2.8	46	0.0	0	2.8	46	0.0	2.8	46	1.5	24	0.0	0	1.5	24
Total (extrapolated for whole of DH)	**114**		**37**	***7***	**45**	***7***	**82**	***14***	**126**	***26***	***207***	***41***	***113***	**94**	***17***	**328**	***63***	**23**	***5***	**352**	***68***

All heat values include a 10% margin

Heat Gains and Losses – Scenario 3

This table summarises peak winter heat losses and peak summer heat gains for a sample of 24 apartments and 3 corridors in Duncan House, based on building fabric improvements as per energy scenario 3. Gross and net values of heat losses are shown to demonstrate the quantity of heat that can be recovered using MVHR (assumed 90% heat recovery efficiency).

Apartment Type (Refer to DSQ-CDL-Z-XX-RD-M-20601)	No.	Apt. for Cymap	Fabric Loss (kW)	*W/m2*	Infiltration Loss (kW)	*W/m2*	Subtotal (kW)	*W/m2*	*Vent. Loss (kW)*	*W/m2*	*Gross Loss (kW)*	*W/m2*	*MVHR Recovery (kW)*	*Net Loss (kW)*	*W/m2*	Total Heat Gain (kW)	*W/m2*	Vent. Gain (kW)	*W/m2*	Total Heat Gain incl. Vent (kW)	*W/m2*
1	2	Dun001	0.2	8	0.1	4	0.3	12	1.2	55	1.5	66	1.1	0.4	17	1.3	58	0.2	11	1.5	68
2	10	Dun711	0.2	7	0.1	4	0.3	11	1.3	50	1.6	60	1.2	0.4	16	2.0	78	0.2	9	2.3	87
24	1	Dun305	0.1	3	0.1	4	0.2	7	1.3	36	1.5	43	1.2	0.4	10	1.7	49	0.3	8	2.0	57
30	2	Dun901	0.3	9	0.1	4	0.5	13	1.5	38	1.9	51	1.3	0.6	16	3.7	96	0.1	3	3.8	99
37	13	Dun005	0.2	5	0.1	4	0.3	8	0.4	11	0.8	19	0.4	0.4	9	2.9	69	0.1	2	3.0	71
3	15	Dun405	0.1	4	0.1	4	0.3	8	1.3	36	1.6	44	1.1	0.4	11	2.3	64	0.3	8	2.6	73
4	2	Dun006	0.3	5	0.2	4	0.4	9	1.3	26	1.8	35	1.2	0.6	11	4.1	82	0.3	6	4.4	88
6	1	Dun804	0.3	7	0.2	4	0.5	10	1.3	29	1.8	39	1.2	0.6	13	3.9	86	0.3	7	4.2	92
46	8	Dun107	0.2	5	0.1	4	0.4	9	1.3	32	1.6	41	1.2	0.5	12	3.4	86	0.1	2	3.5	88
7	4	Dun909	0.5	9	0.2	4	0.6	13	1.3	27	2.0	40	1.2	0.8	15	3.9	78	0.1	2	3.9	80
9	1	Dun809	0.3	7	0.2	4	0.5	11	1.3	27	1.8	38	1.2	0.6	14	4.1	88	0.2	4	4.3	92
10	1	Dun808	0.5	12	0.2	4	0.7	15	1.3	28	2.0	43	1.2	0.8	18	3.3	71	0.2	5	3.5	76
11	8	Dun608	0.2	5	0.1	4	0.3	8	1.3	32	1.6	40	1.2	0.5	11	2.3	57	0.2	5	2.5	62
12	5	Dun401	0.2	5	0.2	4	0.4	9	1.3	28	1.6	36	1.1	0.5	11	3.9	87	0.3	7	4.2	94
13	7	Dun110	0.4	7	0.2	4	0.6	10	1.3	24	1.8	34	1.2	0.7	13	4.3	79	0.2	4	4.5	83
14	7	Dun202	0.2	4	0.2	4	0.4	8	1.3	26	1.7	34	1.2	0.5	10	3.7	76	0.3	6	4.0	82
15	3	Dun907	0.6	10	0.2	4	0.8	13	1.3	21	2.1	35	1.2	1.0	15	4.9	79	0.3	5	5.2	84
16	1	Dun007	0.4	6	0.2	4	0.6	9	1.5	22	2.1	31	1.3	0.8	11	5.1	75	0.3	5	5.4	80
17	8	Dun409	0.4	7	0.2	4	0.6	11	1.3	24	1.9	34	1.2	0.7	13	3.5	64	0.2	4	3.7	68
18	1	Dun905	0.8	11	0.3	4	1.1	15	1.3	18	2.4	32	1.2	1.2	17	5.3	70	0.3	4	5.6	74
19	1	Dun706	0.6	5	0.4	4	1.0	8	1.8	14	2.8	22	1.6	1.2	10	7.9	63	0.4	3	8.2	66
58	1	Dun811	0.6	5	0.4	4	1.1	9	1.8	14	2.9	23	1.6	1.3	10	8.4	67	0.2	2	8.6	69
20	1	Dun801	0.4	5	0.3	4	0.7	9	1.3	17	2.0	26	1.2	0.8	11	6.1	79	0.3	4	6.4	83
21	1	Dun210	0.8	7	0.4	4	1.2	10	2.6	22	3.7	32	2.3	1.4	12	7.5	65	0.4	3	7.9	68
Ground floor corridor	1	Dun00C	0.0	0	4.2	44	4.2	45	0.0	0	4.2	45	0.0	4.2	45	2.4	25	0.0	0	2.4	25
Mid floor corridors	8	Dun07C	-0.1	-2	2.7	45	2.6	44	0.0	0	2.6	44	0.0	2.6	44	1.2	20	0.0	0	1.2	20
9th floor corridor	1	Dun09C	0.0	-1	2.8	46	2.8	45	0.0	0	2.8	45	0.0	2.8	45	1.4	23	0.0	0	1.4	23
Total (extrapolated for whole of DH)	**114**		**28**	**5**	**45**	**7**	**73**	**12**	**126**	**26**	**198**	**39**	**113**	**85**	**15**	**357**	**68**	**23**	**5**	**379**	**73**

All heat values include a 10% margin

Appendix C Electrical Calculations

Project Title	Project Future			
Project Number	1028041			
System Title	Maximum Demand Calculation	**N°. of Pages**	1	

Revision History

Rev	Date	Stage/ Purpose of issue
P01	20/01/2020	Stage 2 Design

CUNDALL

System Number	CA-E-15501

Diversified load totals (kW)

Floor	*Studio*	*1 Bedroom*	*2 Bedroom*	*3 Bedroom*	*4 Bedroom*	*5 bedroom*
Rodney S	22.00	90.00	30.00	7.50	0.00	0.00
Rodney N	36.00	58.00	47.50	12.50	0.00	0.00
Duncan	30.00	106.00	80.00	7.50	3.00	0.00
Beatty	46.00	112.00	77.50	2.50	0.00	0.00
Keyes	26.00	90.00	72.50	7.50	9.00	3.00
Hood	58.00	106.00	80.00	5.00	0.00	0.00
Collingwood	48.00	114.00	67.50	5.00	3.00	0.00
Frobisher	28.00	98.00	42.50	17.50	0.00	0.00
Grenville	40.00	80.00	40.00	10.00	0.00	0.00
Drake	20.00	30.00	25.00	20.00	0.00	3.00
Howard	48.00	108.00	75.00	5.00	0.00	0.00
Nelson	22.00	116.00	37.50	10.00	0.00	3.00
Hawkins	36.00	82.00	45.00	7.50	0.00	0.00
Raleigh	22.00	28.00	27.50	22.50	0.00	0.00
Total	482.000	1,218.000	747.500	140.000	15.000	9.000

Additional Loads	Undiversified Load (kW)	Diversified Load (kW)
0	0.00	0.00
0	0.00	0.00
0	0.00	0.00
0	0.00	0.00
0	0.00	0.00
0	0.00	0.00
0	0.00	0.00
0	0.00	0.00
Sub-Total	0.00	0.00

Total Diversified Power Schedule	
General Lighting & Power kW	2005.00 kW
Hot Water Storage kW	606.50 kW
Total	2611.500

Total Undiversified Load	2611.5000
Total Diversified Load	2611.500

Power Factor	0.95
Future / Spare Capacity	10%

Undiversified Max Demand	2748.9 kVA
Diversified Max Demand	2748.9 kVA
Diversified Max Demand Including Future Capacity	3023.8 kVA

Comments	Note: Hot water load is based on raising the water temperature locally from a base temperature of 40 degrees C, with the water being pre-heated by main central plant

Project Title	Project Future		
Project Number	1028041		
System Title	Maximum Demand Calculation	N°. of Pages	2

Revision History		
Rev	Date	Stage/ Purpose of issue
P01	20/01/2020	Stage 2 Design

CUNDALL

System Number	CA-E-15501

Diversified load totals (kW)

Floor	Circulation	Coffee Station/Café	Reception	Gym Reception	Dining Room	Cinema Room	Gym	Gym Changing	Work From Home
B	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
G	34.13	1.58	1.21	0.49	14.70	1.62	20.16	1.16	4.53
1	34.13	1.58	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2	34.13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3	34.13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4	34.13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5	34.13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6	34.13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
7	34.13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
8	34.13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
9	34.13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
RF	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total	341.250	3.150	1.213	0.485	14.700	1.620	20.161	1.155	4.529

Floor	Meeting Rooms	Lounge	Swimming Pool	Squash Court 1	Squash Court 2	Squash Court 3	Squash Court 4	Ladies Gym	Gym 1	Gym 2	Gym 3	Brasserie
B	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
G	4.53	6.30	15.86	4.76	4.76	4.76	4.76	6.15	6.15	6.15	6.15	30.24
1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
RF	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total	4.529	6.300	15.864	4.759	4.759	4.759	4.759	6.147	6.147	6.147	6.147	30.240

Additional Loads	Undiversified Load (kW)	Diversified Load (kW)
Comms Cabinet Loads (3kW/Cab)	102.00	51.00
Energy Centre	5000.00	4250.00
Lifts (15kW/Lift) 28No	420.00	294.00
Car Charging 10 x 22kW	660.00	88.00
0	0.00	0.00
0	0.00	0.00
0	0.00	0.00
0	0.00	0
Sub-Total	6182	4683.00

Total Diversified Power Schedule	
Lighting (W/m²)	77.36 kW
Small Power (W/m²)	16.99 kW
HVAC (W/m²)	340.08 kW
M&E Load (W/m²)	54.39 kW
Additional Load	4683.00 kW
Total	5171.821

Total Undiversified Load	6894.7350	Power Factor	0.95
Total Diversified Load	5171.821	Future / Spare Capacity	10%

Undiversified Max Demand	7257.6 kVA
Diversified Max Demand	5444.0 kVA
Diversified Max Demand Including Future Capacity	5988.4 kVA

Comments	

Appendix D Light4 External Lighting Report

Light4®

CUNDALL

DOLPHIN SQUARE

EXTERNAL LIGHTING DESIGN

P01

18th January 2021

INTRODUCTION

This report has been prepared on behalf of AXA Group in response to their instruction for Cundall to develop a RIBA Stage 2 conceptual design report for the planned refurbishment works to the 1,233 rental apartments at the ~1,055,000 sq. ft. estate, Dolphin Square, Chichester Street, London SW1V 3LX.

The report presents the conceptual ideas for the external lighting design only.

CONTENTS:

DOCUMENT CONTROL

Project Lighting Designers

Mark Tweedale m.tweedale@cundall.com
+44 161 200 1249
+44 7786 431 864

Project Name	Dolphin Square	Job Number
Report Name	External Lighting Design	1028041

Document Revision History

Revision	Issue Date	Purpose of issue / description of revision

Document Validation (latest issue)

Revision	Issue Date	Purpose of issue / description of revision / version			
P01	18/01/2012	Issued for Stage 2 DRAFT			
			Prepared by	Checked by	Verified by
		Initials	MT	HM	AB
		Signature			

PROJECT APPRECIATION

1.0 INTRODUCTION

1.1 PROJECT APPRECIATION & BRIEF

The following report looks specifically at the external lighting design proposals. Taking into consideration the unique style and Grade II listing of the Moroccan garden the document sets out the key design principles that will ultimately feed into all aspects of the lighting design. The exterior lighting proposal will complement the building's presence at night, provide safe routes for tenants around the site and act as an extension to the internal communal spaces.

It is important that the design acknowledges the rich history of the building, the lighting compliments the to the architectural fabric, is sensitive to the local surrounding and will provide energy efficient and environmentally friendly illumination for all key exterior areas.

SCOPE OF WORK:

- Internal Courtyard
- Terrace
- Gardens

2.0 SITE CONTEXT

2.1 KEY CONSIDERATIONS

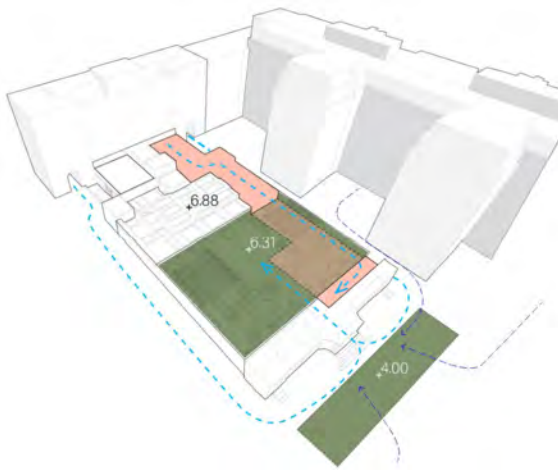
Dolphin Square is a block of flats with ancillary facilities, dating from 1935-1937, designed by Gordon Jeeves for Richard Costain Ltd. The neo-Georgian building consists of over 1200 flats arranged around a large central courtyard garden, and was designed to be a self-contained living environment, which originally included shops and services, sporting and leisure facilities, a bar and restaurant, a telephone exchange, car park, and petrol station.

The project is located along the River Thames in Plimlico, Westminster, London. The upmarket flats were built on the site of an army clothing around 1935. The flats are a mix of concrete and brick construction in the neo-Georgian style typical of buildings built at the beginning of the 20th century.

The history of Dolphin Square is a colourful one and a feat of engineering which during World War 2 became the HQ of General de Gaulle's Free French, an ambulance station and a hospital whilst enduring the blitz. More recently the buildings have been used as a backdrop for both film and television as well as referenced d in a number of books.

To the East of the development sits Georges Square Park large formal gardens that span from the river up to the St Saviours Church. Directly around the development are a number of residential developments and the Pimlico Academy School and although the location is very central the immediate surrounding areas are more familiar to that of a small town centre or urban location. The internal gardens received a Grade II listing from Historic England in July 2018, a summary of the reasons for the designation can be found on the following page. The gardens act as key pedestrian routes for both the residents and the general public who visit the development to make use of its amenity spaces.

The views from elevated terraces across the garden will be a key consideration when developing the lighting design as will the impact and view of the gardens from the inward facing residential apartment.



2.0 SITE CONTEXT

2.2 KEY CONSIDERATIONS

One of the largest communal private gardens in London, the gardens provides a variety of environments: expanses of lawn with backgrounds of seasonal flowerbeds and formal beds, and more intimate, informal areas within the recesses between the building's projecting wings. Themed gardens were built in the four northernmost recesses, following Dutch, Italian, Japanese and Old English traditions, and there was a Spanish and Mexican garden on the roof of the amenity block, the area which would have been exposed to the best sunlight. The courtyard gardens at Dolphin Square, are registered at Grade II, for the following principal reasons:

- Design interest: as a high-quality landscaping scheme providing a series of garden environments, where small-scale intimate spaces contrast with open lawns, with an emphasis on geometry and balance, carefully integrated with the surrounding building;

- Rarity: one of few surviving substantial interwar landscaping schemes to a private housing estate;

- Historic interest: one of a limited number of schemes known to survive by Richard Sudell, an important and influential figure in the development of mid-C20 landscape design, and a pioneering theorist, writer, and advocate of the profession;

Is representative of Sudell's design philosophy, and illustrative of the principles set out in his significant 1933 book, Landscape Gardening;

- Illustrating the fashion of the period for themed gardens, incorporating designs inspired by several nations' landscaping traditions;

- Degree of survival: the overall structural layout survives very well, notwithstanding the reconfiguration of the former Spanish/Mexican garden and one of the western recessed gardens

Thousands of daffodils and tulips were planted, intended to give an early splash of colour, along with pansies, polyanthus and primroses, crocuses and snowdrops.

GRADE II LISTED GARDEN

This is an A4 sized map and should be printed full size at A4 with no page scaling set.

Name: Dolphin Square Gardens

Heritage Category:	Park and Garden
List Entry No :	1455668
Grade:	II

County: Greater London Authority

District: City of Westminster

Parish: Non Civil Parish

Each official record of a registered garden or other land contains a map. The map here has been translated from the official map and that process may have introduced inaccuracies. Copies of maps that form part of the official record can be obtained from Historic England.

This map was delivered electronically and when printed may not be to scale and may be subject to distortions. The map and grid references are for identification purposes only and must be read in conjunction with other information in the record.

List Entry NGR:	TQ2950078004
Map Scale:	1:1250
Print Date:	30 October 2020

Historic England

HistoricEngland.org.uk

3.0 PROJECT VISION

3.1 CORE AIMS

The objective of the refurbishment works for Dolphin Square is to:

- Improve the landscape appearance for the tenants.
- Highlight the key pedestrian routes.
- Improve and enhance the visitor experience.
- Improve energy performance of the building.
- Optimise commercial value and building attractiveness for tenants.

The lighting shall promote key architectural elements and create a visually comfortable night time ambience whilst reducing energy and minimising lighting pollution.

4.0 DESIGN CRITERIA

4.1 PRINCIPLES

4.1.1 ENVIRONMENTAL ZONE:

The site is in close proximity to the city of London where there are high levels of night-time activity. However the development is surrounded by a number of parks and residential properties, therefore the development has been assessed as an "E3 Environmental zone" as defined in the Institution of Lighting Professionals publication 'Guidance Notes for Reduction of Light Pollution' - see Table 1 below.

Category	Description	Examples
E1	Intrinsically dark landscapes	National parks, areas of outstanding natural beauty etc.
E2	Low district brightness area	Rural, small village or relatively dark
E3	Medium district brightness area	Small town centers or urban locations
E4	High district brightness area	Town/city centers with high levels of night-time activity

4.1.2 IPL ENVIRONMENTAL ZONE CLASSIFICATION

Environmental zone	Light on properties (vertical) E_v (lux)		Luminaire intensity I (cd)		Upward light ULR (%)	Luminance (cd/m$_2$)	
	Pre-curfew	Post-curfew	Pre-curfew	Post-curfew		Building facade L_b	Signs L_s
E1	2	0	2,500	0	0	0	**50**
E2	5	1	7,500	500	5	5	**400**
E3	10	2	10,000	1,000	15	10	**800**
E4	**25**	**5**	**25,000**	**2,500**	**25**	**25**	**1,000**

4.1.3 OBTRUSIVE LIGHT LIMITATIONS FOR EXTERIOR LIGHTING INSTALLATIONS

4.1.4 LIGHTING APPLICATION:

The exterior lighting shall be designed in accordance with current good practice Society of Lighting and Lighting (SLL) guidelines and the Institution of Lighting Professionals (ILP) Guidance Notes for the Reduction of Obtrusive Light.

