CANARY WHARF
GROUP PLC

NQ.PA.17

North Quay
Energy Statement

Max Fordham
July 2020

Max Fordham LLP
Max Fordham LLP
42/43 Gloucester Crescent
London
NW1 7PE

T +44 (0)20 7267 5161

maxfordham.com

Max Fordham LLP is a Limited Liability Partnership.

Registered in England and Wales Number OC300026.

Registered office:
42–43 Gloucester Crescent
London NW1 7PE

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1.0 Introduction

Overview

1.1 Canary Wharf (North Quay) Ltd ("the Applicant") are submitting applications for Outline Planning Permission (OPP) and Listed Building Consent ("LBC") to enable the redevelopment of the North Quay site, Aspen Way, London ("the Site").

1.2 Two separate applications are being submitted as follows:

- Application NQ.1: Outline Planning Application (all matters reserved) ("OPA")- Application for the mixed-use redevelopment of the Site comprising demolition of existing buildings and structures and the erection of buildings comprising business floorspace, hotel/serviced apartments, residential, co-living, student housing, retail, community and leisure and sui generis uses with associated infrastructure, parking and servicing space, public realm, highways and access works; and
- Application NQ.2: Listed Building Consent Application ("LBCA") - to stabilise listed quay wall and any associated/necessary remedial works as well as demolition of the false quay in connection with Application NQ.1.

1.3 Together the development proposed under Applications NQ.1 and NQ.2 are referred to as the "Proposed Development".

1.4 At the time of making the OPA, the Applicant is unable to determine exactly how much of the Proposed Development is likely to come forward in which land use. For this reason, the description of development provides the Applicant with flexibility as to the uses that could be undertaken on the Site.

1.5 However, in order to ensure that the level of flexibility is appropriately restricted, the OPA seeks approval for three Control Documents which describe the principal components of the Proposed Development, define the parameters for the Proposed Development (the "Specified Parameters") and control how the Proposed Development will come forward in future. They provide the parameters, design principles and controls that will guide future reserved matters applications ("RMAs"). These Control Documents are – (1) the Development Specification; (2) the Parameter Plans; and (3) the Design Guidelines:

- The Development Specification sets out the type and quantity of development that could be provided across the Site (including setting a maximum floorspace across the Site);
- The Parameter Plans set the parameters associated with the scale, layout, access and circulation and distribution of uses classes and public space for the Proposed Development. They also establish the Development Zones and Development Plots across the Site; and
- The Design Guidelines set the design principles and controls for future development.

1.6 Together, these documents set out the information required to allow the impacts of the Proposed Development to be identified with sufficient certainty as future RMAs will be required to demonstrate compliance with the Specified Parameters and controls in these Control Documents.

Site Description

1.7 The North Quay site ("the Site") is located in the north of the Isle of Dogs, within the administrative boundary of the London Borough of Tower Hamlets (the "LBTH"), at Canary Wharf. It is bounded by Canary Wharf Crossrail Station to the south, Aspen Way (A1261) to the north, Hertsmere Road to the west and Billingsgate Market to the east. The West India Quay Docklands Light Railway (DLR) station and Delta Junction are located on the western side of the Site and the Site also incorporates parts of North Dock, Upper Bank Street and Aspen Way.

1.8 The Site is 3.28 hectares (ha) in area. Currently the Site comprises mostly cleared land, being previously used as a construction laydown site for the Canary Wharf Crossrail Station. There are some temporary uses currently on site, including the LBTH Employment and Training Services, WorkPath and advertising structures.

1.9 A Grade I Listed brick dock wall (Banana Wall) exists below the surface of part of the Site, which originally formed the dockside until it was extended over to the south.

1.10 Existing access to the Site for vehicles is from Upper Bank Street to the east and Hertsmere Road to the west, which both link to Aspen Way. The Site is not currently accessible to the public, however pedestrian routes are located on each side of the Site (Aspen Way, Hertsmere Road, Upper Bank Street, and the western part of the dockside to the south). The Aspen Way footbridge which leads to Poplar also lands on the southern side of Aspen Way.

1.11 The Site is highly accessible by public transport. The West India Quay DLR station is located on the Site, the Poplar DLR station is accessed directly from the Aspen Way Footbridge, the Canary Wharf Crossrail Station is located immediately to the south of the Site, beyond which are the Canary Wharf underground and DLR stations. The Site's PTAL varies from 5 ('very good') to 6a ('excellent'), with improved PTAL closer to Upper Bank Street. The score is expected to improve to 6a across the entire Site by 2021 owing to the planned opening of the Crossrail Station.

1.12 Beyond the Site, 1 West India Quay (the Marriot Hotel (107m AOD) and residential building (41m AOD) are located to the west, adjacent to the DLR tracks. Beyond these, along Hertsmere Road is a cinema, museum, shops, restaurants and other leisure facilities, forming part of the West India Quay Centre. Billingsgate Market is located to the east of the Site, on the opposite side of Upper Bank Street. Billingsgate Market is identified as a Site Allocation (4.2: Billingsgate Market) for redevelopment in LB Tower Hamlet's Local Plan.

1.13 To the north of the Site on the other side of Aspen Way are the Tower Hamlets College and The Workhouse leisure facility. They comprise part of a Site Allocation (4.1: Aspen Way) for redevelopment in LB Tower Hamlet's Local Plan. In close proximity to these there are lower rise residential properties (some with shops beneath them) as well as the Poplar Recreation Ground.

1.14 Beyond the Crossrail station and Crossrail Place to the south of the Site is the Canary Wharf commercial area, with the buildings closest to the Proposed Development including the HSBC (200m AOD), Bank of America and One Canada Square buildings (235m AOD).

Listed Building Works

1.15 Towards the south of the Site, the edge of the dock is defined by a quay wall known as the Banana Wall. The brickwork has a profile and counterfort buttresses, on a gravel bed. The Banana Wall was constructed between 1800-1802 and was Listed Grade I in 1983.

1.16 The Proposed Development will span over the Banana Wall with piles on either side of the wall providing support to the new structures. The new structures will leave a void or compressible material above to avoid permanent loading of the wall. The adjacent existing false quay deck will be removed. The excavation of the basement may require stabilisation works to be undertaken to ensure there are no impacts to the Banana Wall. Remedial works to the Banana Wall will also be undertaken if required.

Canary Wharf Group Science Based Targets

1.17 In 2019 Canary Wharf Group (CWG) commenced the process to establish approved Science Based Targets in line with the latest climate science, and the Paris Climate Accord. In May 2020 CWG submitted target proposals to the Science Based Targets Initiative (SBTI). 2 targets were submitted; an absolute emissions target and a supplier target, as follows: -

• Canary Wharf Group commits to reduce absolute Scope 1, 2 and 3 GHG emissions from downstream leased assets by 65% by 2030 from a 2017 baseline.

• Canary Wharf Group commits that 60% of its suppliers by emissions covering purchased good and services will have Science Based Targets by 2025.

1.18 These targets were approved by the SBTI on 18 June 2020 and have been published in the Canary Wharf Group Annual Sustainability Report.

1.19 The emissions target follows the market-based approach as recognised by SBTI and is dependent on Canary Wharf Group and its Tenants switching to a 100%renewable energy supply by 2030. However, this will only account for a circa 75% reduction in emissions. The remaining 25% comes predominantly from existing portfolio natural gas supply. For Canary Wharf to achieve its longer-term Net Zero Target, a renewable alternative to natural gas will need to be established in our existing portfolio and our proposed developments including North Quay.

1.20 In 2019 Canary Wharf Group signed the Better Buildings Partnership Climate Change Commitment, furthering our commitment to reducing our impacts and striving for a zero-carbon Estate. As part of this commitment we will be publishing our own net zero pathway in 2020, and we will publicly report progress annually.

1.21 The Science Based Target and the Net Zero Pathway will be used to drive carbon reductions across all our activities and those of our tenants and the wider Canary Wharf Group community.

2.0 Executive Summary

2.1 This Statement has been prepared to support the OPA for the Proposed Development at North Quay in the London Borough of Tower Hamlets (LBTH). The development is a flexible, commercially led mixed-use scheme on a brown field Site within the Canary Wharf Estate.

2.2 The proposed building types include offices, retail, residential, serviced apartments, leisure, and student residential. The Indicative Scheme comprises 7 buildings to be developed in 4 phases up to 2029. Extensive public realm will connect the spaces of each building across the Site.

2.3 The primary purpose of this Statement is to describe the approach and measures adopted within the design of the Indicative Scheme in order to show how the Proposed Development could comply with Building Regulations as well as London Plan and LBTH Local Plan energy requirements.

2.4 The Statement sets a framework that could ultimately be applied to any scheme that could come forward under the Outline Planning Permission (OPP). As a worked-up example the Indicative Scheme has been used to test and validate the strategy/approach and establishes benchmarks that could be applied at the RMA stages.

2.5 Each RMA would be accompanied by a further Energy Statement specific to that RMA which would adhere to this OPA Energy Statement. The requirements for this further Energy Statement would be secured through a planning condition.

2.6 The energy assessment follows the GLA Energy Assessment Guidance (October 2018). It aims to:

- Demonstrate approach to compliance with Building Regulations Part L, primarily that the building emission rate (BER) is less than the target emission rate (TER);
- Demonstrate how the development could comply with the Draft London Plan Energy Hierarchy 'Be lean, be clean, be green, and be seen';
- Demonstrate how the development could comply with the London Borough of Tower Hamlets (LBTH) new Local Plan Energy requirements;
- Show the measures adopted in the Indicative Scheme to reduce the cooling demand, by following the Cooling Hierarchy, whilst also ensuring the risk from overheating is reduced.

2.7 The project team has engaged with the GLA and LBTH Energy teams to discuss the energy hierarchy proposals. The feedback has been considered and incorporated into the Energy Statement.

2.8 The project team have considered the impact of the draft 2020 updated version of the GLA Energy Assessment Guidance in the preparation of the OPA.

2.9 The Proposed Development responds to the Mayor's Energy Strategy as stated in the Draft London Plan.

2.10 The proposed Energy Strategy aligns with the wider Science Based Target and Net Zero Carbon pathway for Canary Wharf which aims to reduce natural gas usage and switch to electric solutions.