To minimize the potential adverse effects of light pollution the following design principles will be applied during further design stages:

- Specification of luminaires with directional precision optics and with narrow light beam angles where appropriate to ensure light is focused only where illumination is required.
- Specification of optional accessories (cowls / baffles/ louvres) where necessary to prevent unwanted light spill.
- Specification of time-based lighting control to limit post-curfew light spill.

4.0 DESIGN CRITERIA

4.2 PRINCIPLES

4.2.1 DARK SKIES:

Artificial light at night has revolutionized the way we live and work outdoors, but it has come at a price. When used incorrectly, outdoor lighting can disrupt wildlife, impact human health, waste money and energy, contribute to climate change, and block our view of the universe. Light pollution is increasing worldwide at twice the rate of global population growth and virtually every species studied is impacted in some way by light pollution.

Access to darkness is important both visually and emotionally. However true darkness is hard to come by in the city. The cities around the world have lost their stars and this in itself is wrong. We will be taking our responsibility for caring for the planet one step further and will be adopting the following the principle as determined by the International Dark Sky Association.

1 – ENSURING THAT EVERY LIGHT SERVES A CLEAR AND NECESSARY PURPOSE

2 – ENSURING THAT LIGHT ONLY FALLS WHERE IT IS INTENDED/ NEEDED

3 – ENSURING THAT THE AMOUNT OF LIGHT IS APPROPRIATE FOR THE TASK

4 – PROVIDING CONNECTED ACTIVE CONTROLS

5 – PROVIDING LIGHT SOURCES THAT ARE WARM IN COLOR

4.0 DESIGN CRITERIA

4.3 PRINCIPLES

4.3.1 ILLUMINANCE & UNIFORMITY:

The following target illuminance levels follow from BS EN 12464-2-2014 & CIBSE SLL Guide LG6 2016: CIBSE SLL Code for Lighting will be adopted.

Area	Eav Maintained illuminance	Uniformity (Uo)
Walkways	5	0.25
Staircases & Ramps	50-100	15:1 ratio
Entrance/exits	100	0.40

We are not looking to conform completely with the above guidelines as these are generic recommendations. The light to walkways in particular will be more broken and less uniform in order to provided interest. Secondary walkways highlighted in a lighter pink will not be lit to 5lux 0.25 uniformity. The remaining areas will be lit purely for their aesthetic value and the design inspiration for these areas are presented later in this document.

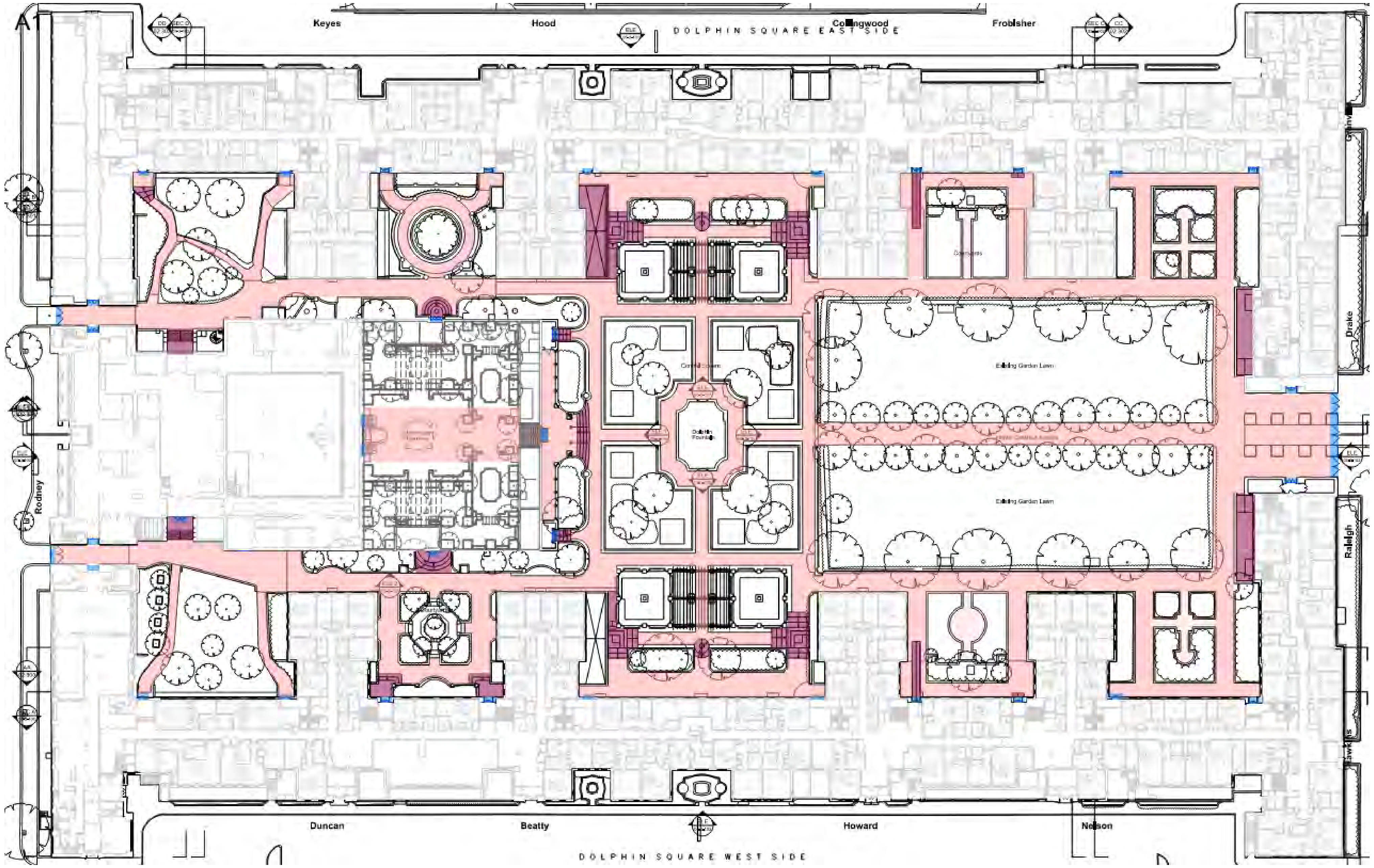
The lighting of exits and entrances shall provide a transition zone to avoid sudden changes in illuminance between inside and outside by day or night.

4.3.2 EMERGENCY LIGHITNG:

Emergency lighting will be based on the following guidelines;

- CIBSE LG12, Emergency Lighting
- BS 5266, Emergency Lighting

The emergency lighting and escape plan will be a key part of the external lighting design as it is important to not just get people out of the building but to a designated safe place. Consideration of the routes people will take in an emergency will be critical to ensuring the scheme is complaint with the current regulations.



4.0 DESIGN CRITERIA

4.4 PRINCIPLES

4.4.1 ENERGY CONSIDERATIONS & LIGHTING CONTROL STRATEGY:

The external lighting shall be design to use energy-efficient LED light sources in accordance with current good lighting practice.

As part of the overall energy saving strategy, it is proposed to introduce a lighting control system. The control system will incorporate astronomical time clock with photocell override and dimming controls.

Controlling exterior lighting elements in groups will enable specific circuits, such as non-essential lighting elements to be switched off late in the evening, to minimise energy use whilst maintaining safe levels of illuminance overnight.

Advanced lighting technology can provide dimming protocols and intelligent controls that can limit the operating hours of an installation to reduce running costs and potentially adverse environmental impact.

The Landscape lighting must be regulated to create a comfortable ambience. Efforts should be put forward to reduce the intensity of vertical illumination during the hours of darkness and retain only minimal lighting for security and safe circulation during post-curfew hours by the entrances and circulations.

4.4.2 MAINTENANCE CONSIDERATIONS:

Ease of maintenance of the lighting scheme is important not only to reduce costs, but also to ensure the integrity of the design aesthetic is maintained and the design life of the project is prolonged.

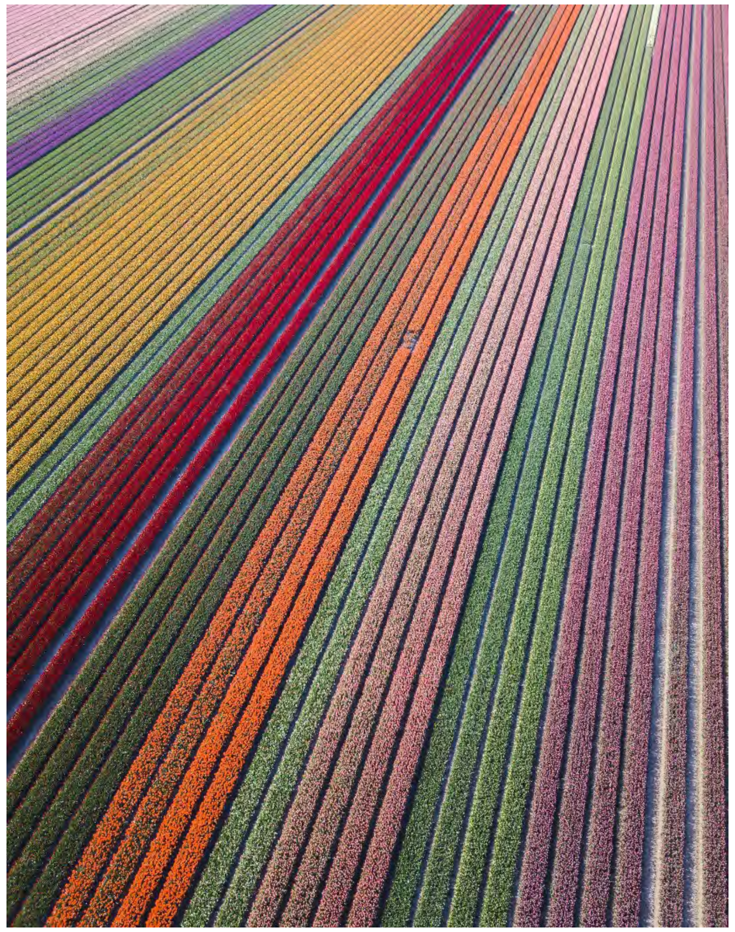
As part of the design process, ease of access for maintenance shall be considered. All luminaires will be either accessible from ground level or by a commercial type ladder and other access equipment (e.g. mewp, scissor lifts, cherry-picker etc.).

To ensure the longevity of the scheme and extend maintenance intervals long-life LED light sources will be specified. Spot replacement of failed light sources is recommended and a group replacement of the installation towards the end of manufacturers' quoted lamp life should be carried out.

High efficiency electronic drivers, which help extend lamp life, will be specified preferably in accessible internal locations. Where external remote drivers are required these need to be enclosed in IP rated boxes placed in accessible locations.

DESIGN INSPIRATION

5.0 DESIGN INSPIRATION



COLOUR / PATTERN / MATERIALITY / FORM / CONNECTION

6.0 PROJECT CONCEPT

6.1 KEY DEISIGN THEMES

The following themes will form the basis of the lighting design and are summarised below:

1. COLOUR – From the rich colours found in the planting of tulip and daffodils by the late Sudell to the vibrant colours found in Moroccan architecture, the lighting design will play on the theme of colours intertwining subtle hints of coloured light to distinguish different parts of the garden. The overarching colour of light will be a warm white with only a subtle hue of colour as an enhancement to white light.

2. PATTERN – Taking inspiration from the rhythmic formal patterns found in the building's façade and in Moroccan design we will create our own unique Dolphin Square pattern that will be utilised throughout the scheme to provide a sense of unity and familiarity to the lighting. The pattern will be weaved into the light or found in the materials of the luminaires themselves as a constant nod back to the buildings history.

3. MATERIALITY – Art deco inspired finishes from wood to copper and brass will be utilised throughout the project. The lighting products will echo the honesty and integrity of the traditional architecture and will be authentic in its form and function. The products will be pared-back to celebrate their simple design.

4. FORM – The absence of linear lines of light, utilising single round point source illumination over more modern linear luminaires will be more in keeping with the types of light sources found when the flats were built. Linear forms will be considered as housings for luminaires but the illumination within should always be cylindrical in its appearance.

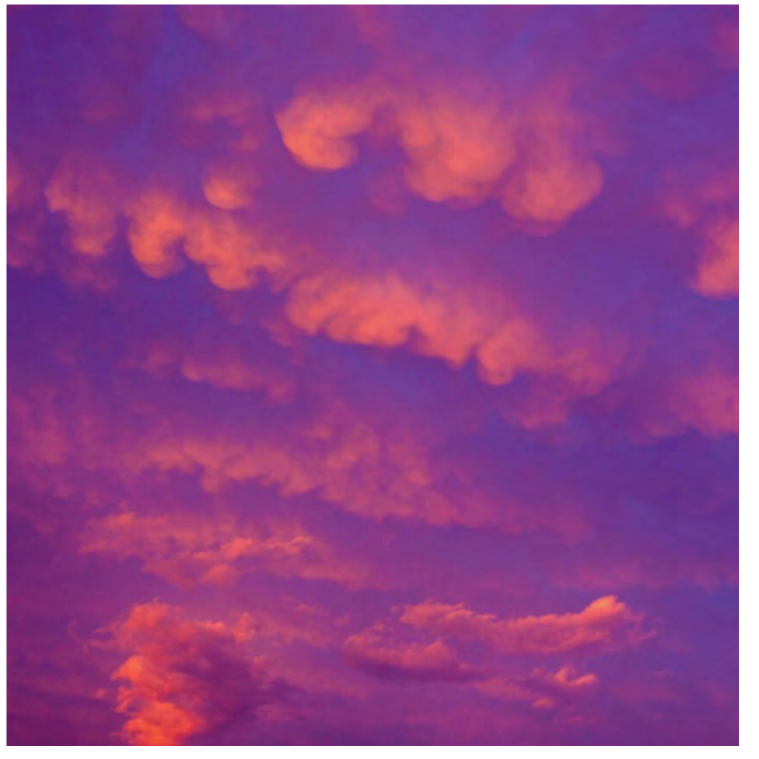
The above themes will be explored in more detail on the following pages and will be constantly referred back to as the design progresses though the stages.

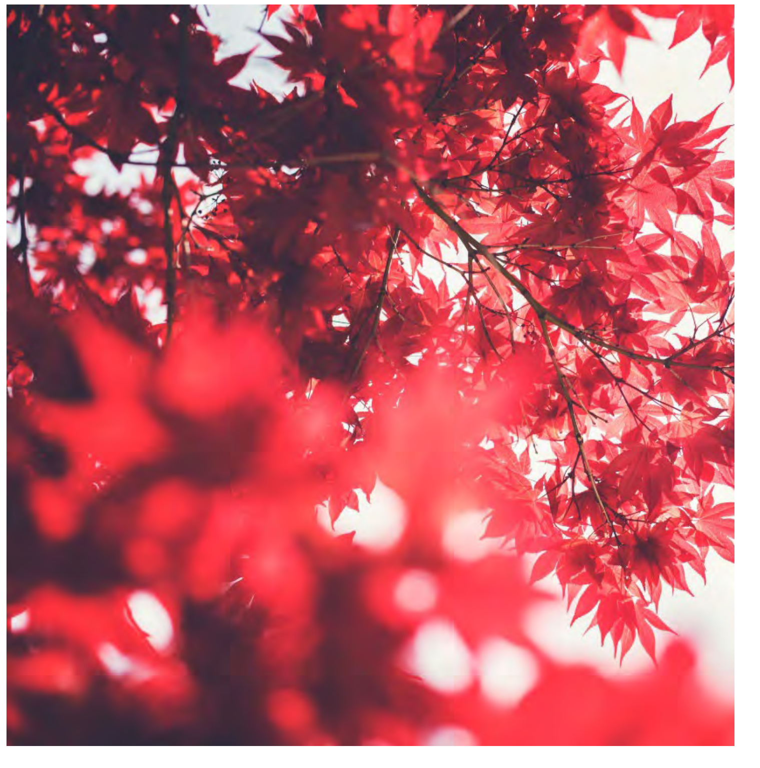
6.0 PROJECT CONCEPT

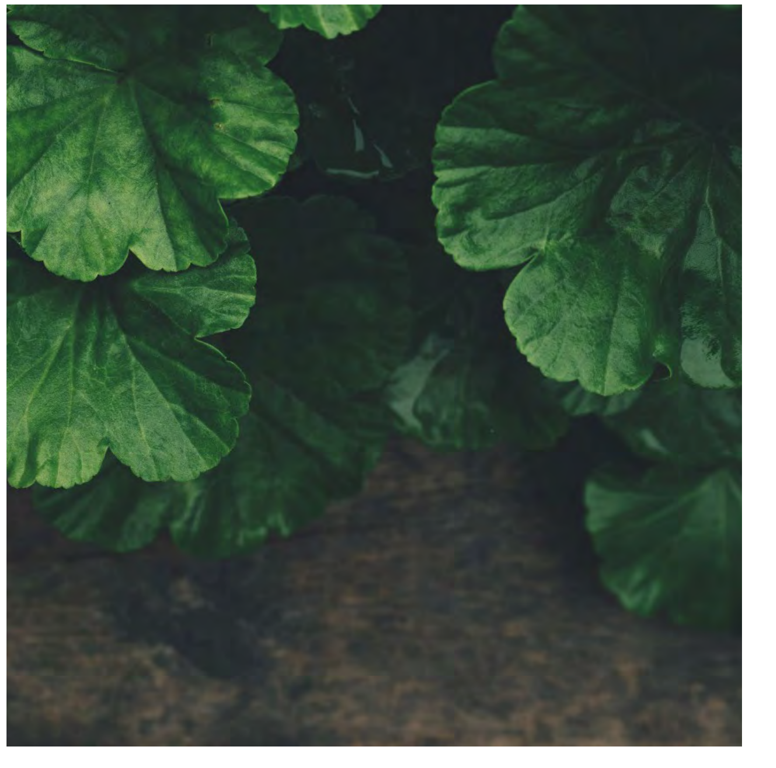
6.2 COLOUR

Moroccan design incorporates bold colours, such as fuchsia, royal blue, deep purple, and vibrant red, with the soothing neutral colours of the desert, such as sand, taupe, beige, and shades of white. Although white and neutral colours are often used as a backdrop almost everything else in a Moroccan style design features bright and bold colours. Jewel colours feature strongly in Moroccan style, as do blues and greens to represent the ocean. Earth tones are also used in this style.

The architectural lighting (backdrop) will be in a tones of white with only accent lighting providing a subtle wash of colour. The colour will be used together in specific areas to create interest and aid navigation.