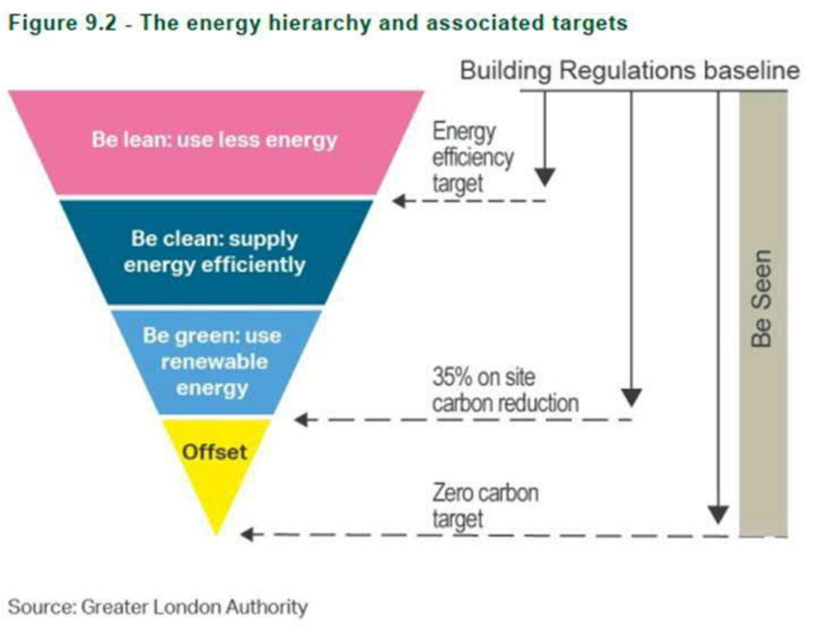


Figure 2.1 London Plan Energy Hierarchy and Associated Targets

2.11 The design team has approached the design of the Indicative Scheme in order to reduce the energy demands in the following way:

A high-performance building fabric (Be Lean - use less energy):

- excellent U-Values and low g-values;
- low air-permeability;
- low thermal bridging;
- façade performance criteria which maximises daylight whilst limiting solar gains in summer;
- optimised ratio of solid to glass on facades appropriate for each building type;
- appropriate external shading to suit each building type.

Energy efficient services such as (Be Lean- use less energy and manage demand during operation):

- heat recovery and demand driven ventilation on fresh air supplies;
- night cooling from fresh air supplies in commercial building;
- energy efficient lighting with intelligent controls;
- mixed mode ventilation where appropriate and feasible;
- energy saving controls.

Energy efficient sources (Be Clean - exploit local energy resources, such as secondary heat, and supply energy efficiently and cleanly):

- There are no existing heat networks in the immediate vicinity that could be viably connected to the Site;
- Commercial building cooling heat rejection will be used as a secondary heat source connected to a site wide heat network for residential and serviced apartment buildings in conjunction with local heat pumps;
- Thermal storage will be included in each heat network for optimising system performance and balancing surplus heating and cooling energy production;
- The site wide heat network will be designed with provision for a future single point connection to a suitable low carbon third party heat network, if one becomes available in the local vicinity of the Site;
- No fossil fuel energy strategy.

Renewable energy technologies (Be Green - maximise opportunities for renewable energy by producing, storing and using renewable energy on-site):

- Ambient loop heat pump systems for residential building heating, hot water, and cooling;
- 4-pipe multifunction ground and air source heat pumps for retail, commercial, and serviced apartment buildings, providing simultaneous heating, cooling, and hot water preheat;
- Water cooled high temperature heat pumps and CO2 air source heat pumps for commercial, student residential, and serviced apartment building hot water generation;
- Photovoltaic panels above suitable roof areas that are not intended for occupant access or heat rejection plant;
- Energy Storage.

Monitoring and reporting on Energy Performance (Be Seen - monitor, verify and report on energy performance):

- Extensive metering and energy monitoring will be included within each building network and the Site wide secondary heat connections to enable system performance optimisation and accurate billing.

2.12 Feasible options for reducing further the energy demands of the Proposed Development through other renewable energy solutions and innovative technologies have been explored, and the results of this analysis is presented within this Energy Statement.

2.13 Emerging new technologies will be investigated during each RMA stage to take account of technology development at the time submission.

Masterplan Massing

2.14 The North Quay Masterplan layout and building orientations have been carefully considered within the constraints of the Site. The external fabric and the windows will be particularly important elements for each façade orientation of the various buildings on the development.

2.15 The balance between daylight and solar gains for each building design will need to be optimised during each RMA. This will result in minimising the need for artificial lighting whilst also minimising overheating risk and cooling requirements.

2.16 The amount of exposed external area relative to the interior volume has a significant influence on the overall building heating demand. The Indicative Scheme has optimised this A/V ratio by proposing regular floor plates and tall buildings.

2.17 The large commercial buildings have been laid out along an East-West orientation which allows solar gain and daylight to be managed on the south facades with measures such as external Brise Soleil type shading with the advantage of allowing passive solar heating in winter.

Building Fabric Measures

2.18 The Draft London Plan (policy S I2) and LBTH Local Plan require domestic developments and non-domestic developments to achieve at least a 10% and 15% improvement respectively on the Building Regulations from energy efficiency measures alone, represented by the "Be Lean" stage.

2.19 This leads to the need for considerable improvements in fabric performance and system efficiencies compared to the Building Regulations Part L notional building baseline parameters.

2.20 The thermal performance of the fabric for each building type in the Indicative scheme has been set out to optimise the balance between energy savings and other considerations such as cost, wall thicknesses, and the diminishing returns available from further increasing the thermal performance of a building envelope.

2.21 The amount of glazing, its orientation and specification will be carefully considered in each RMA to ensure a balance between heat loss, heat gains, daylighting, and ventilation is maintained.

2.22 The benefits of improved insulation levels and more energy efficient heating systems can be lost if warm air is able to leak out of a building and cold air able to leak in. Consequently, achieving a reasonable level of air tightness is important for a building's energy efficiency and the comfort of its occupants. A minimum standard of 3m3/m2/hr is specified for the Indicative Scheme.

2.23 Thermal bridges will be an area of focus in the detailed design within each RMA. Energy lost at thermal junctions shall be minimised using robust details wherever possible and appropriate.

No Fossil Fuel Energy Strategy

2.24 The electrical grid in the UK has been decarbonising and is projected to continue doing so. This means using grid electricity becomes a lower carbon source of energy than gas. This favours electrically powered heat pumps for heating and means that CHP is no longer beneficial in carbon terms.

2.25 For the North Quay Masterplan all heating and cooling generation will be by electrically powered heat pumps with thermal storage. There will be no additional local emissions to account for.

2.26 This aligns with the Net Zero Carbon pathway for Canary Wharf.

Distributed Energy Centres

2.27 The phasing of the North Quay masterplan up to 2029 in 4 phases with mainly commercial buildings makes a single central energy centre challenging to implement for this project.

2.28 As new heating and cooling technologies are rapidly evolving it is more appropriate for each phase of the development to utilise the latest low carbon technology most suitable for the actual building types within each phase. This strategy ensures that the Proposed Development can optimise decarbonisation as it is built out over time and respond to changes in technology, policy and regulation as each phase is implemented. This is a better outcome for achieving the energy policy objectives.

2.29 This is a better outcome for achieving the energy policy objectives.

2.30 In addition to the above it is important to note that in order to prepare this Site for development there will be a considerable amount of infrastructure required and therefore delivering a single large energy centre in Phase 1 would add further up-front costs which would make the viability of commencing the scheme at the earliest opportunity more challenging.

2.31 Site wide low temperature district heat networks (DHN) operating at traditional temperatures (70-80°C depending on the system choice) can have large distribution losses. Moving to very low or ultra-low temperature DHNs can significantly reduce these distribution losses.

2.32 As the majority of the buildings within the Indicative Scheme are non-domestic, with low heating and hot water requirements compared to their cooling energy needs, very-low or ultra-low temperature Building-Level heating networks incorporating cooling heat recovery are considered the most appropriate strategies for this type of development. Distribution losses are minimised, system performance optimisation more achievable, and billing simpler.

2.33 Also, based on the size of each building within each phase, there is already sufficient economies of scale in terms of plant and network system size within each building-level network. The buildings in the Indicative Scheme are up to 85,000m2 GIA.

2.34 It is therefore proposed to have distributed heat pump energy networks within each phase.

2.35 The number of distributed energy centres matches the phasing requirements.

2.36 To comply with draft Policy SI 3 Energy Infrastructure of the Draft London Plan, and as set out in the heating hierarchy of draft GLA "Energy Assessment Guidance 2020"it is proposed to use surplus heat rejection from office and retail buildings as a “secondary heat source” to provide heat recovery energy to any residential and serviced apartment buildings. This strategy can potentially reduce the carbon emissions of the residential buildings in the order of 15% and provides site wide connections between appropriate buildings across the masterplan.