6.0 PROJECT CONCEPT

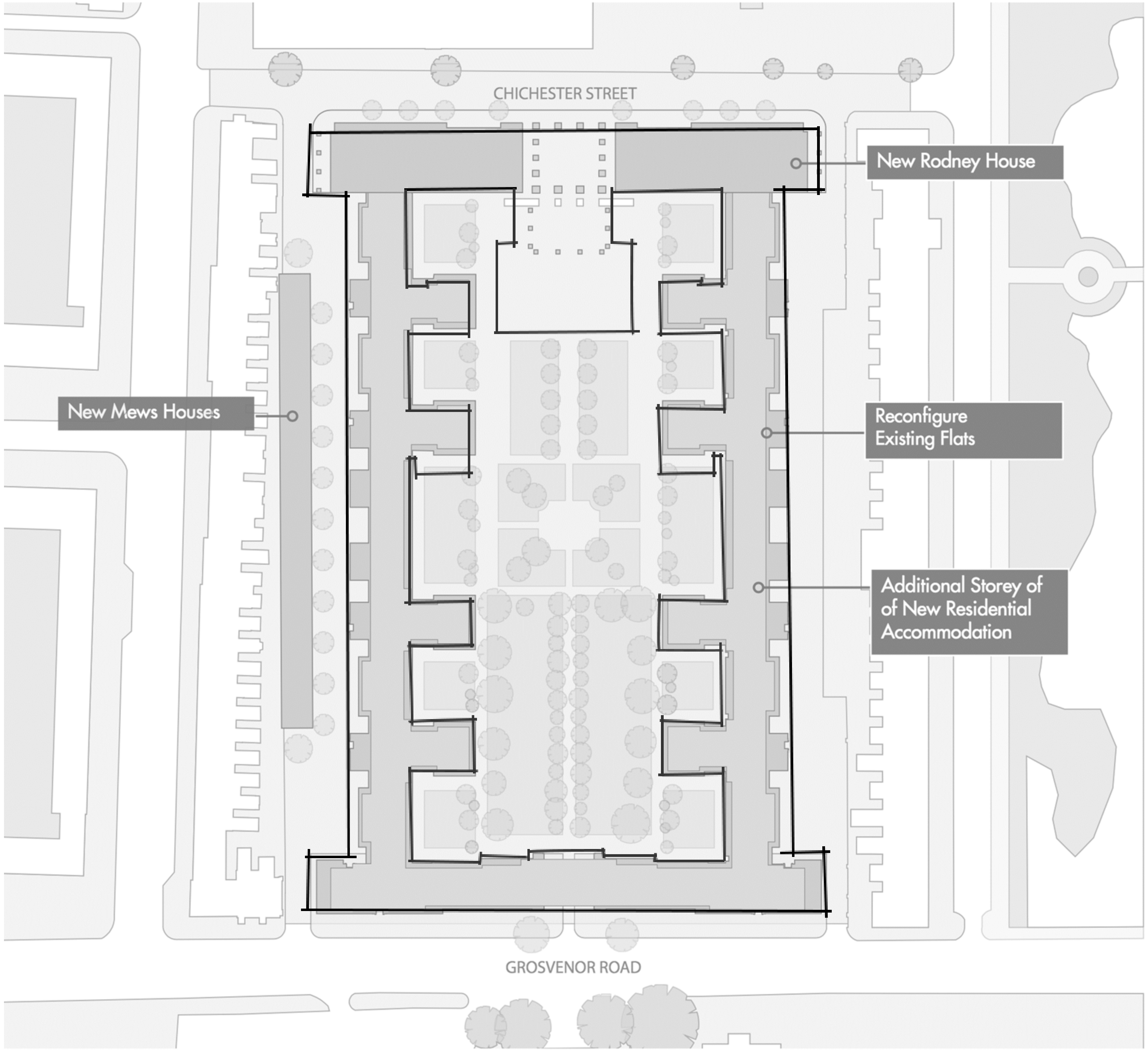
6.3 COLOUR

The below images provide an example of the subtle introduction of colour which will be further explored during the project.

6.0 PROJECT CONCEPT

6.4 PATTERN

The geometric forms of the building outline, would become the inspiration for our pattern work.

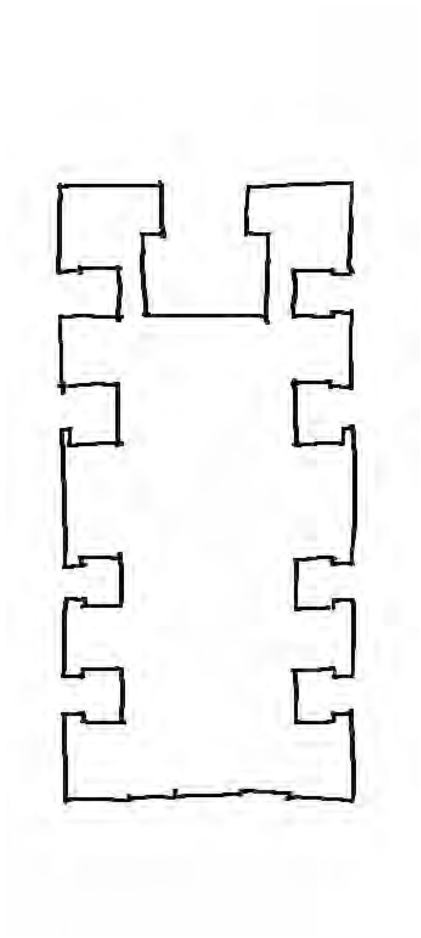


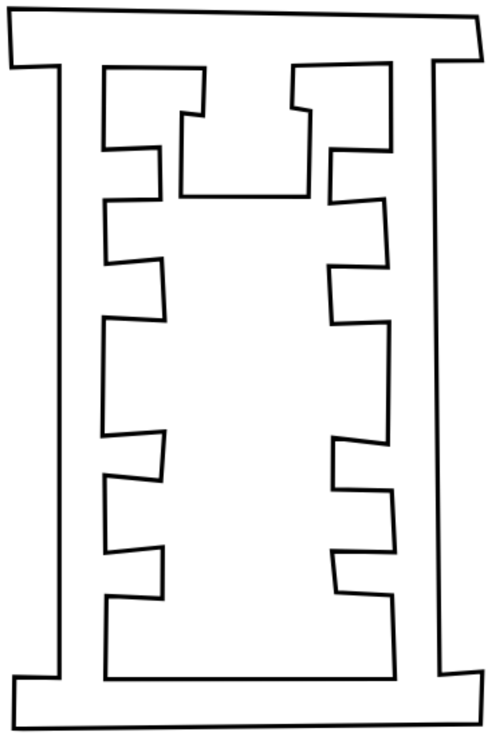
6.0 PROJECT CONCEPT

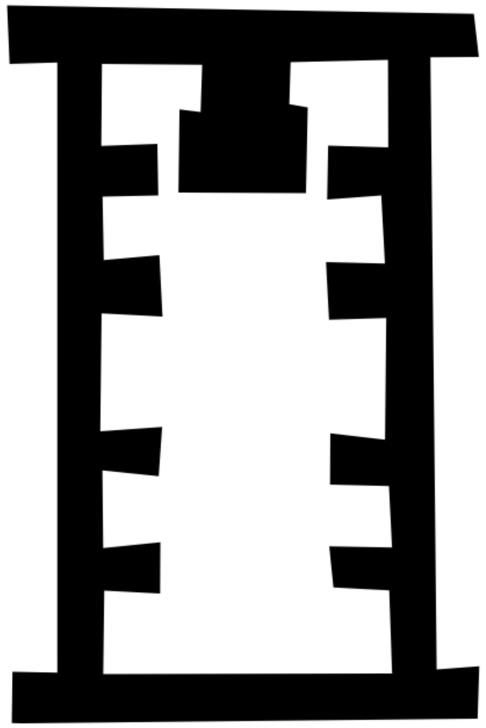
6.5 PATTERN

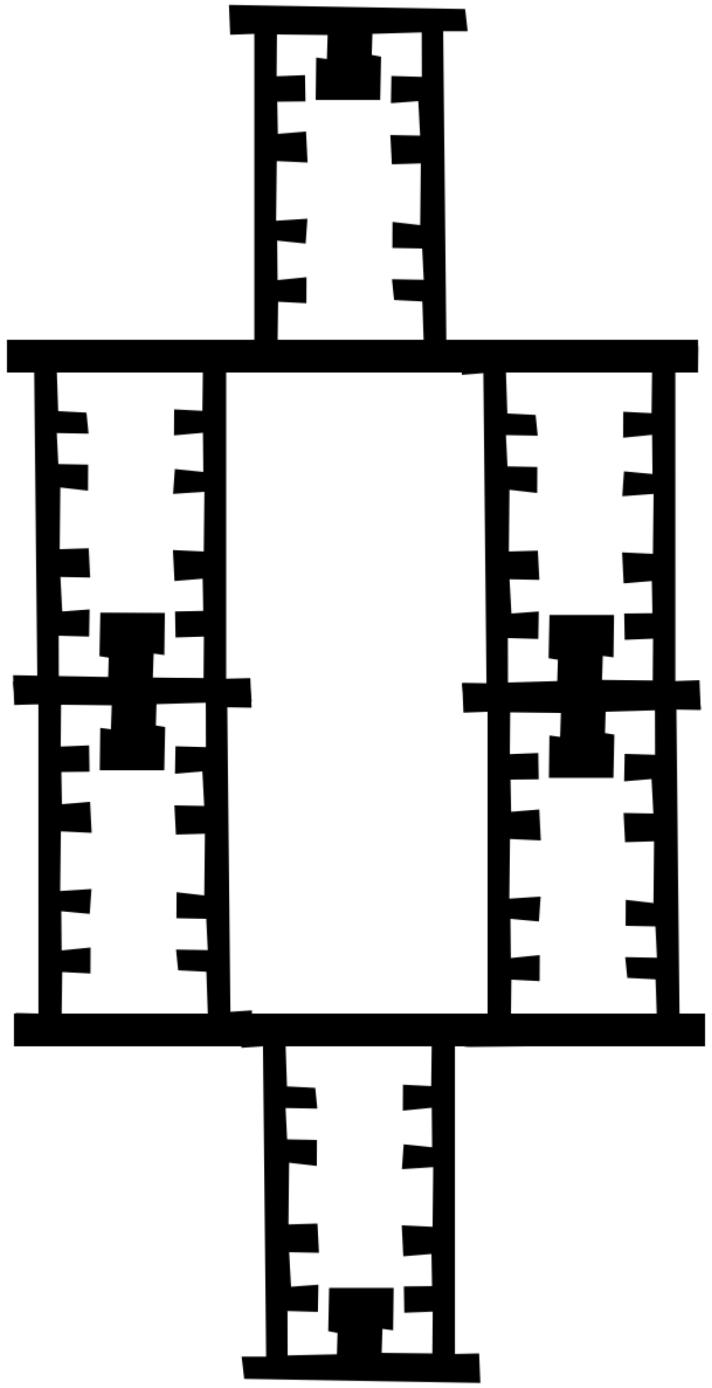
The receptiveness of the form and iconic shape could form part of the luminaire designs or gobo projection patterns in order to imbed the buildings form into the lighting.

The below series of images depicts the formation of what may become the Dolphin Square pattern.





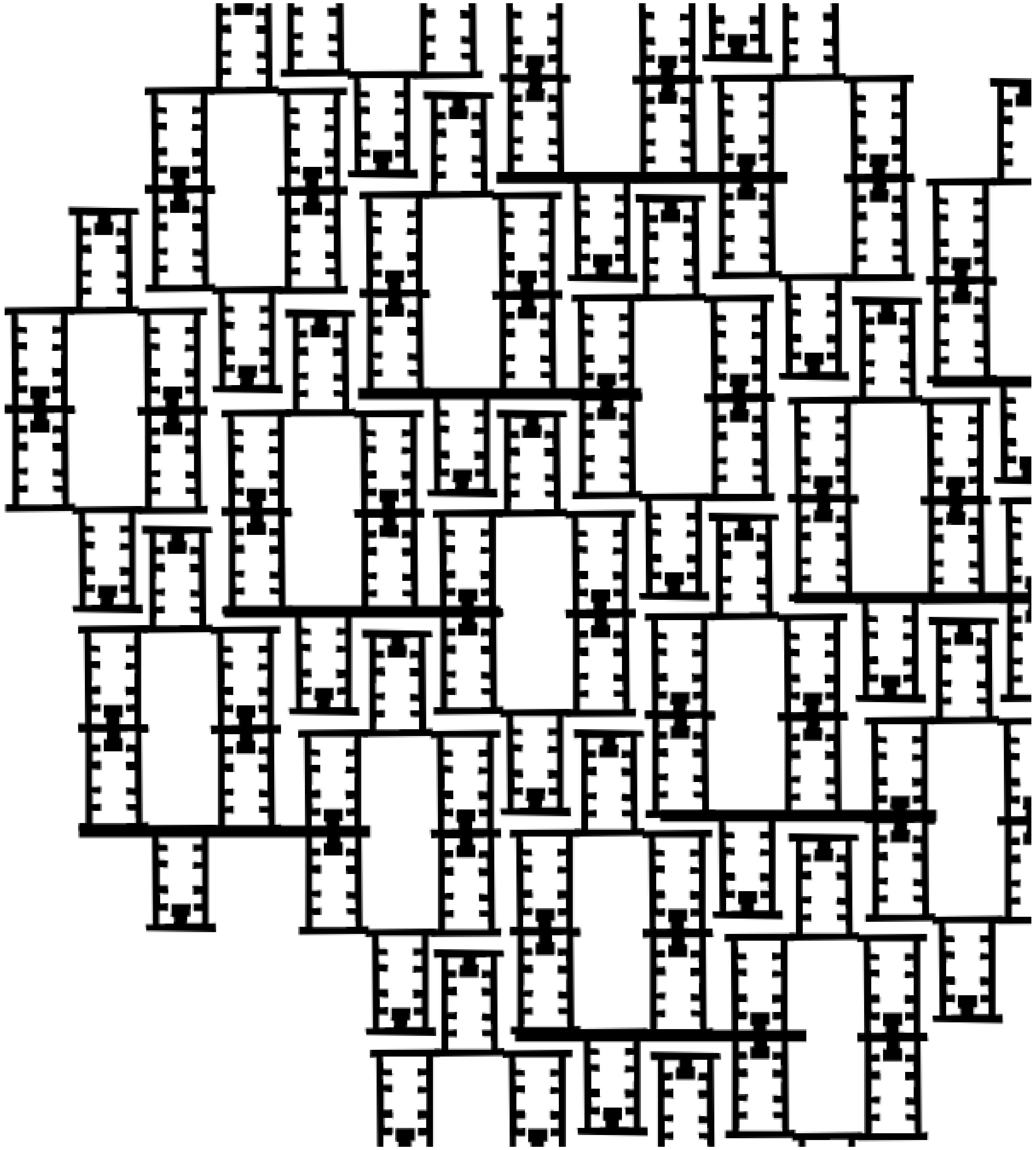


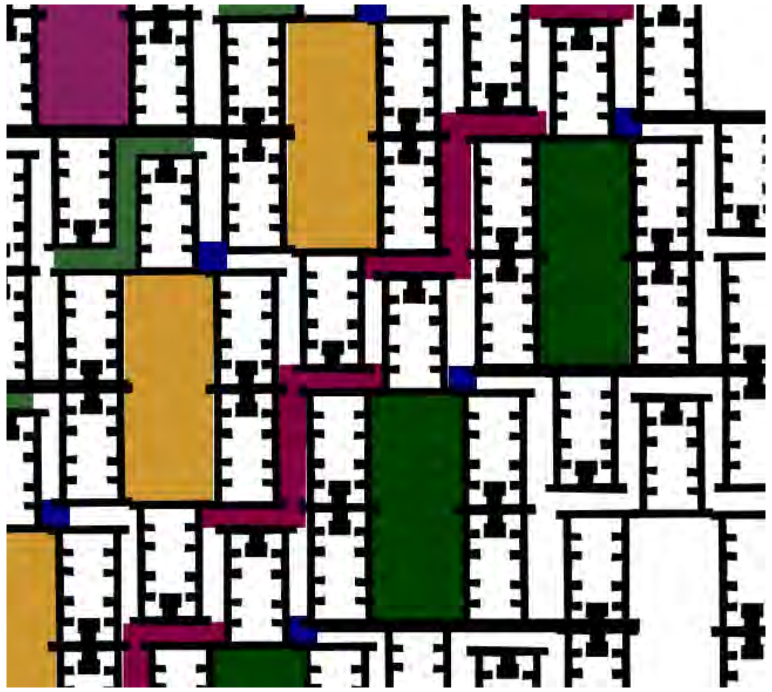


6.0 PROJECT CONCEPT

6.6 PATTERN - OPTIONS

The generic pattern block can be arranged in a variety of patterns depending on the use, the introduction of colour brings it to life.

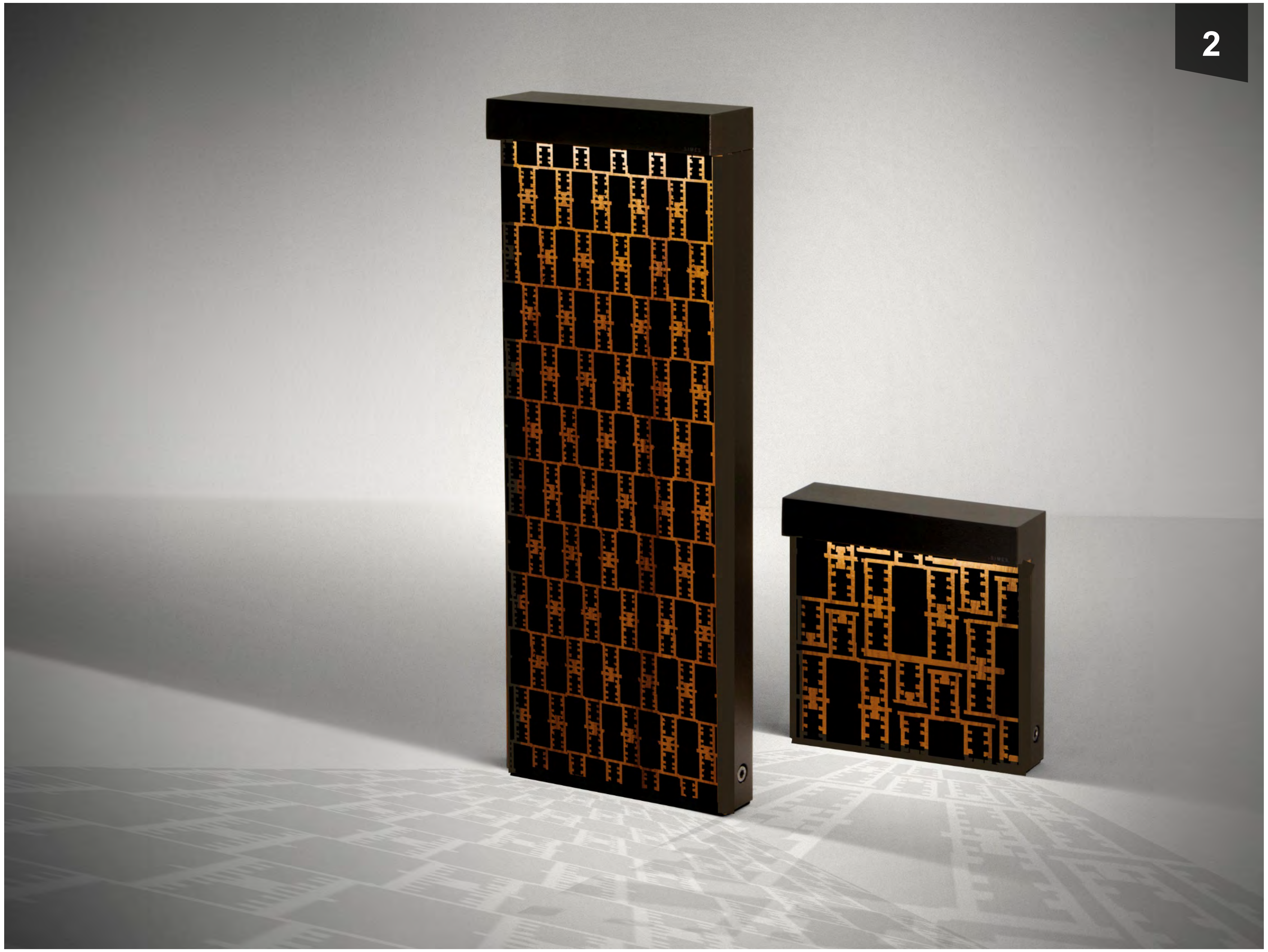




6.0 PROJECT CONCEPT

6.7 PATTERN

The pattern would be used in a number of applications around the development. From bollards to wall lights, the familiarity of the pattern will help to tie the luminaire together.



IMAGES

1. Backlit mesh design that could be incorporated into luminaries . | 2. Applied pattern to generic bollard lighting.

6.0 PROJECT CONCEPT

6.8 MATERIALITY

Art deco inspired finishes from wood to copper and brass will be utilised throughout the project. The lighting products will echo the honesty and integrity of the traditional architecture and will be authentic in its form and function.

Where solid brass and copper finishes become prohibitable bronze painted options will be proposed in order to minimise costs whilst maintaining the aesthetic. We have included below a variety of external luminaire examples in a mix of finishes for consideration.

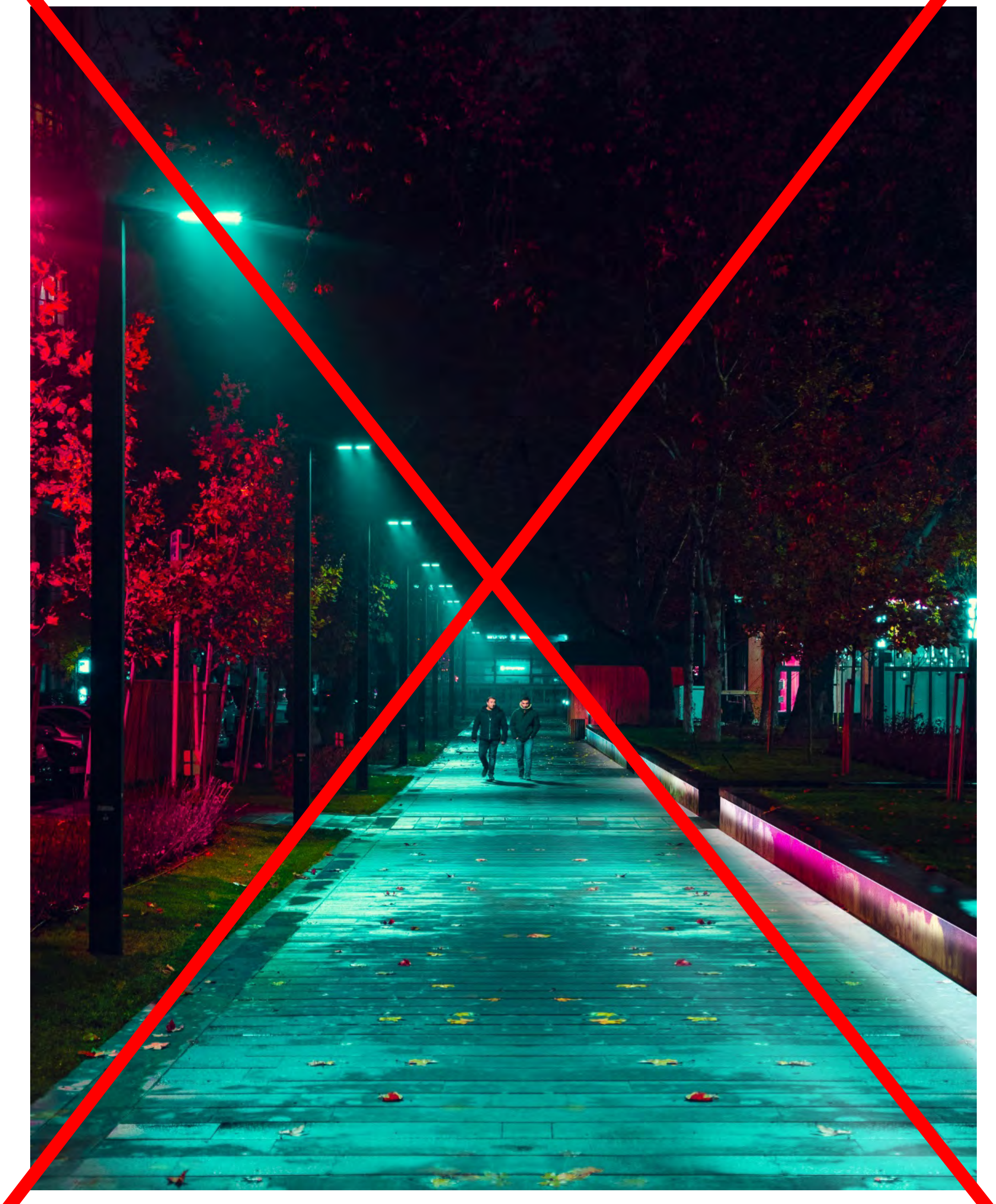
We will focus our selection of luminaires to ones which have 0% upward light to minimise pollution of the night sky.

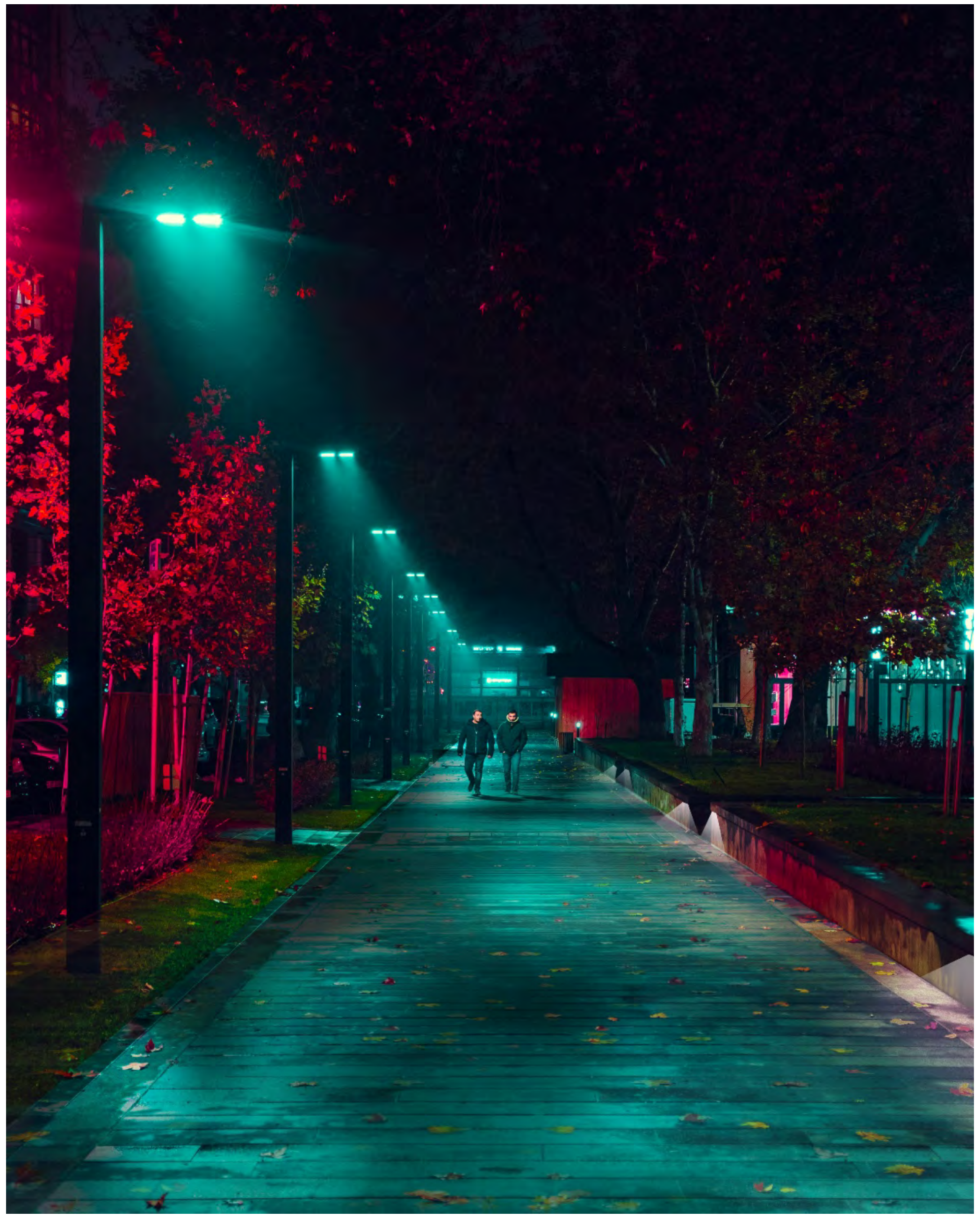
6.0 PROJECT CONCEPT

6.9 FORM

The absence of linear lines of light, utilising single round point source illumination over more modern linear luminaires will be more in keeping with the types of light sources found when the flats were built. Linear forms will be considered as housing for luminaires but the illumination within should always be cylindrical in its appearance.

Likewise surfaces will be lit un-uniformly with broken pools of light in order to add interest and drama to the space.





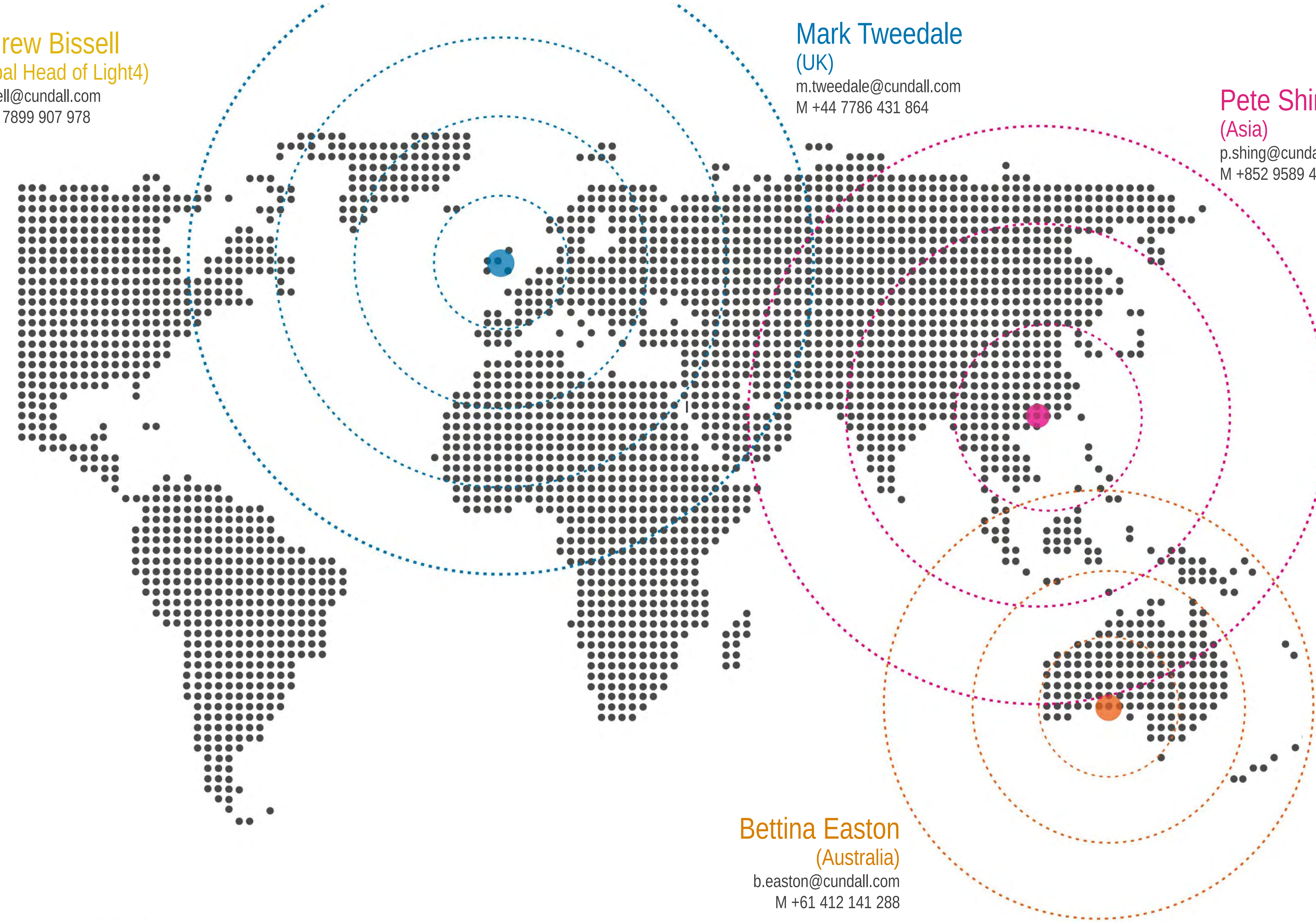
7.0 NEXT STEPS

7.1 ACTIONS

The ideas presented in this report will be developed alongside the appointed Landscape Architect during the stage 3 design phase.

Light4®

CUNDALL



Andrew Bissell
(Global Head of Light4)
a.bissell@cundall.com
M +44 7899 907 978

Mark Tweedale
(UK)
m.tweedale@cundall.com
M +44 7786 431 864

Pete Shing
(Asia)
p.shing@cundall.com
M +852 9589 4012

Bettina Easton
(Australia)
b.easton@cundall.com
M +61 412 141 288

Appendix E Design Risk Assessment

Design Hazard Identification & Risk Assessment

Project name Project Future		**Prepared by: MW** **Date prepared: 13/01/2021**
Job No: 1028041		**Checked by: FRM**
Document ref: DSQ-CDL-Z-XX-HS-Z-90200	**Document Revision: -**	**Verified by:** Click here to enter text.

Item Ref	Activity	Specific description of abnormal hazard	Persons at risk					Risk Matrix				Design measures implemented for hazard elimination or risk reduction	Critical design assumptions	Information provided for management of hazard	Residual hazard		Commentary on residual hazards.
			C	M	P	U	D	Potential to cause harm	Severity	Risk Level without controls	Risk Level after controls				Y	N	
1	Visual survey of electrical installations.	No risks associated as we will not be activating any switchgear.	☐	☒	☐	☐	☐	VU	N	VU	VU	Do not activate any switchgear.	Competent engineers will be visiting the site	Correct PPE worn as required.		N	
2	Working at high level	Using existing fixed ladder systems on site where provided.	☐	☒	☐	☐	☐	L	M	L	VU	Existing fixed ladder systems.	Competent engineers will be visiting the site.	Correct PPE worn as required.		N	
3	Use of step ladders	During the course of the investigations we may use step-ladders or short steps.	☐	☒	☐	☐	☐	L	M	L	VU	Training in the use of steps has been carries out.	Competent engineers will be visiting the site.	Correct PPE worn as required.		N	
4.	Working at heights.	Likely that investigations will be completed on roof or access may be required via roof areas.	☐	☒	☐	☐	☐	L	S	H	VU	Only use designated access routes and/or walkways. Roof inspections only done in fair weather and low winds	Competent engineers will be visiting the site.	Correct PPE worn as required.		N	
5	Commissioning – Pre-start testing and live status of systems during construction.	Electrocution, leaks, moving parts.	☒	☒	☐	☐	☐	U	M	I	I	None – design cannot avoid the need to commission services once they are operational.	Method statements to be submitted and permit to work system operated – note this is not an unusual risk within the commissioning process. Competent contractors to be employed.	Permit to work system.	Y		

Likelihood is the conclusion reached after considering the potential of the harm occurring		
VU	Very Unlikely =	The control measures are unlikely to breakdown, be removed or easily defeated. Maintenance is in place. Training is provided and repeated. Supervision is provided.
U	Unlikely =	The control measures not dependant on individual. Defined supervision and maintenance in place. Training is provided.
L	Likely =	The control measures are not dependant on individual but can breakdown, be easily removed or defeated. Training and supervision is minimal.
VL	Very Likely =	No control measures are provided. Control dependant on good working practices. Training and supervision is very minimal.

Severity is the condition reached after positively considering the extent of harm that would be sustained if the hazard were to be realised:		
N	Negligible =	Less than 3 days absence if ill or injured; superficial damage to the environment or to property.
M	Minor =	3 day or greater absence if ill or injured; damage to the environment causes an impact that will naturally become inert e.g. spillage or small qualities or inert materials such as water.
S	Severe =	Loss of limb or multiple injuries; significant damage to property and an environmental impact that causes harm to the environment.
E	Extreme =	Fatal or multiple fatality; substantial damage to property and a significant environmental impact that causes substantial damage.

Risk Matrix to calculate the Risk Level and the Revised Risk Level:

Likelihood		Severity			
		N Negligible	M Minor	S Severe	E Extreme
VU	Very Unlikely	I	I	L	L
U	Unlikely	I	I	M	M
L	Likely	L	M	H	H
VL	Very Likely	L	M	H	H

Risk Level

H	**High Risk:** The Hazard must be removed/avoided or level of risk significantly reduced by reliable controls.
M	**Medium Risk:** The hazard should be avoided or the level of risk reduced by implanting reliable controls.
L	**Low Risk:** May be controlled by the use of instruction, training and supervision and/or personal protective equipment.
I	**Insignificant Risk:** Controlled by good working practices.

Construction Operatives	C	Maintenance Operatives	M	General Public	P	End users	U	Demolition Operatives	D

Project name Project Future	**Prepared by: MW** **Date prepared: 13/01/2021**
Job No: 1028041	**Checked by: FRM**
Document ref: DSQ-CDL-Z-XX-HS-Z-90200 / **Document Revision: -**	**Verified by:** Click here to enter text.

Item Ref	Activity	Specific description of abnormal hazard	Persons at risk: C	M	P	U	D	Risk Matrix: Potential to cause harm	Severity	Risk Level without controls	Risk Level after controls	Design measures implemented for hazard elimination or risk reduction	Critical design assumptions	Information provided for management of hazard	Residual hazard: Y	N	Commentary on residual hazards.
6	Gassing of refrigerant systems.	Risk of refrigerant leakage / associated cold burns / exceeding exposure limits for refrigerant gas (leaks both at fill point and in system) / adverse skin reaction from compressor oil / environmental damage from gas leaks.	☒	☒	☐	☐	☐	U	S	M	L	Refrigerant gas fill points to be located externally (at condensers). System leakage testing to be specified prior to refrigerant gas fill.	Only contractors trained and certified for the handling of refrigerant gases will be used for system filling. Contractors performing refrigerant gas filling will be equipped with the correct PPE for the task.	Contractors to perform risk assessment and provide suitable method statement, including evidence of operative qualification.	Y		Provide record drawings and O&M instructions to any future contractor.
7	Hot works required to joint pipework systems.	Welding / soldering / brazing creating risk of fire.	☒	☐	☐	☐	☐	L	E	H	M	Practice approved jointing methods, in agreement with the client, to limit hot works required.	Competent contractors. Method statements and permits to work implemented.	Permit to work system.	Y		
8	Installing services in ceiling void or exposed ceiling	Working at height	☒	☒	☐	☐	☐	U	M	I	I	Suspended ceiling or appropriately located access hatches to be provided for ease of maintenance. FCU's and valve sets located in accessible areas avoiding double height spaces and inaccessible areas.	Sufficient space is available in the ceiling void to ensure all items requiring maintenance can be conveniently located.	Locations of all plant requiring maintenance access to be clearly shown on the layouts.		N	
9	Existing as built drawings and information	Accuracy of the information provided unknown	☒	☒	☐	☒	☐	L	M	M	I	Cloud point surveys to be undertaken for basement, reception and existing risers where possible	Accurate survey information will be available for RIBA stage 3	Output of survey findings	Y		

Likelihood is the conclusion reached after considering the potential of the harm occurring		
VU	Very Unlikely =	The control measures are unlikely to breakdown, be removed or easily defeated. Maintenance is in place. Training is provided and repeated. Supervision is provided.
U	Unlikely =	The control measures not dependant on individual. Defined supervision and maintenance in place. Training is provided.
L	Likely =	The control measures are not dependant on individual but can breakdown, be easily removed or defeated. Training and supervision is minimal.
VL	Very Likely =	No control measures are provided. Control dependant on good working practices. Training and supervision is very minimal.