2.37 All the buildings will be connected together through the secondary heat site wide network.

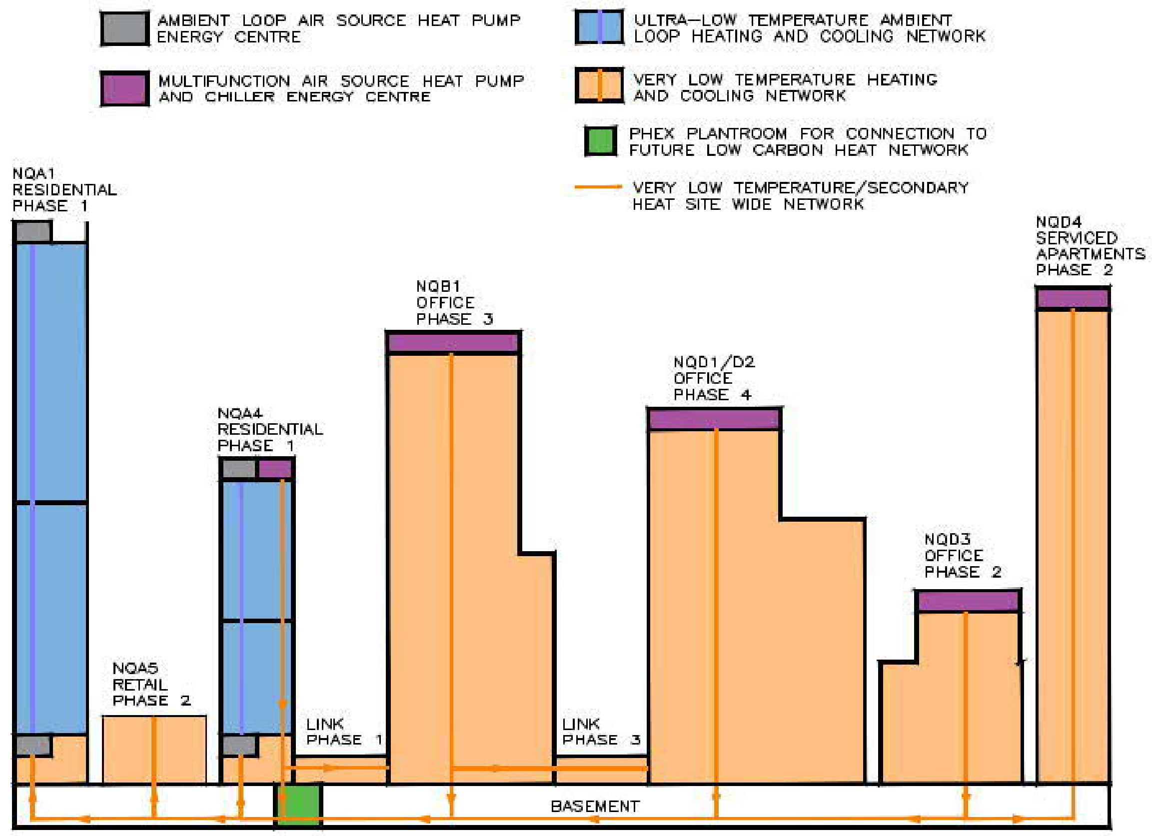


Figure 2.2: Distributed Energy Centre approach within the Indicative Scheme showing secondary heat connections between commercial and residential/serviced apartment buildings.

Future connection to low carbon district heating network

2.38 The Proposed Development will be future proofed to allow a single point of connection to a wider low carbon low temperature DHN if one becomes available in the vicinity of the North Quay development in the future and it is feasible to do so. The secondary heat network connecting the buildings across the Site would become the heat distribution network for such a future DHN connection.

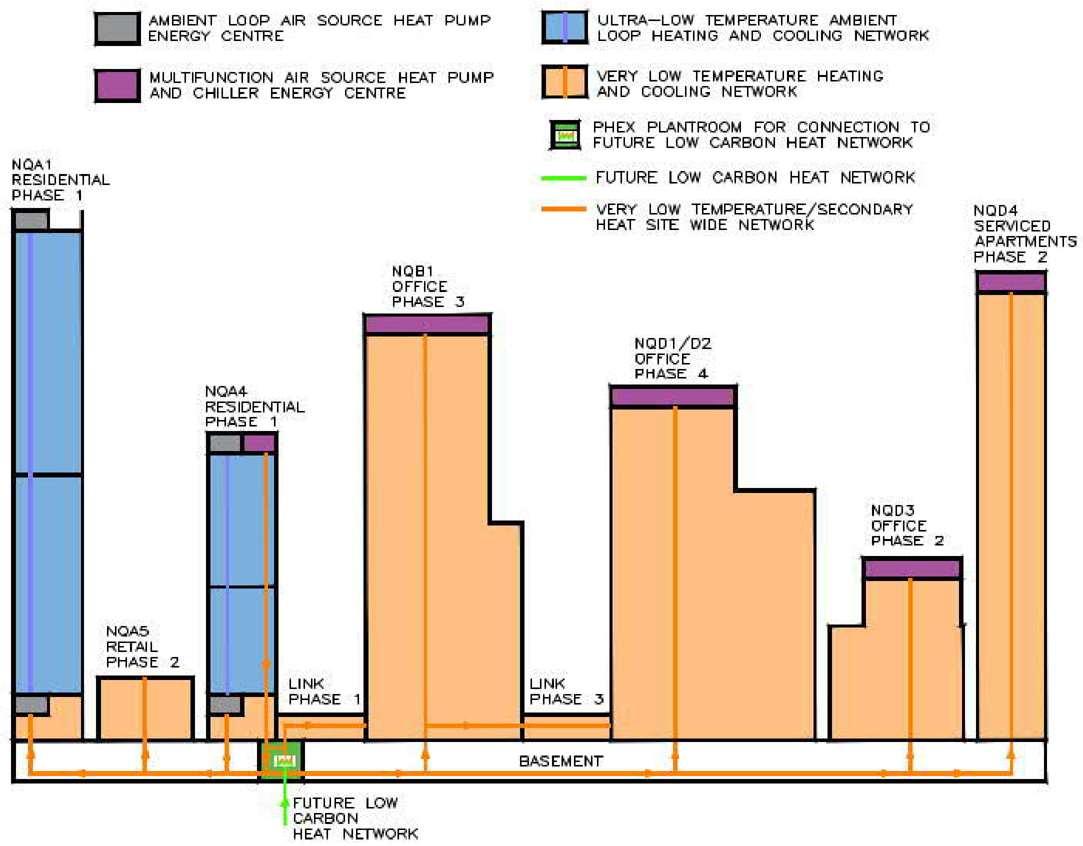


Figure 2.3: Single point connection of a future third party low carbon heat network within the Indicative Scheme

Low to Zero Carbon Technologies

2.39 A renewable energy assessment has been conducted to confirm which renewable energy technologies are considered both practical and viable to serve the Proposed Development. The assessment identified ground and air source heat pumps, photovoltaic panels (PV), and heat from waste as the most appropriate LTZC solutions for this development.

2.40 The Indicative Scheme incorporates the maximum quantity of PV panels that can feasibly be installed on suitable roof areas across The Masterplan.

Cooling Hierarchy

2.41 In line with draft Policy SI 4 Managing heat risk of the Draft London Plan, the cooling hierarchy has been applied to the Indicative Scheme. The following measures are proposed to reduce the demand for cooling across The Masterplan:

1. **Reducing the amount of heat entering the building in summer:**

The Indicative Scheme considers external shading on all buildings on critical facades. High performance solar control glazing will be selected as appropriate for each building type, balancing solar gain with daylighting.

2. **Minimising internal heat gains through efficient design:**

Ultra-low temperature ambient loop networks for residential buildings and very low temperature distribution networks for commercial buildings will reduce heating system heat gains.

3. **Manage the heat within the building.**

Consideration of exposed thermal mass and night-time purge ventilation on appropriate buildings will be considered in each RMA.

4. **Passive ventilation:**

Noise levels across the Site means that mechanical ventilation and active cooling will be required on all buildings to control overheating. Residential buildings will have opening windows to allow mixed mode ventilation and for future proofing for potential reductions in noise levels across the Site.

There may be the possibility to consider mixed mode strategies on some of the commercial buildings on facades facing south and these will be considered within the RMAs for each building and phase.

5. **Mechanical ventilation:**

All apartments in the residential buildings will be mechanically ventilated via Mechanical Ventilation with Heat Recovery within each dwelling
All commercial buildings will consider the latest high efficiency heat, coolth and latent recovery Air Handling Units as part of the "Be Lean" energy strategy.

6. **Provide active cooling systems**

The use of the ambient loop heat pump solutions for heating and hot water production for the residential buildings allows active cooling to apartments from the same distribution network, thus providing heat recovery opportunities for hot water production.
4-pipe multifunction heat pumps for retail and commercial buildings allow for simultaneous heating, cooling, and hot water preheat, and for secondary heat export to residential buildings.

Carbon Emission Reduction Targets

2.42 The Draft London Plan regulated carbon dioxide emissions reduction target for major developments is a minimum of 35% below the Building Regulations target emissions rating and is expected to be delivered on site. In addition, the LBTH Local Plan requires a target of 45% reduction. The remaining emissions are subject to an offset payment.

2.43 The Draft London Plan policy SI2 Minimising greenhouse gas emissions and LBTH Local Plan now require domestic developments and non-domestic developments to achieve at least a 10% and 15% improvement respectively on the Building Regulations from energy efficiency measures alone, represented by the "Be Lean" stage. This leads to the need for considerable improvements in fabric performance and system efficiencies compared to the Building Regulations Part L notional building baseline parameters.

Emission Factors

2.44 For the purposes of this Energy Statement the Indicative Scheme initial baseline emissions and CO_2 reductions are calculated using Government's Standard Assessment Procedure (SAP) 2012 and IES software, which uses SAP 2012 carbon emission factors.

2.45 For the purposes of the energy hierarchy, all of these have been converted to the current SAP 10 carbon emission factors as directed by the GLA Energy Assessment Guidance.

	SAP 2012 (existing)	SAP 10 (new)
Natural Gas	0.216 kg CO_2/kWh	0.210 kg CO_2/kWh
Electricity	0.519 kg CO_2/kWh	0.233 kg CO_2/kWh

Table 2.1: Existing and new carbon dioxide emissions factors

2.46 The SAP 10 carbon factors are more aligned to the current electrical grid emissions with the electricity carbon factors now much lower than before and almost equivalent to gas. This favours electrically powered heat pumps for heating and means that Combined Heat and Power (CHP) is no longer beneficial in carbon terms.

Summary of Results

Part L2A Building Regulations

2.47 The Indicative Scheme achieves Building Regulations compliance, with the BER being below the TER for all buildings, using both SAP 2012 and SAP10 carbon factors.

GLA London Plan Energy Hierarchy

2.48 The draft GLA energy assessment (2020) uses the Draft London Plan new SAP10 carbon factors.

2.49 At the 'Be Lean' stage the development achieves a 18% reduction below the baseline for the non-domestic buildings and 13% reduction below the baseline for the domestic buildings, using SAP10.

2.50 At the 'Be Lean' stage the development achieves a 21% reduction below the baseline for the non-domestic buildings and 15% reduction below the baseline for the domestic buildings, using SAP12.

2.51 'Be Clean' stage is not targeted for the Indicative Scheme, as it is proposed to have distributed building-level heating networks which are future proofed to allow connection to a suitable third-party low carbon heat network if one becomes available.

2.52 Following the 'Be Green' stage the project achieves a total cumulative 47% reduction below the baseline for the non-domestic buildings and a 53% reduction below the baseline for the domestic buildings (64% reduction when including secondary heat contribution from the non-domestic buildings).

2.53 Both these figures exceed the 45% reduction requirement and further saving may be achieved via additional viable onsite measures that should be investigated at the time of each RMA.

2.54 The following tables present a summary of the results of the energy modelling for the Indicative Scheme applying the strategies presented above. The results show that the Indicative Scheme will meet the carbon dioxide saving targets of both the Draft London Plan and the LBTH Local Plan at each stage of the energy hierarchy for both the domestic and non-domestic buildings across the masterplan.