Severity is the condition reached after positively considering the extent of harm that would be sustained if the hazard were to be realised:		
N	Negligible =	Less than 3 days absence if ill or injured; superficial damage to the environment or to property.
M	Minor =	3 day or greater absence if ill or injured; damage to the environment causes an impact that will naturally become inert e.g. spillage or small qualities or inert materials such as water.
S	Severe =	Loss of limb or multiple injuries; significant damage to property and an environmental impact that causes harm to the environment.
E	Extreme =	Fatal or multiple fatality; substantial damage to property and a significant environmental impact that causes substantial damage.

Risk Matrix to calculate the Risk Level and the Revised Risk Level:

Likelihood		Severity: N Negligible	M Minor	S Severe	E Extreme
VU	Very Unlikely	I	I	L	L
U	Unlikely	I	I	M	M
L	Likely	L	M	H	H
VL	Very Likely	L	M	H	H

Risk Level

H	**High Risk:** The Hazard must be removed/avoided or level of risk significantly reduced by reliable controls.
M	**Medium Risk:** The hazard should be avoided or the level of risk reduced by implanting reliable controls.
L	**Low Risk:** May be controlled by the use of instruction, training and supervision and/or personal protective equipment.
I	**Insignificant Risk:** Controlled by good working practices.

Construction Operatives	C	Maintenance Operatives	M	General Public	P	End users	U	Demolition Operatives	D

Project name Project Future		**Prepared by: MW** **Date prepared: 13/01/2021**
Job No: 1028041		**Checked by: FRM**
Document ref: DSQ-CDL-Z-XX-HS-Z-90200	**Document Revision: -**	**Verified by:** Click here to enter text.

Item Ref	Activity	Specific description of abnormal hazard	Persons at risk					Risk Matrix				Design measures implemented for hazard elimination or risk reduction	Critical design assumptions	Information provided for management of hazard	Residual hazard		Commentary on residual hazards.
			C	M	P	U	D	Potential to cause harm	Severity	Risk Level without controls	Risk Level after controls				Y	N	
10	Manual handling of mechanical and electrical plant.	Delivery, offloading & relocation into stores / installation of large heavy plant & equipment.	☒	☒	☐	☐	☐	L	M	L	L	Size and shape of plant/equipment to be reviewed throughout the design to review the potential for compartment form to limit size and weight.	Routes and surfaces from offloading to installation to allow / improve ease of access / movement of items around site.	Contractors to undertake risk assessment for mechanical and electrical plant delivery to site/installation. Suitable method statements and lifting equipment to be supplied as required by the contractor.	Y		The contractor to liaise with site management with regards to deliveries time schedules to minimise the disruptions as the site is located at the very busy road.
11	Live site	The building will be a live site during construction.	☒	☐	☒	☒	☒	U	S	M	L	Contractor to use effective control measures to minimise public exposure: including barriers and safe pathways	Competent contractors used for these works.	Location of works provided. Contractor to provide method statement for works.	Y		The contractor to liaise with site management with regards to deliveries time schedules to minimise the disruptions as the site is located at the very busy road.
12	Access	The existing access to site/plantroom has to be utilised, in some areas limited and restricted access	☒	☒	☐	☒	☒	L	M	M	L	Contractor to familiarise themselves with the site, allowing for flat packed equipment to be built on site	Competent contractors used for these works.	Location of works provided. Access to site to be organised prior to works commencing, contractor to provide method statement for works. Contractor to provide equipment schedule, method statement for the on	Y		

Likelihood is the conclusion reached after considering the potential of the harm occurring		
VU	Very Unlikely =	The control measures are unlikely to breakdown, be removed or easily defeated. Maintenance is in place. Training is provided and repeated. Supervision is provided.
U	Unlikely =	The control measures not dependant on individual. Defined supervision and maintenance in place. Training is provided.
L	Likely =	The control measures are not dependant on individual but can breakdown, be easily removed or defeated. Training and supervision is minimal.
VL	Very Likely =	No control measures are provided. Control dependant on good working practices. Training and supervision is very minimal.

Severity is the condition reached after positively considering the extent of harm that would be sustained if the hazard were to be realised:		
N	Negligible =	Less than 3 days absence if ill or injured; superficial damage to the environment or to property.
M	Minor =	3 day or greater absence if ill or injured; damage to the environment causes an impact that will naturally become inert e.g. spillage or small qualities or inert materials such as water.
S	Severe =	Loss of limb or multiple injuries; significant damage to property and an environmental impact that causes harm to the environment.
E	Extreme =	Fatal or multiple fatality; substantial damage to property and a significant environmental impact that causes substantial damage.

Risk Matrix to calculate the Risk Level and the Revised Risk Level:

Likelihood		Severity			
		N Negligible	M Minor	S Severe	E Extreme
VU	Very Unlikely	I	I	L	L
U	Unlikely	I	I	M	M
L	Likely	L	M	H	H
VL	Very Likely	L	M	H	H

Risk Level

H	**High Risk:** The Hazard must be removed/avoided or level of risk significantly reduced by reliable controls.
M	**Medium Risk:** The hazard should be avoided or the level of risk reduced by implanting reliable controls.
L	**Low Risk:** May be controlled by the use of instruction, training and supervision and/or personal protective equipment.
I	**Insignificant Risk:** Controlled by good working practices.

Construction Operatives	C	Maintenance Operatives	M	General Public	P	End users	U	Demolition Operatives	D

Project name Project Future		**Prepared by: MW** **Date prepared: 13/01/2021**
Job No: 1028041		**Checked by: FRM**
Document ref: DSQ-CDL-Z-XX-HS-Z-90200	**Document Revision: -**	**Verified by:** Click here to enter text.

Item Ref	Activity	Specific description of abnormal hazard	Persons at risk					Risk Matrix				Design measures implemented for hazard elimination or risk reduction	Critical design assumptions	Information provided for management of hazard	Residual hazard		Commentary on residual hazards.
			C	M	P	U	D	Potential to cause harm	Severity	Risk Level without controls	Risk Level after controls				Y	N	
														site building of the equipment.			
13	Location of new plant	Parts of the site prone to flooding	X	X				U	M	I	L	Siting of plant to be reviewed, inclusion of bunded areas and sump pumps to mitigate risk	Historic data to be made available so risk can be managed	Flood risk assessments	Y		
14	Asbestos and similar materials	Existing electrical flash guards and pipework / ductwork gaskets / insulation are likely to contain asbestos	X					VL	E	H	L	Up to date register or survey commissioned to identify all harmful materials in existing MEP and fabric. Licenced contractors to remove parts in safe manner	All such materials will be properly identified and disposed of	Completed survey of all such materials	Y		
15	Domestic water	Mitigation of legionella			X	X		VU	S	L	L	Domestic hot and cold water systems to follow all WRAS and L8, BS and Building regulations	Design, installation and maintenance of systems to follow recognised accepted procure	Working drawings and BMS monitoring to review system performance		N	

Likelihood is the conclusion reached after considering the potential of the harm occurring		
VU	Very Unlikely =	The control measures are unlikely to breakdown, be removed or easily defeated. Maintenance is in place. Training is provided and repeated. Supervision is provided.
U	Unlikely =	The control measures not dependant on individual. Defined supervision and maintenance in place. Training is provided.
L	Likely =	The control measures are not dependant on individual but can breakdown, be easily removed or defeated. Training and supervision is minimal.
VL	Very Likely =	No control measures are provided. Control dependant on good working practices. Training and supervision is very minimal.

Severity is the condition reached after positively considering the extent of harm that would be sustained if the hazard were to be realised:		
N	Negligible =	Less than 3 days absence if ill or injured; superficial damage to the environment or to property.
M	Minor =	3 day or greater absence if ill or injured; damage to the environment causes an impact that will naturally become inert e.g. spillage or small qualities or inert materials such as water.
S	Severe =	Loss of limb or multiple injuries; significant damage to property and an environmental impact that causes harm to the environment.
E	Extreme =	Fatal or multiple fatality; substantial damage to property and a significant environmental impact that causes substantial damage.

Risk Matrix to calculate the Risk Level and the Revised Risk Level:

Likelihood		Severity			
		N Negligible	M Minor	S Severe	E Extreme
VU	Very Unlikely	I	I	L	L
U	Unlikely	I	I	M	M
L	Likely	L	M	H	H
VL	Very Likely	L	M	H	H

Risk Level

H	**High Risk:** The Hazard must be removed/avoided or level of risk significantly reduced by reliable controls.
M	**Medium Risk:** The hazard should be avoided or the level of risk reduced by implanting reliable controls.
L	**Low Risk:** May be controlled by the use of instruction, training and supervision and/or personal protective equipment.
I	**Insignificant Risk:** Controlled by good working practices.

Construction Operatives	C	Maintenance Operatives	M	General Public	P	End users	U	Demolition Operatives	D

Appendix F Beyond Report

THE BEYOND REPORT

It is generally accepted that the property industry has a responsibility to do more to tackle social and environmental sustainability, at both a local and global scale.

Cundall is a One Planet Company and we are committed to pushing **beyond** standard compliance and solutions on every project we deliver. This **Beyond Report**, based on the ten One Planet principles, provides a **selection of environmental and social ideas** that can be considered in order to help make the project more sustainable. The aim of the report is to show how **the project** can go **beyond** the brief and deliver further benefit to developers, owners, occupants, the environment and the community.

The Beyond Report is a simple, **multidisciplinary** and **holistic** report of initiatives relevant to the project that we provide irrespective of which discipline we are engaged for. If you would like further information on any of the initiatives suggested, or would like to know what else is possible under each of the ten One Planet principles, then please contact the Cundall Project Leader.

The Beyond Report

Project Name Dolphin Square MEP Replacement

Project Stage Preparation

Cundall Role Building Services, Sustainability, Fire, Acoustics, Vertical Transportation, CDM

Date 11/11/2020

Health and Happiness

Encouraging active, social, meaningful lives to promote good health and wellbeing.

One Planet Goals

- To increase or support high levels of physical, social, mental and emotional health
- To increase or support high levels of happiness and wellbeing

Guidance Extract

One Planet Communities and Destinations make it easy for all residents, workers or guests to keep healthy and active at all ages. They are places where residents feel part of a safe, inclusive, neighbourly and supportive community. Key determinants of health and happiness include diet, exercise, interpersonal relationships, meaningful work and involvement in community and civic life. They also include a safe environment, interaction with nature, greater equity, and opportunities for spiritual and artistic practice, and shared values.

	Initiative	Goal	Details - how it works/benefits	Examples of how this may be implemented	Possible Synergies
1	Community development - social club	Increase or support high levels of physical, social, mental and emotional health	Social clubs provide a space for interactions and meeting new people, and developing new relationships.	Establish a social club for incoming residents to help plan improvements and develop social capital before move-in. A space could be dedicated for social events, to further encourage social interactions.	
2	Increased health & fitness participation.	Increase or support high levels of physical, social, mental and emotional health	Structured fitness opportunities, classes, workshops etc. support physically healthy lifestyles.	Organise and promote fitness activities, such as yoga classes, tai chi or simply regular frisbee in the park.	
3	Layout planning and spaces for interaction	Increase or support high levels of physical, social, mental and emotional health	Design public, inviting spaces for casual interactions and foster sense of community.	Masterplan to include safe, inviting public spaces and intersections with furniture, places of respite.	

Equity and Local Economy

Creating safe, equitable places to live and work which support local prosperity and international fair trade.

One Planet Goals

- To promote diversity and equality of opportunity across all abilities, gender, race, age and sexual orientation
- To create a vibrant and resilient economy where a significant proportion of money is spent locally
- To promote international trade that is conducted fairly and without exploitation

Guidance Extract

One Planet Communities and Destinations celebrate diversity and foster a sense of inclusion. They recognise the needs of local people, elderly people, young people, people with disabilities, single people and families. The needs of low-income groups are considered whether it be through providing affordable housing or employment opportunities in the green economy.

	Initiative	Goal	Details - how it works/benefits	Examples of how this may be implemented	Possible Synergies
1	Digital access	Promote diversity and equality	Social equity can be promoted by providing fair or free access to digital infrastructure.	This could involve high quality fibre-to-the-home/business and/or free public Wi-Fi.	
2	Promote accessibility	Promote diversity and equality	It is important that the built environment should be barrier-free and adapted to fulfil the needs of all people equally. Building in accessibility beyond national building codes can help achieve this goal.	Target groups should be set, these include: Wheelchair users, people with limited walking abilities, the sightless, the partially sighted, the hearing impaired. Examples include: step free access, ground floor bathrooms, wider doorways, reinforced bathroom walls to take future support bards. Schemes include "Lifetime Homes" in the UK and "Liveable Housing Australia".	
3	Employment / green economy	Vibrant and resilient economy, predominantly local	Supporting and investing in the green economy is one way to promote resilience.	Invest in renewables installation, repair/remanufacture, rental models, organic/local produce vendor.	

The Beyond Report

Project Name Dolphin Square MEP Replacement

Project Stage Preparation

Cundall Role Building Services, Sustainability, Fire, Acoustics, Vertical Transportation, CDM

Date 11/11/2020

Culture and Community

Nurturing local identity and heritage, empowering communities and promoting a culture of sustainable living.

One Planet Goals

- To foster a sense of place and belonging
- To encourage active citizenship
- To enhance local culture, heritage and sense of place
- To nurture a new culture of sustainability

Guidance Extract

One Planet Communities and Destinations support a vibrant and active community and add value to existing and surrounding communities. They involve local people at an early stage through consultation and co-creation of the One Planet Action Plan. The development should be responsive to their needs, for example in housing, employment, education or training.

	Initiative	Goal	Details - how it works/benefits	Examples of how this may be implemented	Possible Synergies
1	Community Development Plan	Sense of place and belonging	Create a specific Community Development Plan that details how the growing community can be supported, encouraged and developed over time.	Such CDPs are good practice in developments which are long term, residential, mixed use or community focused e.g. local government facilities.	Health and happiness
2	Support local artists	Local culture, heritage	Commissioning artworks or sponsoring competitions/prizes for local artists will help support the creative community and foster local culture.	Engaging a local artist to create work for the project is an example of how this can be implemented.	
3	Host cultural events/programmes	Sense of place and belonging	Create a sense of community, as well as a space for meeting new people by hosting events/programmes.	Host, organise and facilitate events or programmes with cultural focus. These could be literary festivals, local photography exhibition etc.	Health and Happiness

Land and Nature

Protecting and restoring land and marine systems for the benefit of people and wildlife.

One Planet Goals

- To ensure a positive contribution to local biodiversity
- To maximise carbon sequestration in the soil and biomass
- To maximise the synergies between agriculture, forestry, biodiversity and carbon storage
- To enhance 'ecosystem services' such as providing clean water and clean air
- To engage people in recognising the value of nature including its value to human health

Guidance Extract

One Planet Communities and Destinations protect and restore natural systems for the benefit of people, local wildlife and the biosphere (the living part of our planet). How land is managed can greatly influence how much carbon it can store, or sequester, as biomass (e.g. growing trees) or as organic matter in the soil.

	Initiative	Goal	Details - how it works/benefits	Examples of how this may be implemented	Possible Synergies
1	Greenwalls	Ecosystem exchange services	Greenwalls provide passive air cleaning, and may also be able to provide habitat for local fauna. An additional benefit is the biophilic aspect	Greenwalls can be located internally (within an office or lobby space) or externally (in a public space, or on an external wall - perhaps as part of the plant housing). Plant species and maintenance requirements should be considered to find the most appropriate plants for the project.	
2	Nature Zone	Nature and human health	Create a nature zone where people can interact and immerse in nature, which may have benefits of stress reduction as well as increasing biodiversity.	Designate or create a "nature zone" for safe human/nature interaction.	Also related to biophilia
3	Multipurpose roof space	Biodiversity	Find multipurpose ways to utilise roof space, that can lead to an increase in biodiversity.	Use roof area to host a herb garden for cafes, hives for bees or nesting boxes for local birds.	

The Beyond Report

Project Name Dolphin Square MEP Replacement

Project Stage Preparation

Cundall Role Building Services, Sustainability, Fire, Acoustics, Vertical Transportation, CDM

Date 11/11/2020

Sustainable Water

Using water efficiently, protecting local water resources and reducing flooding and drought.

One Planet Goals

- For everyone to have access to clean drinking water
- To use water efficiently and return it clean to the environment
- To contribute to sustainable water management and flood risk mitigation in the surrounding area

Guidance Extract

Water is a very local issue and so demands solutions specific to the particular location. In many parts of the world, clean water is not an abundant resource available to everyone. As climate change occurs and the earth's population increases, it is likely that even more areas will become 'water-stressed' or prone to flooding. The process of storing, treating and transporting water has a wide range of environmental impacts and a carbon footprint, even in water-rich areas, so it should always be used efficiently. There may be a case for recycling greywater onsite, but only provided there is a clear net environmental benefit, such as reducing water consumption in an area of water stress.

	Initiative	Goal	Details - how it works/benefits	Examples of how this may be implemented	Possible Synergies
1	Grey water harvesting	Efficient water use and treatment	Harvesting and treating Greywater (showers, hand basins, laundry etc.) for on-site reuse reduces demand on municipal water treatment plants.	Harvest greywater and treat to appropriate levels for reuse on site e.g. WCs, laundry and irrigation. Treatment requirements are less than blackwater, but greater than rain/stormwater. Consider public health issues and regulations, and chemicals and energy involved in treatment.	
2	Lifecycle water analysis	Efficient water use and treatment	Conducting site wide lifecycle water analysis helps to understand major water demands and sources, and identify opportunities to reduce water consumption. This is useful for all sites.	Conduct a study to determine all water flows into and out of the site. At the conclusion of the study, identify 3 opportunities for water reduction or re-use that can be implemented.	
3	Low flow appliances	Efficient water use and treatment	Depending on the project type, appliances can be a major water demand. For example, sites with high laundry demands or commercial kitchens. Reducing water consumption can be easily achieved through installing low flow appliances.	Purchase or specify low flow appliances such as dishwashers, laundry equipment. Look for appliances with ratings that verify their efficiency e.g. WELS or The Water Label. Landlords/developers can include clauses in green leases, specifications or fitout guidelines.	

Local and Sustainable Food

Promoting sustainable, humane farming and healthy diets high in local, seasonal, and organic food and vegetable protein.

One Planet Goals

- To make it easy and attractive for people to enjoy fresh, local, seasonal, healthy produce
- To promote diets high in vegetable protein
- To promote sustainable farming which supports biodiversity and builds soil
- To promote humane farming
- To reduce or eliminate food waste

Guidance Extract

Food and food growing has a huge impact on a range of issues including physical and mental health, culture, heritage, climate change, biodiversity and the local economy. It represents about one quarter of our ecological footprint.

One Planet Communities and Destinations support a food culture which is healthy and sustains wildlife-friendly agriculture, conserving and building soils to absorb carbon dioxide. When designing a One Planet Community or Destination, consider space for farmers' markets and for people to grow food, edible landscaping and community orchards.