	Regulated domestic carbon dioxide savings	
	(Tonnes CO_2 per annum)	(%)
Be Lean: Savings from energy demand reduction	90	13
Be Clean: Savings from heat network	-	0
Be Green: Savings from renewable energy	269	-
Cumulative on-site savings	360	53
Carbon Shortfall	314	

Table 2.2: Regulated Carbon Dioxide Savings for the Indicative Scheme Domestic buildings at each stage of the energy hierarchy

	Regulated domestic carbon dioxide savings	
	(Tonnes CO_2 per annum)	(%)
Be Lean: Savings from energy demand reduction	90	13
Be Clean: Savings from heat network	-	0
Be Green: Savings from renewable energy	340	-
Cumulative on-site savings	430	64
Carbon Shortfall	243	

Table 2.3: Regulated Carbon Dioxide Savings for the Indicative Scheme Domestic buildings at each stage of the energy hierarchy including secondary heat contribution from non-domestic buildings.

	Regulated non-domestic carbon dioxide savings	
	(Tonnes CO_2 per annum)	(%)
Be Lean: Savings from energy demand reduction	443	18
Be Clean: Savings from heat network	-	0
Be Green: Savings from renewable energy	709	29
Cumulative on-site savings	1,151	47
Carbon Shortfall	1,296	

Table 2.4: Regulated Carbon Dioxide Savings for the Indicative Scheme Non-Domestic buildings at each stage of the energy Hierarchy

		Energy demand following energy efficiency measures (tCO2/year)					
		Space Heating	Hot Water	Lighting	Auxiliary	Cooling	Total Reduction (%)
SAP2012	Baseline	304	424	115	28	0	-
	Be Lean	117	389	115	129	2	15
SAP10	Baseline	296	412	52	13	0	-
	Be Lean	114	360	52	58	1	13

Table 2.5 Comparison between SAP2012 and SAP10 carbon factors for Domestic Be Lean stage and the baseline.

		Energy demand following energy efficiency measures (tCO2/year)					
		Space Heating	Hot Water	Lighting	Auxiliary	Cooling	Total Reduction (%)
SAP2012	Baseline	276	228	2466	1314	720	-
	Be Lean	251	228	1392	1566	571	21
SAP10	Baseline	299	221	1107	590	323	-
	Be Lean	244	221	625	703	257	18

Table 2.6 Comparison between SAP2012 and SAP10 carbon factors for Non-Domestic Be Lean stage and the baseline.

3.0 Site Details

Location

3.1 The Site is located in the north of the Isle of Dogs, within the administrative boundary of the London Borough of Tower Hamlets (LBTH), at Canary Wharf. It is bounded by Canary Wharf Crossrail Station to the south, Aspen Way (A1261) to the north, Hertsmere Road to the west and Billingsgate Market to the east. The West India Quay Docklands Light Railway (DLR) station and Delta Junction are located on the western side of the Site and the Site also incorporates parts of North Dock, Upper Bank Street and Aspen Way.

3.2 The Site is 3.28 hectares (ha) in area.

3.3 A Grade I Listed brick dock wall (Banana Wall) exists below the surface of part of the Site, which originally formed the dockside until it was extended over to the south.

3.4 Aspen Way is a busy London arterial road and a local source of traffic and air pollution for the Site. The elevated DLR rail lines with their curved tracks the north side of West India Quay Station are also a noise source. Air quality and noise surveys and modelling studies have been undertaken to identify the levels of existing air and noise pollution on the Site.

3.5 The Masterplan has carefully considered the implications of these factors and the energy strategy for the Proposed Development takes into consideration these environmental constraints.

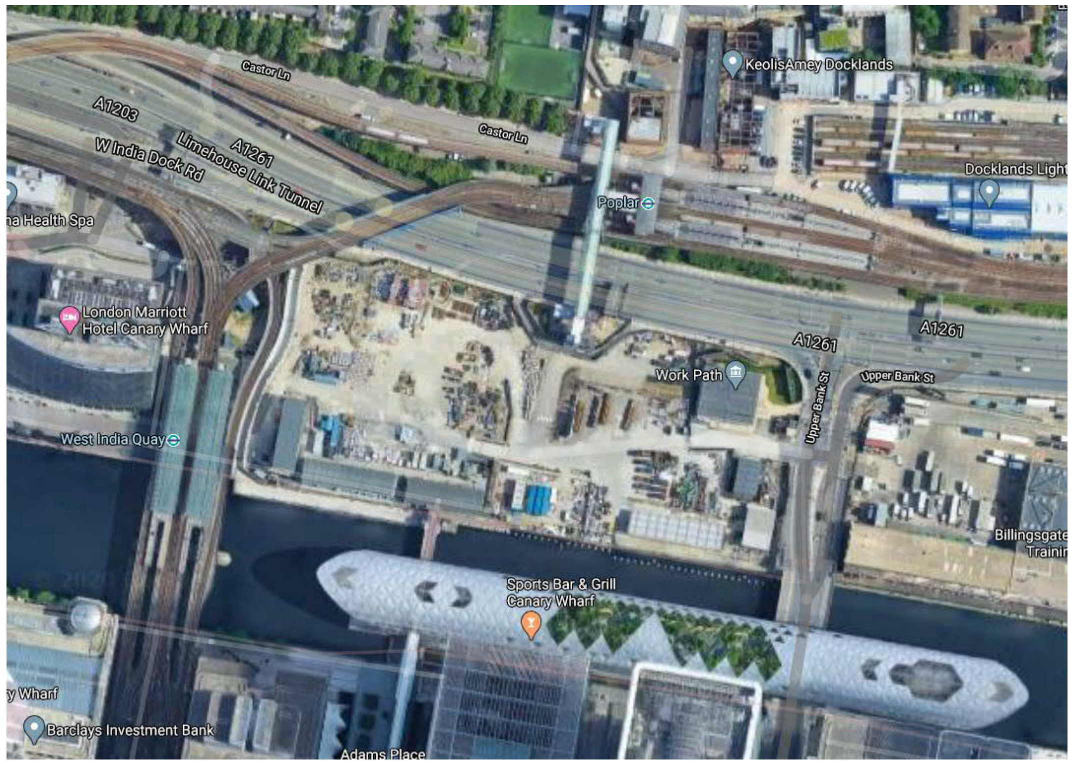


Figure 3.1: - Site and surrounding area.

3.6 The parameters of The Masterplan have informed an Indicative Scheme which makes a proposal for 7 buildings, with shared basement levels that total a maximum of approximately 355,000 sqm GIA. This total area is split, broadly speaking, into 56% office, 25% residential, 14% serviced apartments, 5% retail space. The shared basement is accessed via a shared ramp from under the Delta near Hertsmere Road.

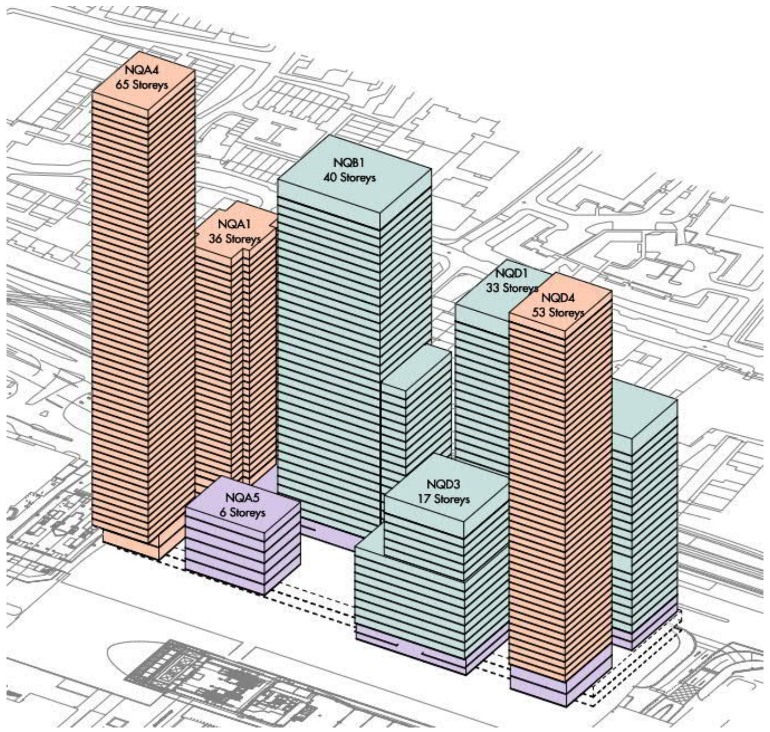


Figure 3.2: 3D view of the Indicative Scheme (Allies & Morrison Architects)

Phasing

3.7 The Indicative Scheme will potentially be delivered over 4 phases. This report covers the Energy Strategy for the OPA, further RMAs will be prepared alongside the detailed design for the individual phases as these come forward.

Indicative Scheme Building Name	Indicative Scheme Building Type	Potential Construction Phase
NQA1	Residential	1
NQA4	Residential	1
NQA5	Retail	2
NQD3	Office	2
NQD4	Serviced apartments	2
NQB1	Office	3
NQD1/D2	Office	4
Basement	Ancillary Spaces	Built out across all phases

Table 3.1 Indicative Scheme Building Type, Size and Phase

4.0 Policy Context

4.1 Under the Climate Change Act 2008 (amended 2019), the Government put in place legally binding carbon reduction targets of 34% by 2020 and 100% by 2050 compared to 1990 levels.

4.2 The construction and operation of the UK buildings account for approximately 60% of national carbon dioxide emissions. Therefore, planning legislation seeks to mitigate the impacts (in particular) of new construction in order to minimise these emissions to meet the national targets.

4.3 The relevant national, regional and local energy policy requirements have been considered when developing these proposals. The policy documentation provides detailed guidance, therefore only the main influencing policy is summarised below and subsequently referred to in this assessment.

4.4 The Draft London Plan and Draft GLA Energy Assessment Guidance – April 2020 have been considered within the proposals given their advanced stage of production.

4.5 As the Proposed Development is being applied for in Outline with RMAs to be submitted for a number of phases over several years, the OPA aims to set a framework for the future detailed design.

National Policy

National Planning Policy Framework

4.6 The NPPF sets out the overarching planning policies on the delivery of sustainable development through the planning system. It outlines a wide range of topics, such as:

- Sustainable transport
- Delivering high quality homes
- Healthy communities
- Protecting Green Belt land
- Meeting the challenge of climate change, flooding and coastal change
- Conserving and enhancing the natural environment

Building Regulations (England)

4.7 The Building Regulations set out statutory requirements and building standards nationally and are applicable to the Proposed Development. Approved Documents Part L1A: Conservation of Fuel and Power in New Dwellings (2013 edition with 2016 amendments) and Part L2A: Conservation of Fuel and Power in New Buildings other than Dwellings (2013 edition with 2016 amendments) applies to the Proposed Development.

4.8 The carbon emission reduction targets ("TER") stated in the London Plan and Local Plan makes reference to reductions in relation to baseline emissions ("BER") calculated for a building meeting the minimum requirements for Building Regulations compliance.

4.9 The TER is calculated based on a notional building of the exact same size, location and orientation as the proposed building. In order to meet building regulations the BER must be lower than the TER.

4.10 In the case of buildings other than dwellings, compliance may be demonstrated by the BER for the whole building is no greater than the TER.

The London Plan

4.11 The London Plan promotes sustainable development, health and equality within London. With particular reference to this Energy Statement, Chapter 5 of the London Plan concerns climate change and sets out the policies that concern energy usage and carbon dioxide emissions. The aim of this section is provided in Policy 5.1:

"Policy 5.1 Climate Change Mitigation
The Mayor seeks to achieve an overall reduction in London's carbon dioxide emissions of 60 percent (below 1990 levels) by 2025. It is expected that the GLA group, London boroughs and other organisations will contribute to meeting this strategic reduction target, and the GLA will monitor progress towards its achievement annually."

4.12 The following policies implement the different aspects of Policy 5.1. The OPA's response to these policies is addressed within this report:

- *Policy 5.2 Minimising Carbon Dioxide Emissions*
- *Policy 5.3 Sustainable Design and Construction*
- *Policy 5.5 Decentralised Energy Networks*
- *Policy 5.6 Decentralised Energy in Development Proposals*
- *Policy 5.7 Renewable Energy*
- *Policy 5.9 Overheating and Cooling*

GLA Energy Assessment Guidance - October 2018

4.13 The GLA issued in October 2018 a guidance document for preparing energy assessments.

Domestic

4.14 The three main points that need to be satisfied to meet Building Regulations Part L1A and the London Plan for Major Domestic developments are as follows:

1. Meet the Fabric Energy Efficiency Target (TFEE), guaranteeing DFEE<TFEE (kWh energy use, carbon factors not relevant);

2. Achieve a 10% Reduction on Carbon Emissions at the "Be Lean" stage using new SAP 10 carbon factors (i.e. passive measures and active energy reduction measures);
3. Achieve a minimum on site 35% Reduction on Carbon Emissions at the "Be Green" stage (adding onsite renewables). Remaining emissions to be subject to offset payments.

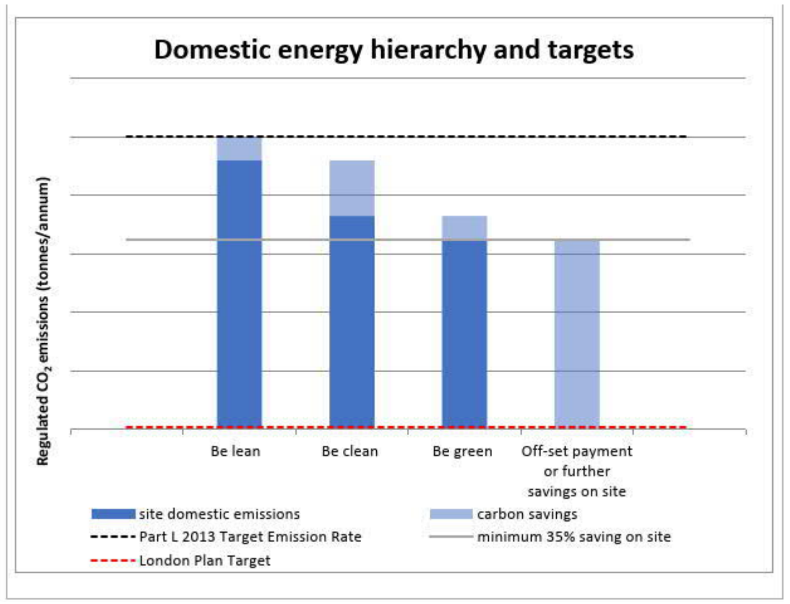


Figure 4.1: The domestic energy hierarchy - - from GLA Energy Assessment Guidance (Oct 2018)

Non-Domestic

4.15 The three main points that need to be satisfied to meet Building Regulations Part L2 and the London Plan for non-domestic developments are as follows:

1. Meet the Fabric Energy Efficiency Target (TFEE), guaranteeing DFEE<TFEE (kWh energy use, carbon factors not relevant);
2. Achieve a 15% Reduction on Carbon Emissions at the "Be Lean" stage using new SAP 10 carbon factors (i.e. passive measures and active energy reduction measures);
3. Achieve a minimum on site 35% Reduction on Carbon Emissions at the "Be Green" stage (adding onsite renewables).

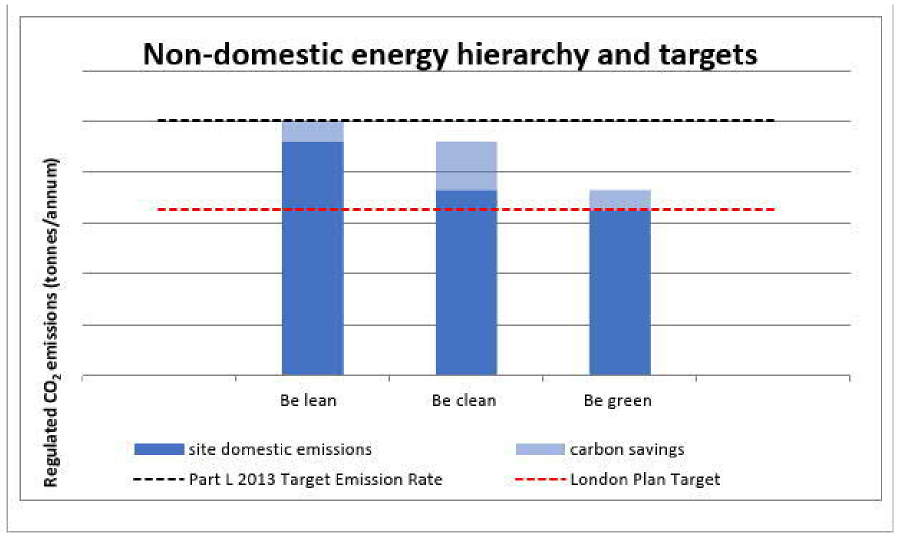


Figure 4.2: The non-domestic energy hierarchy - - from GLA Energy Assessment Guidance (Oct 2018)

LBTH Local Plan

4.16 The Local Plan (Policy D.ES7 – A zero carbon borough) requires a target of 45% Reduction on Carbon Emissions at the "Be Green" stage relative to Building Regulations 2013.

4.17 This higher target will require innovative onsite solutions such as very-low temperature and ultra-low temperature ambient loop networks incorporating cooling secondary heat recovery.

Policy D.ES7

A zero carbon borough

1. Development is required to meet the carbon dioxide emission reduction standards as set out below.

Residential development	
Year	**Improvement on the 2013 building regulations**
2016-2031	Zero carbon (to be achieved through a minimum 45% reduction in regulated carbon dioxide emissions on-site and the remaining regulated carbon dioxide emissions to 100% - to be off-set through a cash in lieu contribution)

Non-residential development	
Year	**Improvement on the 2013 building regulations**
2016-2019	45% regulated carbon dioxide emissions reduction
2019-2031	Zero carbon (to be achieved through a minimum 45% reduction in regulated carbon dioxide emissions and the remaining regulated carbon dioxide emissions to 100% - to be off-set through a cash in lieu contribution)

2. Development is required to maximise energy efficiency based on the following standards:
   a. All new non-residential development over 500 square metres floorspace (gross) are expected to meet or exceed BREEAM 'excellent' rating
   b. All major non-residential refurbishment of existing buildings and conversions over 500 square metres floorspace (gross) must meet at least BREEAM non-domestic refurbishment 'excellent' rating
   c. As a minimum, all self-contained residential proposals will be strongly encouraged to meet the Home Quality Mark.
3. Major residential and major non-residential development will be required to submit an energy assessment. Minor non-residential development will be strongly encouraged to prepare an assessment.
4. The energy assessment should demonstrate how the development has been designed in accordance with the energy hierarchy and how it will:
   a. maximise energy efficiency as per the requirements set out in Part 2
   b. outline the feasibility of low nitrogen dioxide decentralised energy, and
   c. seek to provide up to 20% reduction of carbon dioxide emissions through on-site renewable energy generation.
5. The sustainable retrofitting of existing development with provisions for the reduction of carbon emissions will be supported.

Table 4.1: Tower Hamlets Plan 2031 – Zero Carbon Policy (Jan 2020)

Carbon Emission Factors

4.18 The electrical grid in the UK has been decarbonising and is projected to continue doing so. This means using grid electricity becomes a lower carbon source of energy than gas, as shown in the figure below.

4.19 This favours electrically powered heat pumps for heating and means that CHP is no longer beneficial in carbon terms. It also means that the perceived benefit of PVs is reduced.

4.20 The GLA Guidance on Preparing Energy Assessments (October 2018) states the Mayor will apply a 35% carbon reduction target beyond Part L 2013 of the Building Regulations, which is deemed broadly equivalent to the 40% target set for the period of 2013-2016 in Policy 5.2 of the current London Plan.