	Initiative	Goal	Details - how it works/benefits	Examples of how this may be implemented	Possible Synergies
1	Vegan/vegetarian cooking classes	Promote vegetable protein	Cooking classes will help promote vegetable protein options.	Run cooking course focussing on vegetarian and vegan cuisine, healthy and local ingredients.	Health and Happiness
2	Host farmers markets	Access to fresh, local, seasonal, healthy produce	Host farmers market events to facilitate access to fresh and local produce. This initiative also supports the local economy	Reach out to local farmers and offer affordable or free space for selling their produce.	Equite and Local Economy
3	Farmer to consumer	Access to fresh, local, seasonal, healthy produce	Catering operators have an opportunity to increase access to locally grown, fresh, seasonal and healthy food.	Develop and implement a scheme to bring local produce to consumers directly and easily e.g. Farmers Markets, Veg Vans. http://cultivateoxford.org/vegvan	Equity and local economy

The Beyond Report

Project Name Dolphin Square MEP Replacement

Project Stage Preparation

Cundall Role Building Services, Sustainability, Fire, Acoustics, Vertical Transportation, CDM

Date 11/11/2020

CUNDALL

Travel and Transport

Reducing the need to travel, encouraging walking, cycling and low-carbon transport.

One Planet Goals

- To reduce car dependence and the need for daily travel
- To make it easy and attractive for people to walk and cycle
- To promote car-sharing (including car clubs) and public transport
- To promote low/zero-carbon vehicles including electric cars
- To raise awareness of the impacts of, and promote alternatives to, air travel

Guidance Extract

Envision your One Planet Community or Destination as a place where people can walk and cycle easily and where it is easier to live without a car. Consider the proximity or provision of local services such as schools, healthcare, business districts, shops and leisure facilities. Onsite facilities will complement existing local facilities as appropriate and are likely to include home and community workspaces. Neighbourhoods will be attractive and 'permeable,' making walking and cycling the most convenient mode of transport.

	Initiative	Goal	Details - how it works/benefits	Examples of how this may be implemented	Possible Synergies
1	Electric vehicle charging points	low/zero carbon vehicles	Providing EV charge points will encourage electric vehicle purchase.	Provide at least one electric vehicle charging point for use by the public.	
2	Regenerative lifts	Low/zero carbon vehicles	Converting the excess energy generated by the lift into electricity that can be used elsewhere in the building reduces operational energy consumption. It also reduces the heat load created by drive or breaking resistors from the building.	Specify that lifts should have a regenerative drive - it will cut the lift energy consumption by up to 35% (in some certain circumstances e.g. heavy traffic, this can reduce the energy consumption by up to 60%)	
3	Easy and safe bicycle storage	Promotion of walking and cycling	Facilities for safe storage and use of bikes will encourage users	Provide bike racks or other storage facilities in a secure location with at least passive surveillance. Paths to storage areas should be easy and safe to navigate, and sufficiently lit at night time	

Materials and Products

Using materials from sustainable sources and promoting products which help people reduce consumption.

One Planet Goals

- To promote sustainable living by making it easy to share and reduce consumption of natural materials
- To carefully consider every material and product and select them for their positive social and environmental benefit or for reducing negative impact
- To promote materials and products that are not toxic to humans or wildlife at any stage in their lifecycle, from raw material through to manufacturing, use and end-of-life

Guidance Extract

One Planet Communities and Destinations make it easy for people to improve their quality of life while reducing their environmental impact. They support a circular economy and a collaborative, sharing economy. They prioritise materials and products with a low environmental impact across their lifecycle, and promote those which have positive social and environmental impacts, such as sustainable timber which stores carbon.

	Initiative	Goal	Details - how it works/benefits	Examples of how this may be implemented	Possible Synergies
1	Develop sharing economy	Reduced consumption of natural materials	Sharing less frequently used items such as cars, power tools or items that have a limited use to some people, this reduces the consumption and production of new materials.	Provide a local swap/buy/donate web service to support the share economy.	Culture and community
2	Locally sourced	Positive social and environmental benefit or for reducing negative impact	Locally sourced materials have lower embodied energy as the energy associated with transportation is lower. Purchasing locally also supports local businesses.	Specify or procure products that are extracted or manufactured locally. Many cities have a matching database that can be used to identify companies that can supply to the construction sector. E.g. http://www.mtwconsultants.co.uk/	Equity and Local Economy
3	Low embodied carbon building materials - General	Positive social and environmental benefit or for reducing negative impact	Standard building materials often have high embodied carbon. Using alternatives can reduce the embodied carbon dramatically, without compromising quality or performance of the product.	Conduct a high level embodied carbon assessment at concept stage to identify high impact areas of the design, then prioritise top 3-5 key areas (e.g. building form, design parameters for loading, steel or timber frame). Next, review alternative materials e.g. timber framework in stud partitions rather than metal, use of sheep wool in lieu of rock wool (whilst still ensuring u-value and fire rating is achieved). Keep a record of the changes so you know how much you have reduced your embodied carbon by.	

The Beyond Report

Project Name Dolphin Square MEP Replacement

Project Stage Preparation

Cundall Role Building Services, Sustainability, Fire, Acoustics, Vertical Transportation, CDM

Date 11/11/2020

Zero Waste

Reducing consumption, re-using and recycling to achieve zero waste and zero pollution.

One Planet Goals

- To reduce wasteful consumption
- To maximise upcycling, re-use and recycling
- To aim for zero waste to landfill

Guidance Extract

Waste can be considered a resource and can be part of the circular economy, so a One Planet Community or Destination is designed around the waste hierarchy:

• Reduce consumption
• Prevent waste
• Reuse materials and products
• Recycle and compost
• Recover energy from waste
• Dispose to landfill.

Design, construct and operate for a healthy and happy life where wasteful consumption is reduced and there is no waste produced.

	Initiative	Goal	Details - how it works/benefits	Examples of how this may be implemented	Possible Synergies
1	Recycling hub	Zero waste to landfill	Many recyclables materials are not collected as part of the regular recycling service. Establish a hub for these items - even better is to allow nearby sites access to the established recycling service.	Establish collection facilities and arrange pick up for items such as batteries, mobile phones etc. and encourage staff/students/occupants to bring items from home. If extending the hub to use by nearby sites, advise them of this service.	Materials and products
2	Waste to energy	Zero waste to landfill	This initiative has the benefit of reducing the volume of waste to landfill, and the conversion of waste to energy which can be consumed off or onsite.	Follow the waste heirachy: reuse, then look to recycle, where that isn't possible - divert the waste stream to a energy plant. Waste to energy should not detract from recycling rates of up to 70%, and plants should be sized as such so that it isn't dependant on large waste inputs	If all recyclable streams removed, this can be considered renewable energy and complimentary to zero carbon energy
3	Reduce consumption	Reduce wasteful consumption	One of the first steps to reduce waste to landfill is to stop its generation in the first place. Projects should consider how to reduce the amount of waste produced. This can apply in construction or operation.	Conduct a study to identify opportunities to reduce consumption. Projects may consider going paperless, using higher quality specification products that require less frequent replacement, avoiding heavily packaged items, buying in bulk etc.	Materials and Products

Zero Carbon Energy

Making buildings energy efficient and supplying all energy with renewables.

One Planet Goals

- Buildings are energy efficient compared to a stated local or national benchmark or a recognised standard
- 100% of energy consumed is supplied by non-polluting renewable energy generated onsite or offsite

Guidance Extract

All buildings in a One Planet Community are designed to be energy efficient to stated local sector-specific best practice standards, preferentially using passive methods. Having made the buildings energy efficient, all the buildings in a One Planet Community run on renewable energy ('net zero carbon') from a combination of onsite and offsite sources.

	Initiative	Goal	Details - how it works/benefits	Examples of how this may be implemented	Possible Synergies
1	Embedded network / private electricity networks	Energy efficient compared to benchmarks and standards	Setting up multiple buildings on embedded networks can increase diversity of demand, better utilise on-site generation/renewables and possibly allow re-use of waste heat.	Examples include a CHP engine in a mixed-use development. This can provide electrical power, and possibly cooling, to an office during the day and residential developments during the evening/weekends.	
2	Insulation and building sealing	Energy efficient compared to benchmarks and standards	In some climates, a well insulated and well sealed building fabric can significantly reduce heating and cooling loads, and thus carbon emissions.	Roof insulation is often highly cost-effective, and use of building pressure testing can significantly reduce heating and cooling loads while enhancing comfort. Note: minimum requirements may be in local building codes and are typically climate specific. Projects should improve on minimum requirements.	
3	Use of efficient lighting technologies	Energy efficient compared to benchmarks and standards	Lighting technology has advanced rapidly, and new LED technology is now capable of providing the high lighting levels with reduced energy consumption. Other benefits are the increased lifespan of LED products, which means less replacement costs and waste generation.	LEDs are generally suitable for most uses and are often cost effective when increased life spans are considered. Effective spacing and daylight-linking can also increase efficiency.	Materials and Products, Zero Waste

The Beyond Report

Project Name	Dolphin Square MEP Replacement
Project Stage	Preparation
Cundall Role	Building Services, Sustainability, Fire, Acoustics, Vertical Transportation, CDM
Date	11/11/2020

Document Validation (latest issue)

X

Principal author Mouawad, Farid

Created on 11/11/2020

X

Checked by Smitten, Barbara

Checked on 19/11/2020

X

Verified by Wilkinson, Martyn

Verified on 19/11/2020

Appendix G BREEAM / WELL Credits

BREEAM Credits

On the 30th November 2021 Longevity (BREEAM Assessors) circulated a BREEAM pre assessment. The below table includes credits identified by Longevity as Cundall 'Responsible Stakeholder'. Comments are provided below regarding the additional design requirements to be carried out at Stage 3 to achieve compliance along with cost estimation where available. The BREEAM manual can be accessed https://www.breeam.com/domrefurb2014manual/

BREEAM ID	Credits Available	Requirement (as BREEAM pre-assessment column D 'Assessment Criteria according to BREEAM Manual'	Impact on Stage 3 MEP Design	Other Designer Impacts	Include in Stage 3 Design
Hea 05 Ventilation	One Credit – Minimum ventilation requirements	An assessment is carried out to establish the current levels of airtightness and structural moisture prior to the specification of fabric measures and heating systems. The assessment should establish the appropriate level of ventilation for the building, based upon: - The minimum ventilation requirement to meet that set out in Building Regulations Approved Document Part F, - Ventilation rates in all habitable and inhabitable spaces are sufficient to allow structural moisture to be dealt with effectively. This may be required by Building Regulations Approved Document Part F where the structure or fixtures needs higher levels of ventilation in order to deal with moisture levels.	Assessment completed by third part on sample apartments. Minimum Part F requirements via MVHR will be provided There are no habitable / inhabitable areas known that require higher levels of ventilation to deal with the accumulation of moisture. Should any areas of concern be highlighted at stage 3 then appropriate natural / mechanical ventilation strategies can be reviewed and included as appropriate.	The credit requires compliance with Part F Purge ventilation. The strategy is for the windows to provide purge ventilation. GRID to confirm windows comply.	Yes
	Two Credits – Advanced ventilation	Two credits are awarded where: The following testing is carried out in order to develop the ventilation and airtightness strategy for the building: - Pressure testing was carried out before and after refurbishment in accordance with the appropriate standard - Temperature and humidity are monitored before and after refurbishment An airtightness test per dwelling type per block	The target is to provide and test apartments to achieve an air permeability of <3. With an aspiration to achieve closer to 1. Sample pressure testing has been carried out and ranged from 2.5 to 10. The stage 3 design will assume that <3 is achieved, and Section 5 of Part F complied with via the provision of the MVHR with continuous and boost ventilation.	QS to include for air pressure testing for each apartment on completion.	Yes

BREEAM ID	Credits Available	Requirement (as BREEAM pre-assessment column D 'Assessment Criteria according to BREEAM Manual'	Impact on Stage 3 MEP Design	Other Designer Impacts	Include in Stage 3 Design
Ene 01 Improvement in Energy Efficiency	Up to 6 Credits – Improving the dwelling's energy efficiency rating (EER)	- Determine the dwelling's energy efficiency rating (EER) before refurbishment (EPC from HOLLIS assessment). - Determine the dwelling's EER after refurbishment (preferably) from full SAP (2012) or where not available from the dwelling's EPC report. An average improvement in EER can be calculated for all the dwellings in the building. In such cases, the average improvement in EER is the floor-area-weighted average improvement in EER of all the individual dwellings Averaging is only permitted for multiple dwellings in the same building. It is not permitted across multiple buildings on the same site. 8 EER analysis for each block of DSQ.	Section 6 of the RIBA stage 2 Energy feasibility report included 8 EPCs based on various scenarios. During RIBA stage 3 the assessment before and after refurbishment for the 15 apartment types (per phase) will be provided. This will determine the credits that can be achieved and identify any further measures to achieve a greater number of credits.	Impact is not known until assessment carried out to determine the credits achievable with scenario 2 energy strategy.	Yes
Ene 02 Energy Efficiency Rating post-refurbishment	Up to 4 credits are awarded - EER post-refurbishment	Up to 4 credits are awarded – EER post-refurbishment 1. Whereas a result of refurbishment, the dwelling meets a minimum energy efficiency rating, credits can be awarded. 0.5 credits, EER post-refurbishment ≥ 50 (Pass level minimum requirement) 1.0 credits, EER post-refurbishment ≥ 55 (Good level minimum requirement) 1.5 credits, EER post-refurbishment ≥ 60 2.0 credits, EER post-refurbishment ≥ 65 (Very Good level minimum requirement) 2.5 credits, EER post-refurbishment ≥ 70 (Excellent level minimum requirement) 3.0 credits, EER post-refurbishment ≥ 75 3.5 credits, EER post-refurbishment ≥ 80 (Outstanding level minimum requirement) 4.0 credits, EER post-refurbishment ≥ 85	During RIBA stage 3 the assessment before and after refurbishment for the 15 apartment types (per phase) will be provided. This will determine the credits that can be achieved and identify any further measures to achieve a greater number of credits. It is noted that the stage 2 EER for the scenario 2 included insulated walls which is no longer recommended. **It is noted that the Exemplar A rated EPC (EER >90) is unlikely to be achieved.**	Impact is not known until assessment carried out to determine the credits achievable with scenario 2 energy strategy. QS to include for air pressure testing for each apartment on completion.	Yes
Ene 03 Primary Energy Demand	Primary Energy Demand	The following demonstrates compliance: 1. Primary energy demand targets. Whereas a result of refurbishment the dwelling meets the primary energy demand targets, up to 7 credits may be awarded: 0.5 credits, Primary Energy Demand Post Refurbishment (kWh/m2/year) ≤ 400 1.0 credits, Primary Energy Demand Post Refurbishment (kWh/m2/year) ≤ 370 1.5 credits, Primary Energy Demand Post Refurbishment (kWh/m2/year) ≤ 340 2.0 credits, Primary Energy Demand Post Refurbishment (kWh/m2/year) ≤ 320 2.5 credits, Primary Energy Demand Post Refurbishment (kWh/m2/year) ≤ 300 3.0 credits, Primary Energy Demand Post Refurbishment (kWh/m2/year) ≤ 280 3.5 credits, Primary Energy Demand Post Refurbishment (kWh/m2/year) ≤ 260 4.0 credits, Primary Energy Demand Post Refurbishment (kWh/m2/year) ≤ 240 4.5 credits, Primary Energy Demand Post Refurbishment (kWh/m2/year) ≤ 220 5.0 credits, Primary Energy Demand Post Refurbishment (kWh/m2/year) ≤ 200 5.5 credits, Primary Energy Demand Post Refurbishment (kWh/m2/year) ≤ 180 6.0 credits, Primary Energy Demand Post Refurbishment (kWh/m2/year) ≤ 160 6.5 credits, Primary Energy Demand Post Refurbishment (kWh/m2/year) ≤ 140 7.0 credits, Primary Energy Demand Post Refurbishment (kWh/m2/year) ≤ 120	During RIBA stage 3 the PER assessment after refurbishment for the 15 apartment types (per phase) will be provided. This will determine the credits that can be achieved and identify any further measures to achieve a greater number of credits.	Impact is not known until assessment carried out to determine the credits achievable with scenario 2 energy strategy. QS to include for air pressure testing for each apartment on completion.	Yes

BREEAM ID	Credits Available	Requirement (as BREEAM pre-assessment column D 'Assessment Criteria according to BREEAM Manual'	Impact on Stage 3 MEP Design	Other Designer Impacts	Include in Stage 3 Design
Ene 04 Renewable technologies	Up to two credits – Renewable technologies	One credit: 1. Where at least 10% of the dwelling's primary energy demand per annum is supplied by low or zero carbon technologies AND 2. Where the dwelling has reduced energy demand prior to the specification of renewable technologies with a maximum primary energy demand as follows: ~~2.a. For detached, semi-detached, bungalows and end terraces: 250 kWh/m2/year~~ 2.b. Mid terraces and flats: 220 kWh/m2/year Two credits: 3. Where for mid to high-rise flats at least 15% of each dwelling's primary energy demand per annum is supplied by low or zero carbon technologies 4. ~~Where for dwellings other than mid to high-rise flats at least 20% of each dwelling primary energy demand per annum is supplied by low or zero carbon technologies~~ 5. Where the dwelling has reduced energy demand prior to the specification of renewable technologies with a maximum primary energy demand as follows: ~~5.a. For detached, semi-detached, bungalows and end terraces: 250 kWh/m2/year~~ 5.b. Mid terraces and flats: 220 kWh/m2/year	The ASHP can be specified to be provided by MCS certified installer and will be part of a later stage specification / equipment schedule. Cundall Accredited Domestic Energy Assessor to carry out calculation to predict the energy scenario 2 heat pumps provision in support of the BREEAM evidence if necessary (i.e. due to limitations in SAP software). During RIBA stage 3 the Ene 04 results to be provided. This assessment can also be used to determine any further measures required to achieve compliance.	Impact is not known until assessment carried out to determine the credits achievable with scenario 2 energy strategy. QS to include for air pressure testing for each apartment on completion.	Yes