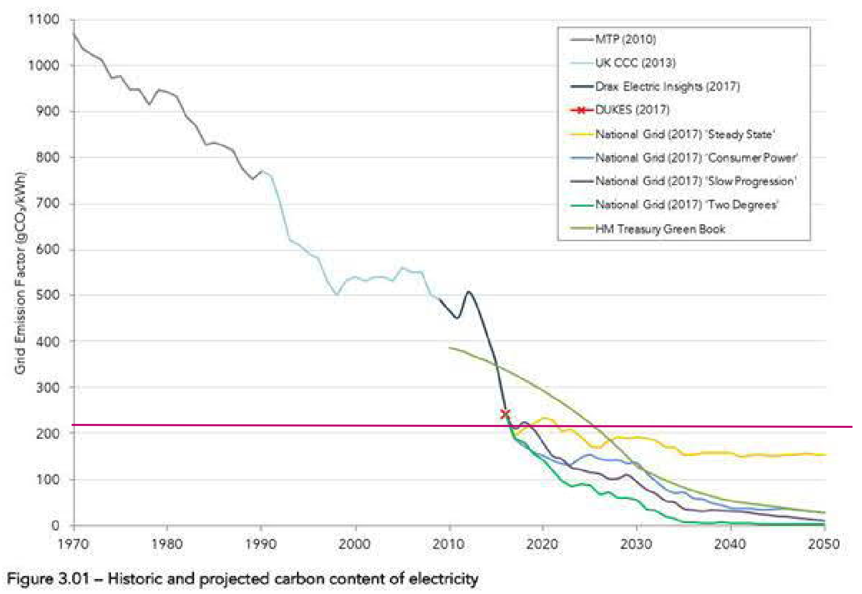


Figure 4.3: Carbon intensity of grid electricity, with purple horizontal line indicating carbon intensity of gas. Table from the 'Low Carbon Heat: Heat Pumps in London' by the Greater London Authority

4.21 This Energy Assessment uses the Building Regulations methodology for estimating energy performance against Part L 2013 energy requirements using SAP 2010.

Fuel Carbon Factors (kgCO2/kWh)		
	SAP 2012	**SAP 10**
Natural Gas	0.216 kg CO_2/kWh	0.210 kg CO_2/kWh
Electricity	0.519 kg CO_2/kWh	0.233 kg CO_2/kWh

Table 4.2: Carbon Emission factors

4.22 The Be Lean stage of the hierarchy also needs to be achieved using the SAP12.

Draft London Plan Policy SI 3 Energy Infrastructure

4.23 The draft London Plan Policy SI 3 Energy Infrastructure Section D states that major development proposals within Heat Network Priority Areas should have a communal low-temperature heating system:

1) The heat source for the communal heating system should be selected in accordance with the following heating hierarchy:

a) connect to local existing or planned heat networks;

b) use zero-emission or local secondary heat sources (in conjunction with heat pump, if required);

c) use low-emission combined heat and power (CHP) (only where there is a case for CHP to enable the delivery of an area-wide heat network, meet the development's electricity demand and provide demand response to the local electricity network);

d) use ultra-low NOx gas boilers.

2) CHP and ultra-low NOx gas boiler communal or district heating systems should be designed to ensure that they meet the requirements in Part B of Policy SI 1 Improving air quality.

3) Where a heat network is planned but not yet in existence the development should be designed to allow for the cost-effective connection at a later date.

4.24 Other key changes include a revised energy hierarchy, where domestic developments will be required to achieve a 10% carbon reduction through energy efficiency alone and commercial developments a 15% reduction, and a revised heating hierarchy.

Draft London Plan Policy SI 2 'Minimising Greenhouse Gas Emissions'

4.25 The existing London Plan requirements have been strengthened, and some aspirations of the previous London Plan have been clarified:

The New Energy Hierarchy:

- **Be lean:** use less energy and manage demand during operation
- **Be clean**: exploit local energy resources (such as secondary heat) and supply energy efficiently and cleanly
- **Be green**: maximise opportunities for renewable energy by producing, storing and using renewable energy onsite
- **Be seen**: monitor, verify and report on energy performance

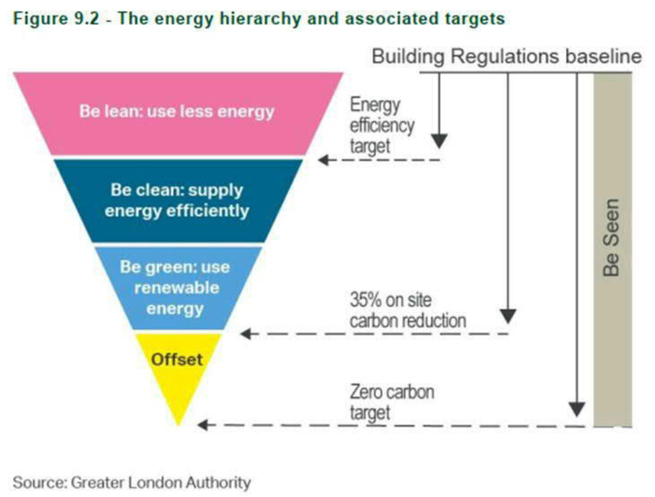


Figure 4.4: London Plan Energy Hierarchy and Associated Targets

Energy Strategy Requirements

- Major developments to be net-zero carbon overall, although this can be achieved through off-site or offsetting payments.
- As with current London Plan at least a 35% reduction on building regulations must be achieved on site.

- For non-domestic 15% of reductions must be achieved through energy efficiency.
- For domestic 10% of reductions must be achieved through energy efficiency
- Major development proposals should calculate and minimise carbon emissions from any other part of the development, including plant or equipment, that are not covered by Building Regulations, i.e. unregulated emissions.
- Development proposals referable to the Mayor should calculate whole lifecycle carbon emissions through a nationally recognised Whole Life-Cycle Carbon Assessment and demonstrate actions taken to reduce life-cycle carbon emissions.
- All developments to demonstrate how the development will achieve net-zero carbon on-site by 2050.
- All major developments to monitor and report on their energy use for 5 years after completion.
- The Mayor recognises that Building Regulations use outdated carbon emission factors and that this will continue to cause uncertainty until they are updated by Government. Interim guidance has been published in the Mayor's Energy Planning Guidance on the use of appropriate emissions factors. This guidance will be updated again once Building Regulations are updated to help provide certainty to developers on how these policies are implemented.
- Demand-side response, specifically through installation of smart meters, minimising peak energy demand and promoting short-term energy storage, as well as consideration of smart grids and local micro grids where feasible, required.

Draft London Plan Policy SI3 "Energy infrastructure"

4.26 Major development proposals within Heat Network Priority Areas should have a communal low-temperature heating system.

4.27 Requirement for an energy masterplan for large-scale developments (town centres and areas of multiple development) which should consider:

1) major heat loads (including anchor heat loads, with particular reference to sites such as universities, hospitals and social housing)
2) heat loads from existing buildings that can be connected to future phases of a heat network
3) major heat supply plant including opportunities to utilise heat from energy from waste plants
4) secondary heat sources, including both environmental and waste heat
5) opportunities for low and ambient temperature heat networks
6) possible land for energy centres and/or energy storage
7) possible heating and cooling network routes
8) opportunities for futureproofing utility infrastructure networks to minimise the impact from road works
9) infrastructure and land requirements for electricity and gas supplies
10) implementation options for delivering projects, considering issues of procurement, funding and risk, and the role of the public sector.
11) opportunities to maximise renewable electricity generation and incorporate demand-side response measures

4.28 The heat source for the communal heating system should be selected in accordance with the following heating hierarchy:

a) connect to local existing or planned heat networks
b) use zero-emission or local secondary heat sources (in conjunction with heat pump, if required
c) use low-emission CHP (only where there is a case for CHP to enable the delivery of an area-wide heat network, meet the development's electricity demand and provide demand response to the local electricity network).
d) use ultra-low NOx gas boilers.

4.29 CHP and ultra-low NOx gas boiler communal or district heating systems should be designed to ensure that they meet the requirements of policy SI1 Part B (Air Quality).

Draft London Plan Policy SI 4 Managing heat risk

4.30 Major development proposals should reduce potential overheating and reliance on air conditioning systems and demonstrate this in accordance with the following cooling hierarchy:

Policy SI 4 Managing heat risk

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

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

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

Figure 4.5: The "intend to publish" London Plan Cooling Hierarchy

4.31 Major developments should demonstrate how the design, materials, construction and operation of the development will minimise overheating and also meet its cooling needs. New developments in London should also be designed to avoid the need for energy intensive air conditioning systems as much as possible.

Draft GLA Energy Assessment Guidance – April 2020

4.32 The GLA issued a draft new guidance document for preparing energy assessments in April 2020.

4.33 The following updates have been made to the Energy Assessment Guidance:

- Section 1:
  a. Introduction of the 'be seen' policy applicable to all major developments with links to separate detailed guidance
  b. Introduction of the whole life cycle policy applicable to all referable applications with links to separate detailed guidance
  c. Reference to the London Plan energy hierarchy (Policy SI 2)
- Section 2: Further explanation setting out what is required for different types of planning application
- Section 5: Further explanation on when applicants will be expected to use SAP 10.0 carbon emission factors and when SAP 2012 will still be allowed
- Section 6:
  a. Further detail around the carbon calculating, reporting offsetting requirements
  b. A revised section on the requirements for refurbishments and an introduction of a section addressing modular buildings, temporary construction and co-living spaces
- Section 7: Further explanation around cost estimates
- Section 8:
  a. Replacing the GLA's Overheating Checklist with the Good Homes Alliance Early Stage Overheating Risk Tool, for preliminary stage overheating analysis
  b. Clarifying the GLA's position in cases where there are limitations on opening windows for ventilation purposes
- Section 9:
  c. General restructure of the 'be clean' section to align with the heating hierarchy
  d. Inclusion of a reference to the heating hierarchy
  e. Reiterating the importance and role of heat networks
  f. Clarification on the role of CHP generally and in heat networks
  g. Requirements related to the decarbonisation of heat networks
  h. Reference to the updated London Heat Map and requirement for developers to provide information to update the Heat Map
  i. Reference to ambient loop systems and their limitations when connection to district heat networks is viable
  j. More guidance introduced on best practice measures of heat network design
  k. Further clarity provided for schemes where a single energy centre may not be the most suitable solution
  l. More information provided around air quality limits and compliance requirements

Figure 4.6: Summary of Guidance Updates - - from draft GLA Energy Assessment Guidance (April 2020)

Figure 2: *Worked example of savings anticipated from the London Plan energy hierarchy*

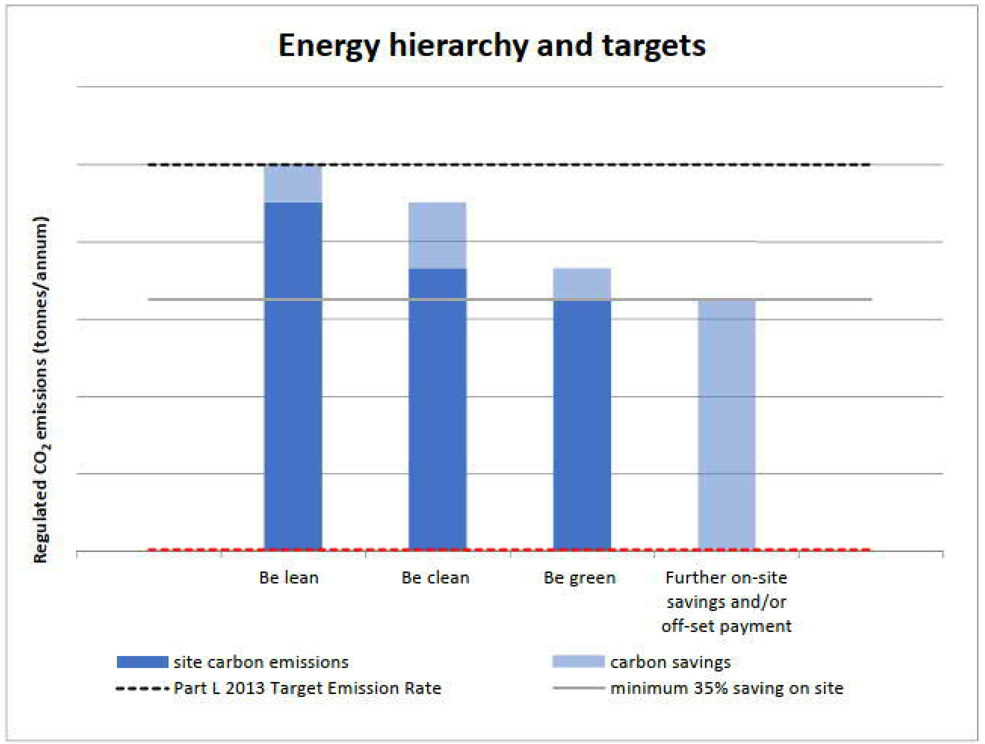


Figure 4.7: New London Plan energy Hierarchy for both domestic and nondomestic buildings - from draft GLA Energy Assessment Guidance (April 2020)

5.0 'Be Lean' – Demand reduction

5.1 The first step in the GLA energy hierarchy is to reduce energy demand compared to the baseline. It is cheaper and easier to implement fundamental measures earlier in the design and it is at this stage that most passive measures can have their greatest effect.

5.2 The design aim will be to prioritise robust measures which are less likely to be changed, are easier to build successfully, and have the greatest effect on energy use.

5.3 This section outlines the passive and active measures that have been applied to the Indicative Scheme to realistically maximise the 'Be Lean' energy demands.

Architectural Massing

5.4 The North Quay Masterplan layout and building orientations have been carefully considered within the constraints of the Site. The external fabric and the windows will be particularly important elements for each façade orientation of the various buildings on the development.

5.5 The balance between natural ventilation, daylight and solar gains for each residential building design will need to be optimised during each RMA. This will result in minimising the need for artificial lighting whilst also minimising overheating risk.

Layout, orientation and building form - Area to Volume ratio (A/V ratio)

5.6 The amount of exposed external area relative to the interior volume has a significant influence on the overall building heating demand. The Indicative Scheme has optimised this A/V ratio by proposing regular floor plates and tall buildings.

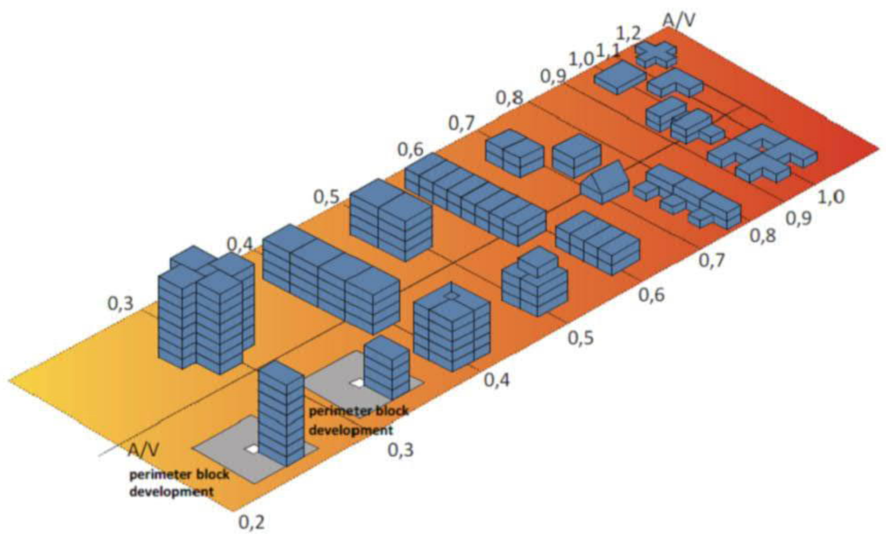


Figure 5.1: Building A/V ratio to illustrate effect of building form (lower ratio means less heat loss)

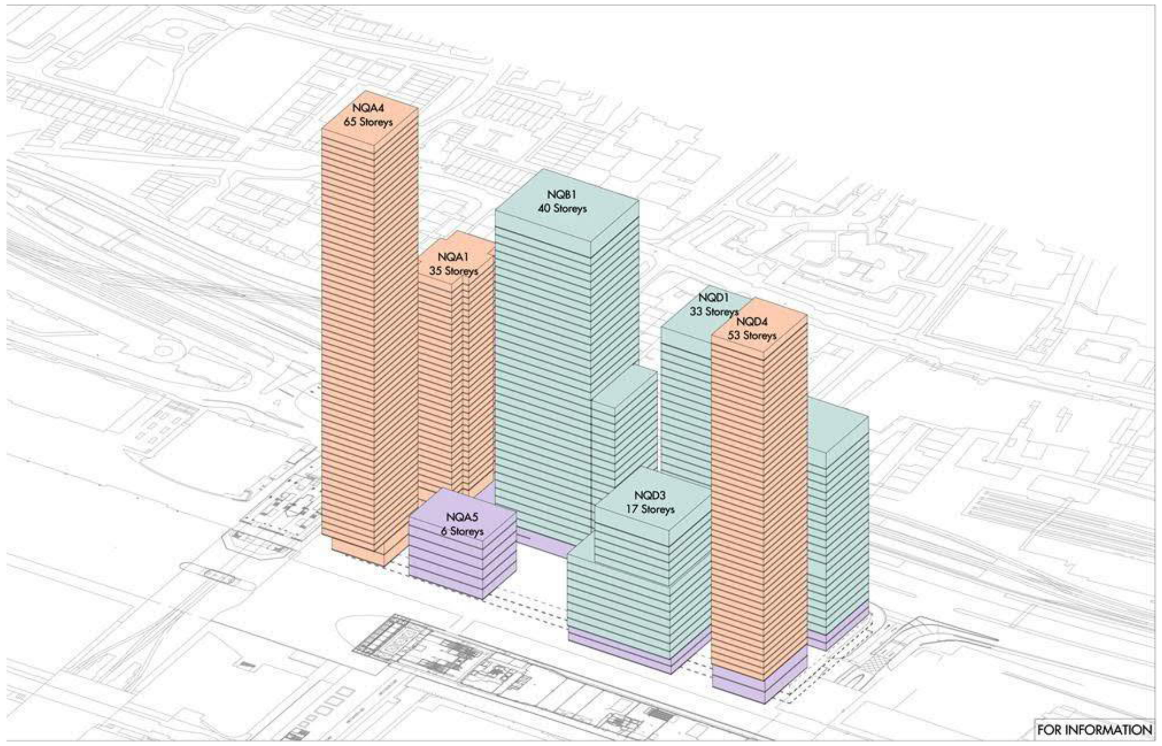


Figure 5.2: North Quay Indicative Scheme (A&M Architects).

5.7 The large commercial buildings have been laid out along an East-West orientation which allows solar gain and daylight to be managed on the south facades with measures such as external Brise Soleil which also allows passive solar heating in winter.

Figure 5.3: Visualisation of Proposed Indicative Scheme (A&M Architects).

Building Fabric Measures

5.8 The Draft London Plan has introduced a required % reduction in carbon emissions at the "Be Lean" stage using the new GLA carbon factors. This is set at 10% for domestic buildings and 15% for non-domestic buildings. The Building Regulations Part L sets out the Notional Building performance targets and so for major residential developments and non-domestic developments the actual performance of each building element will need to be better than the Part L targets to help achieve the % reductions in carbon emissions.

5.9 The thermal performance of the building fabric has been set out to optimise the balance between energy savings and other considerations such as cost, wall thicknesses, and the diminishing returns available from further increasing the thermal performance of a building envelope.

Element	Building Regulations Part L1A Notional Building	Proposed North Quay Residential Buildings
External Wall U-value W/(m2.K)	0.18	0.14
Floor U-value W/(m2.K)	0.13	0.11
Roof U-value W/(m2.K)	0.13	0.11
Window U-value W/(m2.K)	1.4	1.0-1.2 (including framing)
G-value (%)	0.63	0.4
Light transmittance (%)	0.8	0.7
Air permeability m3/(m2.hour)	5	3
Y-value (thermal bridging)	0.15	0.10
Ventilation Type	Mechanical Extract Ventilation MEV and natural ventilation for summer comfort	Mechanical Ventilation with Heat Recovery MVHR.
Cooling	None	Due to noise levels across the site cooling will be required.

Table 5.1: Proposed Domestic Building Fabric Performance

Element	Building Regulations Part L2A Notional Building	Proposed North Quay Commercial Buildings
External Wall U-value W/(m2.K)	0.35	0.15
Floor W/(m2.K)	0.25	0.13
Roof U-value W/(m2.K)	0.25	0.13
Windows and transparent curtain walling (whole window, i.e. inc. frames) W/(m2.K)	2.2	1.2
Roof windows and glazed roof-lights (whole window, i.e. including frames) W/(m2.K)	2.2	1.2
High-usage entrance doors	3.5	2.20
g-value	n/a	0.15 to 0.27
Light transmittance %	n/a	50 to 60%
Rooflight g-value	n/a	0.22
Rooflight light transmittance	n/a	0.50
Air permeability ($m^3/(h.m^2)$ at 50 Pa)	10.0	3.0
Linear thermal transmittance (W/(m.K))	n/a	10% of U-value equivalent

Table 5.2: Proposed Non-Domestic Building Fabric Performance

Air Tightness

5.10 The benefits of improved insulation levels and more energy efficient heating systems can be lost if warm air is able to leak out of a building and cold air able to leak in. Consequently, achieving a reasonable level of air tightness is important for a building's energy efficiency and the comfort of its occupants.