BREEAM ID	Credits Available	Requirement (as BREEAM pre-assessment column D 'Assessment Criteria according to BREEAM Manual'	Impact on Stage 3 MEP Design	Other Designer Impacts	Include in Stage 3 Design
Ene 07	One credit – External lighting	1. Where energy efficient space lighting <45 Lumens / circuit watt (including lighting in communal areas) and energy efficient security lighting is provided. OR 2. Where energy efficient space lighting <45 Lumens / circuit watt (including lighting in communal areas) and no security lighting is provided. **Energy efficient space lighting** Any lighting more than 45 lumens per circuit watt **General space lighting** Lighting for external doors, porch, steps, pathways, patio, garage, garden, carports and any other outbuildings provided by energy efficient fittings, controlled by manual switching. **Space lighting in communal areas** • Lighting in lobbies, main external entrances, internal entrance porches, external steps and pathways equipped with fluorescent fittings (or other efficient luminaires like SON or metal halide) and controlled by a time clock or daylight sensor. • Lighting in hallways, landings, stairwells, internal corridors and garages equipped with fluorescent fittings that are controlled by push button time switches, PIR sensors or equivalent. • Lighting in communal rooms (laundries, cycle and other storage spaces, etc.) equipped with fluorescent fittings and manual switching or occupant sensors. **Energy efficient security lighting** • Security lighting, which are fittings designated for energy efficiency and are adequately controlled such that: • Burglar security lights have a maximum wattage of 150 W, movement detection control devices (PIR) and daylight cut-off sensors. • Other security lighting which has energy efficient fittings and is fitted with daylight cut-off sensors or timers. • Lighting design for the affected areas should follow the requirements of the standard(s) applicable or CIBSE LG9, and should not compromise the safety of any persons using the building. **Control systems** A method for controlling the external lighting to ensure that it will not operate unnecessarily during daylight hours or when a space is unoccupied. Control systems that can be considered are passive infra red (PIR), 'dusk to dawn' daylight sensors and time switches. **Daylight sensors (dusk to dawn)** A type of sensor that detects daylight and switches lighting on at dusk and off at dawn. **Internal lamps** Internal lamps includes all lighting in habitable rooms including: living rooms, dining rooms, kitchens, bedrooms, hallways, studies, bathrooms, WCs and utility rooms. Lighting of internal stairs within the dwelling should also be included. The following rooms or areas must be excluded: garages, walk-in wardrobes, cupboards, external areas. **Metal halide lamps** A type of high intensity discharge lamp. They can be specified in varied environments. These lamps combine good colour rendering with high luminous efficacy and long life. **Passive infrared (PIR) Movement Detecting Devices** A type of motion detector that uses infra red radiation to detect movement and switches lighting on. **Security lighting** Security lighting is provided to deter burglars or intruders and to protect property. There are two types of security lighting commonly used in dwellings – high wattage intruder lights that are operated via PIR sensors, which only switch on for a short time, and low wattage lighting that is controlled by time switches and daylight sensors. **High pressure sodium lamp (SON or HPS)** A type of high intensity discharge lamp primarily used for street lighting purposes. These lamps have a very good luminous efficacy (up to 150 lumens per circuit watt). **Space lighting** The normal lighting required to illuminate a space when in use. It can be used outside the entrance to the home, in outbuildings such as garages and external spaces such as paths, patios, decks, porches, steps and verandas. Space lighting should usually be designed to be switched off when the space is uninhabited and during daylight hours. It is acceptable that some lighting remains switched on outside of daylight hours for safety reasons. Situations where this may be acceptable include: main external entrances, external steps, pathways and car parks.	Noting that privately managed site by a local authority are excluded. Retained existing external lights may need to be replaced. MEP stage 3 design to include requirements. Noting that Architectural (appearance) and Efficiency compliance needs to be checked with lighting manufacturers.	GRID relating to any specific appearance and checking energy compliance with Electrical designer.	Yes
	One credit - Internal Lighting	3. One credit is awarded where the energy required for internal lighting is minimised through the provision of a maximum average wattage across the total floor area of the dwelling of 9 watts/m^2.	MEP stage 3 design to include requirements. Noting that Architectural (appearance) and Efficiency compliance needs to be checked with lighting manufacturers.	GRID relating to any specific appearance and checking energy compliance with Electrical designer.	Yes

BREEAM ID	Credits Available	Requirement (as BREEAM pre-assessment column D 'Assessment Criteria according to BREEAM Manual'	Impact on Stage 3 MEP Design	Other Designer Impacts	Include in Stage 3 Design
Ene 08 Energy Display Devices	Up to two credits - Energy display devices	One credit 1. Current electricity OR primary fuel consumption data is displayed to occupants through a compliant energy display device. Two credits 2. Where current electricity AND primary heating fuel consumption data are displayed to occupants by a compliant correctly specified energy display device. OR 3. Where electricity is the primary heating fuel and current electricity consumption data are displayed to occupants by a compliant energy display device. Compliant energy display devices: This is a system comprising a self-charging sensor(s) fixed to the incoming mains supply or supplies, to measure and transmit energy consumption data to a visual display unit. As a minimum the visual display unit must be capable of displaying the following information: • Local time • Current (real time) energy consumption (kiloWatts and kiloWatt hours) • Current (real time) estimated emissions (g/kg CO_2) • Current (real time) tariff • Current (real time) cost (per hour) • Visual presentation of data (i.e. non-numeric) to allow consumers to easily identify high and low level of usage Recording of consumption data: Historical consumption data so that consumers can compare their current and previous usage in a meaningful way. This should include cumulative consumption data in all of the daily, weekly, monthly or other billing periods. The data must be stored internally for a minimum of two years or be connected to a separate device with automatic upload from the energy display device	MEP stage 3 design to include requirements. Noting that this credit potentially could add significant cost. Note exemplar credit should also be targeted where recording of consumption data capability is required.	Hollis to check likely cost impact with MEP designers.	Yes
Wat 01 Internal water Use	Internal water Use	1 credit: from 129 to < 140 litres/person/day All showers specified to 'Excellent' OR All showers and bathroom taps to 'Good'. 2 credits: from 107 to < 118 litres/person/day All bathroom and WC room fittings specified to 'Excellent' OR All bathroom fittings Specified to 'Excellent' and WC room fitting specified to 'Good' OR All bathroom fittings, kitchen and utility fittings specified to 'Good'. 3 credits: < 96 litres/person/day All bathroom fittings specified to 'Excellent' and WC room, kitchen and utility room fittings specified to 'Good'. Water facilities: Showers: 'Good' 8 litres per minute or less ; 'Excellent' 6 litres per minute Baths: 'Good' 140 litre capacity to overflow or less ; 'Excellent' 140 litre capacity to overflow or less WCs: 'Good' 4 litres effective flushing volume or less ; 'Excellent' 3 litres effective flushing volume or less Bathroom and WC room taps: 'Good' 5 litres per minute or less ; 'Excellent' 3 litres per minute or less Kitchen and utility room taps: 'Good' 5 litres per minute or less ; 'Excellent' 5 litres per minute or less Dishwashers: 'Good' 13 litres per cycle ; 'Excellent' 12 litres per cycle Washing machines: 'Good' 60 litres per use ; 'Excellent' 40 litres per use	MEP stage 3 Design to be based on 2 credits being targeted and typical flow rates as identified. Noted that where reasonable reduced water flow type fitting to be provided to reduce overall energy. Dishwasher and washing machines should be 'Excellent' to reduce energy in general. Showers typically are the issue in achieving a high-quality shower with a low flor wate, hence 2 credits advised.	GRID to confirm appliance flow rates.	Yes
Wat 02 External water use	External water use	One credit 1. Where a compliant rainwater collection system for external or internal irrigation use has been provided to dwellings. OR 2. Where dwellings have no individual or communal garden space.	MEP stage 3 Design to support landscape architect at next stage to provide BREEAM compliance.	Landscape Architect to advise if irrigation is required.	Yes

BREEAM ID	Credits Available	Requirement (as BREEAM pre-assessment column D ‘Assessment Criteria according to BREEAM Manual’	Impact on Stage 3 MEP Design	Other Designer Impacts	Include in Stage 3 Design
Wat 03 Water meter	Water meter	One credit 1. Where an appropriate water meter for measuring usage of mains potable water has been provided to dwelling or dwellings in accordance with CN1 or CN2	MEP stage 3 to include new water meters. The BREEAM requirement and meter location to be agreed: The meter to be in a location visible to occupants (i.e. not hidden within a cupboard) and capable of recording and displaying historic water consumption to allow water consumption to be monitored over time. The meter should be capable of displaying current consumption either instantaneously or at half-hourly intervals.	GRID to be aware of requirement for location.	Yes
Pol 01 Nitrogen Oxide Emissions	Up to 3 credits – Low NOx space heating and hot water systems	Up to 3 credits – Low NOx space heating and hot water systems 1. Credits are awarded on the basis of NOx emissions arising from the operation of space heating and hot water systems for each refurbished dwelling as follows: 1.a. One credit where the dry NOx emissions of space heating and hot water systems are ≤ 100 mg/kWh (NOx class 4 boiler). 1.b. Two credits where the dry NOx emissions of space heating and hot water systems are ≤ 70 mg/kWh (NOx class 5 boiler). 1.c. Three credits where the dry NOx emissions of space heating and hot water systems are ≤ 40 mg/kWh.	MEP stage 3 to include design for three credit requirements through specification of Low NOx boilers.	None	Yes

WELL Credits

<table>
<tr><th>WELL Feature</th><th>Feature Requirements</th><th>Comment</th><th>Technical Risk</th><th>Cost Impact</th><th>Next Step</th></tr>
<tr><td>A03.1
Ensure Adequate Ventilation</td><td>Newly installed ventilation systems are designed to meet the supply and exhaust rates set in one or more of the following ventilation guidelines, which must describe ventilation rates for at least 90% of the project area. The ventilation system is scheduled to be tested and balanced after project occupancy:
1. ASHRAE 62.1-2010 or any more recent versions (Ventilation Rate Procedure or IAQ Procedure).[12]
2. ASHRAE 62.2-2016.[13]
3. EN 16798-1 (for Category IV buildings).[14]
4. AS 1668.2-2012 or any more recent version.[15]
5. CIBSE Guide A: Environmental Design, version 2007 or any more recent version</td><td>Route of compliance to follow CIBSE Guide A latest edition.</td><td>Low</td><td>Low</td><td>Letter of Assurance to be provided at end of RIBA stage 3.</td></tr>
<tr><td>A04
Construction Pollution Management</td><td>For construction occurring after project registration, the following requirements are met:
a. Ducts are maintained per one of the below:
1. Ducts are sealed and protected from possible contamination during construction.[5]
2. Ducts are cleaned prior to installing registers, grills and diffusers.
b. If permanently installed ventilation system is operating during construction, filters must meet the following:
1. Media filters with a PM_{10} removal rating of at least 70% (e.g., MERV 8) are used to filter return air.[6]
2. All filters are replaced prior to occupancy.[5]
c. The project implements the following moisture and dust management procedures:
1. Carpets, acoustical ceiling panels, fabric wall coverings, insulation, upholstery and furnishings and other absorptive materials are stored separately in a designated area protected from moisture damage.[5]
2. All active areas of work are isolated from other spaces by sealed doorways or windows or through the use of temporary barriers.[5]
3. Walk-off mats are used at entryways to reduce the transfer of dirt and pollutants.[5]
4. Saws and similar tools use dust guards or collectors to capture generated dust.[5]</td><td>MEP and QS Prelims to include requirements</td><td>Low</td><td>Low</td><td>QS to complete Contractor Letter of Assurance for Tender.</td></tr>
<tr><td>A05.1
Meet Enhanced Thresholds</td><td>The following requirement is met:
a. Projects comply with the thresholds specified in the table below:<table><tr><th>Particulate Matter Thresholds</th><th>Points</th></tr><tr><td>$PM_{2.5}$: 12 μg/m^3 or lower.[8]
PM_{10}: 30 μg/m^3 or lower.[9]</td><td>1</td></tr><tr><td>$PM_{2.5}$: 10 μg/m^3 or lower.[9]
PM_{10}: 20 μg/m^3 or lower.[9]</td><td>2</td></tr></table></td><td>Not targeted. Suggest this is included in the assessment but not depended on and prior to the GBCI Performance Test, compliance may be checked. (Similar strategy may be applied to organic A05.2 and inorganic A05.3 – do not change design but see if achievable post completion)</td><td>Low</td><td>Low</td><td>Verified by Performance Test – Post Completion</td></tr>
<tr><td>A06.1
Increase Outdoor Air Supply</td><td>Increased air supply
For mechanically ventilated projects, the following requirement is met in all occupiable spaces:
a. Exceed outdoor air supply rates described in ASHRAE 62.1-2010 by the percentages shown in the table below:<table><tr><th>Thresholds</th><th>Points</th></tr><tr><td>30%</td><td>1</td></tr><tr><td>60%</td><td>2</td></tr></table></td><td>ASHRAE 62.1-2010 for apartment living spaces requires 2.5 l/s per person.
CIBSE Guide F for whole house ventilation ~5 l/s/person. Therefore 2 credits are feasible.</td><td>Low</td><td>Low</td><td>Letter of Assurance to be provided at end of RIBA stage 3.</td></tr>
</table>

WELL Feature	Feature Requirements	Comment	Technical Risk	Cost Impact	Next Step
A07.2 **Operable Windows**	The following requirement is met: a. Outdoor levels of $PM_{2.5}$, temperature and humidity are monitored at intervals of at least once per hour, based on a data-gathering station located within 4 km of the building. This monitoring system may be operated by the project or by another entity (e.g., a government). Indicator lights at windows (at least one per room with windows) cue occupants when the conditions outside are suitable for opening windows: a. $PM_{2.5}$: 15 µg/m^3 or lower. b. Dry-bulb temperature: within 8 °C of indoor air temperature setpoint. c. Relative Humidity: 65% or lower.	May require software integration with local air quality monitoring station. Integration to apartments and alerting Tenants may be costly using indicator lights.	High	High	Recommend credit is not targeted initially and reviewed at end of stage 3 if required.
A08.1 **WELL Indoor Air Monitors**	1: Sensor requirements The following requirements are met: a. The project deploys monitors that measure at least three of the following parameters: 1. $PM_{2.5}$ or PM_{10} (accuracy 25% at 50 µg/m^3). 2. Carbon dioxide (accuracy 10% at 750 ppm). 3. Carbon monoxide (accuracy 1 ppm at values between 0 and 10 ppm). 4. Ozone (accuracy 10 ppb at values between 0 and 100 ppb). 5. Nitrogen dioxide (accuracy 20 ppb at values between 0 and 100 ppb). 6. Total VOCs (accuracy 25% at 500 µg/m^3). 7. Formaldehyde (accuracy 20 ppb at values between 0 and 100 ppb).	Quantity to be determined. This credit can be purchased. Typically, 1 sensor required per 325 m^2. Advise that this is standalone system, locations are agreed, annual subscription and calibration costs to be considered.	Low	High	Letter of Assurance to be provided at end of RIBA stage 3.
A08.2 **Promote Air Quality Awareness**	Certification note: Projects may only receive points for this part, if Part 1 is also achieved Information about the air quality measured in Part 1 of this feature is made available to occupants as follows: a. Data are presented through one of the following: 1. Display screens prominently positioned at a height of 1.1–1.7 m with at least one display per 325 m^2 of regularly occupied space. 2. Hosted on a website or phone application accessible to occupants. Signs are present indicating where the data may be accessed at a density of at least one sign per 325 m^2 of regularly occupied space. b. Data presented include one of the following: 1. Concentrations of the parameters measured. 2. Qualitative results of air quality (e.g., colored-coded levels).	Requires A08.1 to be achieved. Cost could be part of A08.1 and subscription cost and allowing Tenants to access data via phone applications.	Low	High	AXA to provide Letter of Assurance.
A09.2 **Perform Envelope Commissioning**	For projects undergoing design and construction, the following requirements are met: a. The project uses a façade engineer that is responsible for defining the building envelope performance metrics (including materials, components, assemblies and systems) at the concept design stage. b. The building envelope performance requirements are included in the Basis of Design document and reflect the Owner's Project Requirements. c. The commissioning process includes envelope commissioning for air infiltration and leakage, which is reflected in the specification and commissioning plan. d. The envelope commissioning process is executed, as outlined in the commissioning plan. e. The envelope commissioning plan is included in the project Operation & Maintenance (O&M) Manual.	An air test will be required to all apartments and communal areas on a phased approach. This will benefit BREEAM (for Ene01 credits), EPCs as well as energy strategy compliance. WELL Assessor to check if credit can be achieved due to scope of works (roof insulation, replacement windows etc).	Low	Low	Verified by Technical Document – Such as the requirements in the preliminaries for the Contractor to appoint and carry out.
A10.1 **Manage Combustion**	2: Low-emission combustion sources Equipment used in the project for heating, cooling, water heating, process heating or power generation (including back-up, if used for more than 200 hours per year) within the building or project site meet some combination of the following requirements: a. Comply with California's South Coast Air Quality Management District emission rules for pollution.[7] b. Are electric. c. Are supplied by district heating or cooling.	Depends on Energy Strategy. If all electric, then credit is achieved at no additional cost or risk. If boilers or CHP are provided, then requirements are difficult to achieve and would require further review at Stage 3.	TBC	TBC	Letter of Assurance to be provided at end of RIBA stage 3.

WELL Feature	Feature Requirements	Comment	Technical Risk	Cost Impact	Next Step
A11.1 **Manage Pollution and Exhaust**	For all ovens, cooking burners and stove top cooking appliances that use a range hood, the following requirements are met: a. Exhaust air is vented directly to the outdoors.[16] b. Exhaust air outlets are separated from any air intakes by at least 3 m, unless otherwise specified by local code.[17] c. The minimum operating exhaust airflow rate is the greater of 150 L/s per linear meter of range hood width or 94 L/s.[18] d. The range hood device, when in operation, covers at least 75% of the burner area.[19]	Bathrooms and kitchens to have extract. The text on the left, 'range hood' needs clarification with WELL. This text is specific for dwellings. If a domestic cooker with extraction hood is not a 'range hood' then credit may be achieved by default. Assume for now credit cannot be achieved until feedback received.	High	High	Letter of Assurance to be provided at end of RIBA stage 3.
A12.1 **Implement Particle Filtration**	**1: Filtration levels** The following requirement is met: a. Media filters are used in the ventilation system to filter outdoor air supplied to the space, in accordance with thresholds specified in the table below:[5,6] Annual Average Outdoor $PM_{2.5}$ Threshold — Minimum Air Filtration Level ($PM_{2.5}$ removal) 23 μg/m³ or less — ≥80% (e.g., MERV 12 or M6) 24–39 μg/m³ — ≥90% (e.g., MERV 14 or F8) 40 μg/m³ or greater — ≥95% (e.g., MERV 16 or E10)	Based on London Air website. Annual $PM_{2.5}$ during 2016 was 14ug/m³. Therefore MERV 12 or M6 is acceptable filtration. To be reviewed at stage 3	Medium	Medium	Letter of Assurance to be provided at end of RIBA stage 3.
A13.1 **Improve Supply Air**	**1: Air supply requirements** All occupiable spaces utilize one of the following strategies: a. 100% outdoor air (i.e., supply air has not recirculated from within the building). b. Partially recirculated air which has been treated with the following: 1. Activated carbon filter. 2. At least one of the following: (i) Media filter with $PM_{2.5}$ removal of ≥90% (e.g., MERV 14 or F8), (ii) UVGI within the ducts to treat the moving air, or (iii) upper-room UVGI. c. Partially recirculated air and include air purification/cleaning devices within the space (with a quantity appropriate to the room volume or area, based on manufacturer specification) that include the following: 1. Activated carbon filter. 2. Media filter with $PM_{2.5}$ removal of ≥90% (e.g., MERV 14 or F8) or UVGI.	No air is recirculated therefore credit can be achieved.	Low	Low	Letter of Assurance to be provided at end of RIBA stage 3.
A14.1 **Implement Ultraviolet Air Treatment**	**1: UV system design** The following requirements are met: a. All central air handling units use ultraviolet lamps to irradiate the surfaces of the cooling coils and drain pans.[10] b. All cooling coils and drain pans associated with fan coil units either: 1. Are irradiated by ultraviolet lamps. 2. May be opened for inspection for mold growth and cleaned, if necessary.	Expensive and not recommended.	High	High	Not recommended.
W01.1 & W02.2 **Water Quality**	Refer to manual for extensive list of requirements.	For our London Office, filtration was required to comply with WELL v1 requirements. As this is mandatory, recommend a WELL water test is carried out to determine level of filtration required, cost and plant space etc.	High	High	Testing to be commissioned.

WELL Feature	Feature Requirements	Comment	Technical Risk	Cost Impact	Next Step
W04.1 **Enhanced Water Quality**	Water delivered to the project for human consumption meets the following thresholds: a. Aluminum ≤ 0.2 mg/L.[2] b. Chloride ≤ 250 mg/L.[2] c. Copper ≤ 1 mg/L.[2] d. Manganese ≤ 0.05 mg/L. e. Iron ≤ 0.3 mg/L.[2] f. Silver≤ 0.1 mg/L.[2] g. Sodium ≤ 270 mg/L.[3] h. Sulfate ≤ 250 mg/L.[2] i. Sulfide ≤ 0.05 mg/L.[3] j. Zinc ≤5 mg/L.[2] k. Total Dissolved Solids (TDS) ≤ 500 mg/L.[2] l. Free Chlorine ≤ 1.25 mg/L.[4]	To be reviewed at stage 3	Medium	High	Verified by Performance Test – Post Completion
W06.1 **Drinking Water Access**	1: Dispenser availability The following requirements are met: a. At least one drinking water dispenser (minimum one per floor) is located within a 30 m walk distance of all regularly occupied floor area and in all dining areas. b. Water delivered by the dispensers is directly piped through the building's water supply or is stored in containers designed for refilling. c. All newly installed drinking water fountains are designed for water bottle-refilling.	Architect to show on drawings. WELL assessor to confirm that circulation spaces do / do not require water dispensers.	TBC	TBC	Architect drawing
W07.2 **Water leak control**	The following requirements are met: a. All hard-piped fixtures, such as toilets, dishwashers, icemakers, water treatment devices and clothes washers, have a labeled, readily accessible single-throw manual shut-off (governed or activated per use) or automatic shut-off at point-of-connection. b. All installed water treatment devices have a waste line fixed in-place, equipped with a backflow preventor.	Issue with compliance is having a readily accessible single-throw manual shut-off to toilets, dish washers and washing machines. Coordination and location to be considered by GRID.	High	High	To be considered at stage 3. Recommend alternative credit is targeted.
W08.2 **Hygiene Support**	All bathrooms meet the following: a. Toilets are equipped with hands-free flushing. b. Contactless soap dispensers and hand drying. c. Users can exit the bathroom hands-free. d. Faucets meet the following: 1. Sensor-activated. 2. Equipped with a programmable line-purge system. 3. If mixing is used, hot- and cold-water lines are mixed at the point of use.	Architect to confirm. Credit requirements for apartment bathrooms appear to be high risk and high cost.	High	High	Architect to review and confirm.

WELL Feature	Feature Requirements	Comment	Technical Risk	Cost Impact	Next Step
W09.1 **Onsite non-potable water capture and re-use**	The following requirements are met: a. The project implements a safety plan that contains the following: 1. A list of key team roles for design, operations, maintenance and third-party inspection of the non-potable water system capture, treatment and use. 2. A list of all applicable codes and regulations in the jurisdiction where the non-potable water reuse system is being installed and that govern the design, commissioning, and approval of operation of the system. 3. A process flow diagram that displays the non-potable water sources, conveyances, storage units, treatment devices and points of use, emphasizing the points where makeup potable water (i.e., water needed to supplement non-potable needs) may be added. 4. A description of the system that includes the sources and estimated contaminant loads of the non-potable water, the intended uses for the non-potable water, the water treatment devices (if any) and their certifications, and the water quality parameters expected at the points of use. 5. An analysis of how human exposure to pathogens through ingestion and inhalation of non-potable water is minimized, including (if applicable) a description of how the potable water network is protected from the introduction of non-potable water, emphasizing strategies that address cross-connection control and backflow prevention. 6. A description of the signage and identifiable pipe color-coding to distinguish the non-potable water network. 7. A list of strategies for the control of odours, nuisances and vectors due to stagnation of non-potable water. 8. A narrative that details provisions for emergency operations caused by overflow of storage tanks, leaks and outages. 9. A list of operational parameters (such as flow, turbidity, coliforms or other treatment-dependent indicators) to monitor the intended functioning of the water system, their monitoring frequency and control actions if such parameters are beyond target ranges. 10. A list of control points where the operational parameters are being measured. 11. A list of routine maintenance protocols and schedules. 12. A description of the procedures for system start-up, determination of protocols for verification of the safety plan, including Legionella testing if a risk of inhalation exists, and schedule for third-party inspections. b. Projects provide visual evidence of conspicuous signage to occupants to help them to clearly distinguish potable from non-potable water (where applicable) as well as informative displays to highlight the safety features and conservation goals of the non-potable water system.	This relates to rainwater re-use. If not provided, then credit may not be achieved. If provided, then credit details to be considered and implemented during RIBA stage 3.	Medium	High	To be confirmed at RIBA stage 3

<table>
<tr><th>WELL Feature</th><th>Feature Requirements</th><th>Comment</th><th>Technical Risk</th><th>Cost Impact</th><th>Next Step</th></tr>
<tr><td>L01.1
Light Exposure</td><td>The project demonstrates, through computer simulations, that the following requirement is achieved:
a. One of the following targets are met in each dwelling unit:
<table><tr><th>Calculations per IES LM-83-12</th><th></th><th>Calculations per Annex A of CEN 17037:2018</th></tr><tr><td>Average sDA 200,40% is achieved for > 30% of regularly occupied floor area</td><td>OR</td><td>Target illuminance 200 lux is achieved for >30% of individual unit area throughout 50% of daylit hours of the year</td></tr></table>OR
The following requirement is met:
a. The envelope glazing area is no less than 7% of the regularly occupied floor area for each dwelling unit.</td><td>Three options for dwelling compliance. Daylight simulation, envelope glazing area compliance or circadian lighting design.

Of these options the target illuminance of 200 lux through MEP design or the 7% rule may be the easiest way to demonstrate compliance. As this is a pre-requisite and the lighting design is all we have control over this is to take a priority route for compliance.</td><td>Low</td><td>Low</td><td>Lighting design - Technical Document.</td></tr>
<tr><td>L02.1
Visual Lighting Design</td><td>The following requirements are met:
a. All indoor and outdoor spaces (including transition areas) comply with the illuminance thresholds specified in one of the following lighting reference guidelines:
1. IES Lighting Handbook 10^{th} Edition.[3]
2. EN 12464-1: 2011.[4]
3. ISO 8995-1:2002(E) (CIE S 008/E:2001).[5]
4. GB50034-2013.[6]
5. CIBSE SLL Code for Lighting.[7]
b. The illuminance thresholds take into consideration the tasks and the age groups of the occupants.</td><td>Design to CIBSE SLL.</td><td>Low</td><td>Low</td><td>Lighting design - Technical Document.

Performance Test (by GBCI)</td></tr>
<tr><td>L03.1
Circadian Lighting Design</td><td>The following requirements are met in each dwelling unit:
a. Electric lighting is used to achieve the following light levels:
<table><tr><th>Threshold</th><th></th><th>Threshold for Projects with Enhanced Daylight</th><th>Points</th></tr><tr><td>At least 150 EML [136 M-EDI(D65)]</td><td>OR</td><td>The project achieves at least 120 EML [109 M-EDI(D65)] and at least 2 points in Feature L05: Enhanced Daylight Access</td><td>1</td></tr><tr><td>At least 240 EML [218 M-EDI(D65)]</td><td>OR</td><td>The project achieves at least 180 EML [163 M-EDI(D65)] and at least 2 points in Feature L05: Enhanced Daylight Access.</td><td>3</td></tr></table>b. The light levels are dimmable. If automated lighting is used, it is automatically dimmed after 8:00 pm.
c. The light levels are achieved in living rooms and kitchens at a height of 140 cm in the center of the room. If workstations are present, light levels are achieved at a height of 45 cm above the work-plane.</td><td>To be reviewed at RIBA stage 3</td><td>Medium</td><td>High</td><td>Performance Test</td></tr>
</table>

WELL Feature	Feature Requirements	Comment	Technical Risk	Cost Impact	Next Step
L04.1 **Manage Glare from Electric Lighting**	**Luminaire considerations** Each luminaire meets one of the following requirements for regularly occupied spaces at light output representative of regular use conditions. Wall wash fixtures and concealed fixtures, installed as specified by manufacturer's data, as well as decorative fixtures may be excluded from meeting these requirements: a. 100% of light is emitted above the horizontal plane. b. Classified with Unified Glare Rating (UGR) of 16 or lower. c. Luminance that does not exceed 6,000 cd/m^2 at any angle between 45 and 90 degrees from nadir. Verified by Technical Document OR **Space considerations** The following requirement is met in all regularly occupied spaces: a. Unified Glare Rating (UGR) of 16 or lower.	To be reviewed at stage 3. May limit fitting types and impact on Architectural design.	Medium	High	Lighting design - Technical Document.
L05.1 **Implement Daylight Plan**	The following requirement is met: a. One of the following requirements is met in each dwelling unit: <table><tr><th>Vertical Envelope Glazing Requirements</th><th>Points</th></tr><tr><td>Vertical envelope glazing is no less than 15% of each dwelling unit. Visible light transmittance (VLT) is greater than 40%</td><td>1</td></tr><tr><td>Vertical envelope glazing is no less than 25% of each dwelling unit. Visible light transmittance (VLT) is greater than 40%</td><td>2</td></tr></table>	Architect to review % compliance requirements. As windows are being replaced VLT >40% is achievable.	TBC	Low	Architect to review.
L08.1 **Electric Light Quality**	All luminaires (except decorative fixtures, emergency lights and other special-purpose lighting) meet at least one of the following color rendering requirements. If tunable white lighting is used, the requirements are met at 1,000K intervals from the lower end (with a minimum of 2,700K) to the higher end (with a maximum of 5,000k): a. CRI ≥90. b. CRI ≥ 80 with R9 ≥ 50. c. IES $R_f \geq 78$, IES $R_g \geq 100$, $-1\% \leq$ IES $R_{cs,h1} \leq 15\%$. Verified by Technical Document **For Circulation Areas:** All luminaires (except decorative fixtures, emergency lights and other special-purpose lighting) meet at least one of the following color rendering requirements: a. CRI ≥ 80. b. IES $R_f \geq 75$, IES $R_g \geq 95$, $-7\% \leq$ IES $R_{cs,h1} \leq 15\%$.	To be reviewed at stage 3. May limit fitting types and impact on Architectural design.	Medium	High	Lighting design - Technical Document.
L08.2 **Manage Flicker**	All luminaires, in combination with the appropriate controls (except decorative lights, emergency lights and other special-purpose lighting), used in regularly occupied spaces meet at least one of the following flicker requirements: a. Classified as "reduced flicker operation" per California Title 24, when tested according to the requirements in Joint Appendix JA-10.[8] b. Recommended practices 1, 2 or 3 as defined by IEEE standard 1789-2015 LED.[9] c. Pst LM ≤ 1.0 and SVM ≤ 1.6 for indoor applications per NEMA 77-2017.[10,11]	To be reviewed at stage 3. May limit fitting types and impact on Architectural design.	Low	Low	Lighting design - Technical Document.

WELL Feature	Feature Requirements	Comment	Technical Risk	Cost Impact	Next Step
L09.1 **Enhance Occupant Controllability**	2: Lighting control system Each lighting zone meets the following requirements: a. Lighting systems have at least three lighting levels or scenes that allow for changes in light levels and have the ability to change at least one of the following: 1. Color. 2. Color temperature. 3. Distribution of light by controlling different groups of lights or through preset scenes. b. All regular occupants have control over their immediate lighting environment through at least one of the following: 1. Manual controls (e.g. switches or control panels) located in the same space as each lighting zone. 2. Digital interface available on a computer or phone. c. Lighting for presentation or projection walls are separately controlled.	If smart lighting system provided, then credits likely to be achieved in apartments. Other communal areas may not be compliant due to cost / technical design requirements. To be reviewed at stage 3. Note for zone compliance controls 1/30 m^2 or 5 occupants = 2 credits, 1/60 m^2 or 10 occupants = 1 credit	High	High	Lighting design - Technical Document and professional narrative.
T01.1 **Thermal Performance**	Thermal comfort surveys The following requirement is met: a. The project achieves at least two points in Feature T02: Verified Thermal Comfort.	Recommend route for compliance is based on the Thermal comfort survey option. Natural ventilation criteria unlikely to be met.	NA	NA	May require additional thermal comfort studies.
T01.2 **Monitor Thermal Parameters**	Continuous monitoring The following requirement is met: a. Project meets Feature T06: Thermal Comfort Monitoring.	Confirm which option for compliance will be pursued. Annual testing (onus on FM) or continuous monitoring.	TBC	TBC	TBC
T02.1 **Verified Thermal Comfort**	Post-Occupancy survey twice a year. Summer and winter.	By Client	NA	NA	Confirm if this will be carried out thus alleviating risk with T01.1

WELL Feature	Feature Requirements	Comment	Technical Risk	Cost Impact	Next Step
T03.1 **Thermal Zoning**	The following requirements are met for at least 90% of regularly occupied spaces: a. Control over temperature in the space is available through either: 1. Thermostats present within the thermal zone. 2. A digital interface accessible to occupants on a computer or phone. b. The maximum size of each thermal zone is 60 m² or 10 occupants, whichever is larger. c. Projects earn points based on the number of thermal zones: Number of Zones / Number of Zones / Points: One per 60 m² OR One per 10 occupants: 1 One per 30 m² OR One per 5 occupants: 2 d. Temperature sensors are positioned at least 1 m away from exterior walls, windows and doors, direct sunlight, air supply diffusers, mechanical fans, heaters or any other significant sources of heat or cold.	Low risk to achieve.	Low	Low	Mechanical Design – Technical Document
T06.1 **Thermal Comfort Monitoring**	1: Thermal comfort monitors The project monitors dry-bulb temperature and relative humidity, satisfying the following requirements: a. Sensors are located in occupiable areas; 1.1-1.7 m above the floor; and at least 1 m away from exterior walls, doors, direct sunlight, air supply/exhausts, mechanical fans, heaters or any other significant source of heat or cold. b. A minimum of one sensor per 325 m² of occupiable floor area. c. Measurements are taken at least once every 15 minutes. d. Sensors comply with the Device Requirements listed in the WELL Performance Verification Guidebook.	This would require multiple sensors and would be quite expensive. Note – this credit is one that could be purchased to achieve the rating. Recommend WELL Assessor raised query relating to sensors in circulation areas only being sufficient?	Medium	High	Letter of Assurance to be provided at end of RIBA stage 3.
T07.1 **Humidity Control**	The following requirement is met in all regularly occupied areas, except high-humidity areas: a. The mechanical system has the capability of maintaining relative humidity between 30% and 60% at all times by adding or removing moisture from the air.[10,11]	Unlikely to be achieved as humidification is not provided. Issue is with low humidity levels during cold periods.	High	High	Recommend not targeted.
T09.2 **Outdoor Thermal Comfort**	A computational fluid dynamic model of the building and any adjacent buildings that takes into account at least one day per season (i.e., per quarter) demonstrates the following: a. Winds are not expected to exceed 5 m/s for more than 5% of hours in the year in seating areas or 10% of hours on paths and parking lots.[14] b. Winds are not expected to exceed 15 m/s on paths, parking lots or seating areas for more than 0.05% of hours in the year.[14]	For an additional fee, the gardens and any roof terrace areas may be assessed, and measures put into place to reduce wind.	Medium	Medium	Commission CFD assessment.

Appendix H UKPN New HV Connection Quotation

Registered Office
Newington House
237 Southwark Bridge Road
London SE1 6NP

Company:
UK Power Networks
(Operations) Limited

Registered in England and Wales No: 3870728

Mr. Farid Mouawad
Cundall Johnston & Partners LLP
15, Colmore Row
Birmingham
B3 2BH

Date: 13 January 2021

Our Ref: 8600021009 / QID 3000031159

Dear Mr. Mouawad,

Site Address: Dolphin Square, London SW1V 3LX

Thank you for your recent budget enquiry regarding supply to the above premises. I am writing to you on behalf of London Power Networks plc the licensed distributor of electricity for the above address trading as UK Power Networks.

I am pleased to be able to provide you with a budget estimate for the work.

It is important to note that this budget estimate is intended as a guide only. It may have been prepared without carrying out a site visit or system studies. No enquiry has been made as to the availability of consents or the existence of any ground conditions that may affect the ground works. It is not an offer to provide the connection and nor does it reserve any capacity on UK Power Networks electricity distribution system.

Budget estimate:

The Budget solution to provide 6MVA supply at 11kV is £700,000 (exclusive of VAT), if the Point of Connection (PoC) is at our Moreton Street Main substation.

The above budget estimate is based on the following:
- install 2x300mm low smoke copper cable at Moreton Street Main substation
- Install 2X11kV Al cable from Moreton Street Main substation (first 250m for each route is 300mm Copper 11kV cable) to customer's site
- establish an 2X11kV Metered Ring Main Unit (MRMU) substation via 2Xtrunk feeder units (RMUs) on your site
- undertake four final joints
- Commission RTUs
- undertake all 11kV outages

Assumptions

This budget estimate is based on the following assumptions:

- The most appropriate Point of Connection (POC) is as described above.
- A viable cable route exists along the route we have assumed between the Point of Connection (POC) and your site.
- In cases where the Point of Connection (POC) is to be at High Voltage, that a substation can be located on your premises at or close to the position we have assumed.

- Where electric cables are to be installed in private land UK Power Networks will require an easement in perpetuity for its electric lines and in the case of electrical plant the freehold interest in the substation site, on UK Power Networks terms, without charge and before any work commences.

- You will carry out, at no charge to UK Power Networks, all the civil works within the site boundary, including substation bases, substation buildings where applicable and the excavation/reinstatement of cable trenches.

- Unless stated in your application, all loads are assumed to be of a resistive nature. Should you intend to install equipment that may cause disturbances on UK Power Networks' electricity distribution system (e.g. motors; welders; etc.) this may affect the estimate considerably.

- All UK Power Networks' work is to be carried out as a continuous programme of work that can be completed substantially within 14 months from the acceptance of the formal offer.

Please note that if any of the assumptions prove to be incorrect, this may have a significant impact on the price in any subsequent quotation. You should note also that UK Power Networks' formal connection offer may vary considerably from the budget estimate. If you place reliance upon the budget estimate for budgeting or other planning purposes, you do so at your own risk.

Post estimate call

I will contact you within the next few days to discuss your estimate, to ensure you understand the work we will do for the estimated price, your responsibilities, any dependencies and the likely timescales for the work. UK Power Networks are always looking to improve our service offering and as such, the post estimate call may be recorded for training purposes. We will not share the recorded call with anyone outside of our connections business and it will be deleted as soon as we have completed the training review. However, if you do not want us to record the call please let me know at the beginning of the call.

If you would like to proceed

If you would like to proceed to a formal offer of connection then you should apply for a quotation. Please refer to our website click here for `The connection process' which details our application process.

To help us progress any future enquiry as quickly as possible please quote the UK Power Networks Reference Number from this letter on all correspondence.

If you have any questions about your budget estimate or need more information, please do not hesitate to contact me. The best time to call is between the hours of 9am and 4pm, Monday to Friday. If the person you need to speak to is unavailable or engaged on another call when you ring, you may like to leave a message or call back later.

Yours sincerely

Mr. Edwin Lathbridge
Centenary House
London, West Ham
E16 4ET
02070557514
edwin.lathbridge@ukpowernetworks.co.uk

Cundall Johnston & Partners LLP
4th Floor 15 Colmore Row Birmingham B3 2BH United Kingdom Tel:+44 (0)121 262 2720
Asia Australia Europe MENA UK and Ireland
www.cundall.com

ONE PLANET LIVING
An initiative by Bioregional