5.11 A minimum standard of 3m3/m2/hr is specified. Although this is considered a high standard, it is also generally considered as practical and viable. In order to achieve this air tightness the design must:

- Ensure the continuity of the air barrier;
- Ensure the air barrier is correctly located within the fabric to avoid cold air breaching the insulation layer;

- Avoid complex detailing which is difficult to build, resulting in ad hoc air leakage pathways;
- Specify airtight barrier materials than can be adequately lapped and sealed;
- Mark-up details showing how penetrations through the air barrier will be sealed, e.g. structural elements (floor joists, beams etc.) and services (water/gas pipes, ducts, cables etc.).

Thermal Bridging

5.12 Thermal bridges will be an area of focus in the detailed design of the buildings? within the RMAs. Energy lost at thermal junctions shall be minimised using robust details wherever possible and appropriate. As the design is developed, the details will be carefully monitored and considered in view of thermal bridging, and the assessment updated with a more accurate thermal bridging parameter if necessary.

Daylight and Solar Control

5.13 Natural light makes an important contribution to energy use by reducing the need for artificial lighting. It also contributes to the well-being of occupants, and the aesthetics and feel of a space.

5.14 The façade systems of the respective buildings as they evolve will be optimised to reduce summertime solar gains, reducing the need for cooling in summer while maximising winter gains and daylight to reduce heating and artificial lighting demands.

5.15 Glass and façade types that will be considered in the detail design of each building shall include:

- High performance solar control neutral double or triple glazing. Typically, with 50% total light transmission and g-value of 0.23
- Double facade (active or passive) with blind systems integrated within the double façade cavity. Typical systems have 60% Total Light Transmission and g-value of 0.1 to 0.15 (with blinds deployed).
- Closed Cavity Facades CCF. Typical systems have 65% Total Light Transmission and g-values of 0.1 to 0.15 (with blinds deployed).

5.16 For the energy modelling as part of the OPA submission, high performance solar control glazing combined with external solar shading has been used.

Natural Ventilation

Residential Buildings

5.17 Policy 5.9 of the current London Plan states that, where air quality and noise levels permit, all residential buildings are expected to have openable windows with additional security and rain protection details to allow for purge ventilation at night. Units should also have dual aspect where feasible, enabling the benefits of cross ventilation to be realised.

5.18 Due to acoustic issues across the North Quay masterplan from Aspen Way and the DLR railway lines the overheating control will not be achievable by opening windows alone and mechanical ventilation and comfort cooling will be required. A study on the internal acoustic conditions, ventilation and overheating will be carried out in the detailed design of any residential building and as part of the RMA submissions.

5.19 The SAP10 energy modelling for the OPA has assumed that the residential buildings are mechanically ventilated, and comfort cooled.

Commercial Buildings

5.20 Commercial building facades facing towards the south of the Site could employ a mixed mode ventilation solution with natural ventilation openings in the façade. When the external conditions allow occupants would be able to open windows or panels providing improvements in occupant satisfaction and cooling and ventilation energy reduction. Opening windows would need to be interlocked with the Heating Ventilation and Airconditioning (HVAC) systems to allow terminal units to be switched off when windows are open.

5.21 An automatic opening natural ventilation system could also be considered for commercial buildings to allow night-time ventilation of the office spaces to reduce the overall cooling energy for the next day.

5.22 The energy modelling for the OPA has assumed that the commercial buildings are fully mechanically ventilated and air conditioned. Opportunities for mixed mode solutions will be investigated as part of each RMA for each phase.

Free Cooling from Mechanical Ventilation

5.23 It is also possible to operate air handling units at night to provide free cooling to the commercial buildings. This could be considered during the detailed design of each building as a cooling energy reduction measure.

Thermal Mass

5.24 Using exposed thermal mass where appropriate to absorb and release heat to the internal environment to offset the peaks and troughs experienced through the day in heating and cooling demand could be considered on a building by building basis during the RMA submission process.

Variable Speed Pumps and Fans

5.25 Variable speed pumps will be used on all heating and cooling water distribution systems as this allows each system to respond to different loads efficiently at lower speeds thus minimising pumping energy.

5.26 Air Handling Units (AHU) and Mechanical Ventilation with Heat Recovery (MVHR) units will be equipped with high efficiency variable speed fans that respond to the varying ventilation requirements in the office spaces, based on occupancy and heating or cooling load demands. Fans will be selected and sized to minimise their energy consumption.

5.27 Inverter driven compressors on heat pumps and chillers.

Heat Recovery Ventilation Systems

Residential Building

5.28 MVHR units will be used for each apartment in the residential buildings. This approach provides excellent energy efficiency, especially when used in conjunction with very low air permeability.

Commercial Buildings

5.29 For the commercial buildings central air handling units will have high efficiency heat recovery. The use of twin-wheel heat recovery AHUs will be considered for office floors during the RMAs, as this technology has a number of benefits including:

- the sorption wheel extracts moisture from incoming air in summer cooling mode, reducing the need for dehumidification
- the system uses the thermal wheel for 're-heat' in cooling mode, rather than wasting heat from the central heating system
- the two wheels in series provide a very good heat recovery efficiency of 85% or higher
- the sorption wheel can recover moisture in winter, improving internal humidity conditions

Serviced Apartments

5.30 Centralised high efficiency heat recovery ventilation is proposed for the Serviced Apartments similar to the commercial buildings. This could be centralised on each floor or for multiple floors.

Domestic Hot Water Service

5.31 Low flow fixtures and fittings will be specified to reduce the consumption of hot water.

5.32 Hot water waste heat recovery will be considered in each RMA.

Lighting

5.33 Lighting energy contributes to a significant portion of any building energy demand. Consequently, it is proposed that all buildings types will utilise high efficiency LED lighting that exceeds the minimum efficacy standards.

5.34 Lighting will be specified to offer the best balance between performance and efficiency whilst ensuring 100% of fittings in dwellings are low energy, as defined by the Domestic Building Services Compliance Guide.

5.35 For the commercial buildings, where practical, daylight will be used to light spaces, supplemented by artificial lighting. All electrical lighting will be by low energy and high efficiency LED sources, with a minimum efficacy of 100lumen/circuit Watt.

5.36 Lighting controls will be simple and easy to use, avoiding the use of lights when not required. Lighting controls will include the use of daylight controlled dimming, absence detection, and time clock control where appropriate. In summary lighting control will:

- Be simple and easy to use
- Include occupancy detection
- Included time clock control (where appropriate)
- Include daylight dimming

Lifts

5.37 Energy efficient lifts installed with regenerative motor drives.

Basement Loading Bay/Car Park Ventilation

5.38 The Loading Bay and Car Park ventilation system will be mechanical ventilation with ceiling mounted impulse fans moving air across the space with exhaust fans at the opposite ends to the natural ventilation make-up air through the entrance ramp. The ventilation will be demand-controlled on CO/CO2 Sensors to only run the fans when required.

'Be Lean' Results

5.39 At the 'Be Lean' stage the Indicative Scheme achieves a 20% reduction below the baseline for the non-domestic buildings and 13% reduction below the baseline for the domestic buildings, using SAP10.

5.40 At the 'Be Lean' stage the Indicative Scheme achieves a 21% reduction below the baseline for the non-domestic buildings and 15% reduction below the baseline for the domestic buildings, using SAP12.

		Energy demand following energy efficiency measures (tCO2/year)					
		Space Heating	Hot Water	Lighting	Auxiliary	Cooling	Total Reduction (%)
SAP2012	Baseline	304	424	115	28	0	-
	Be Lean	117	389	115	129	2	15
SAP10	Baseline	296	412	52	13	0	-
	Be Lean	114	360	52	58	1	13

Table 5.3 Comparison between SAP2012 and SAP10 carbon factors for Domestic Be Lean stage and the baseline.

		Energy demand following energy efficiency measures (tCO2/year)					
		Space Heating	Hot Water	Lighting	Auxiliary	Cooling	Total Reduction (%)
SAP2012	Baseline	276	228	2466	1314	720	-
	Be Lean	251	228	1392	1556	571	21
SAP10	Baseline	299	221	1107	590	323	-
	Be Lean	244	221	625	703	257	20

Table 5.4 Comparison between SAP2012 and SAP10 carbon factors for Non-Domestic Be Lean stage and the baseline.

5.41 Both the regulated energy consumption and CO2 emissions from the GLA spreadsheet and the unregulated consumption are included in the tables below.

Building use	Energy demand following energy efficiency measures (MWh/year)					
	Space Heating	Hot Water	Lighting	Auxiliary	Cooling	Unregulated electricity
Residential	543	1712	221	248	3	10968
Commercial	558	1803	2604	2035	434	6662
Basement	44	259	25	58	37	547
Total	1145	2049	2850	2341	474	18177

Table 5.5 Be Lean energy demand

Building use	CO2 emissions following energy efficiency measures (Tonnes CO2/year)					
	Space Heating	Hot Water	Lighting	Auxiliary	Cooling	Unregulated electricity
Residential	114	360	52	59	1	2541
Commercial	117	379	615	480	102	1572
Basement	9	54	6	14	9	129
Total	240	430	673	552	112	4242

Table 5.6 Be Lean CO2 emission

6.0 'BE CLEAN' – HEATING INFRASTRUCTURE

Introduction

6.1 The GLA energy assessment guidance (2018) specifically encourages the implementation of decentralised power generation. The hierarchy for selecting an energy system is as follows:

1. Connection to an area wide heat network;
2. Communal heating system (site-wide then building-level networks);
3. Individual heating system;

"Where proposed developments are located near to existing or planned networks, connection must be prioritised".

6.2 The Draft London Plan now places an emphasis on low-temperature communal heating systems using zero-emission or local secondary heat sources (in conjunction with heat pump) as opposed to the previous drive towards CHP. Heat pumps and ultra-low NOx gas boilers are now favoured over CHP.

6.3 Moving to heat pumps aligns with the wider Science Based Target and Net Zero Carbon pathway for Canary Wharf which aims to reduce natural gas usage and switch to electric solutions.

6.4 With the recent update in carbon factors for energy assessments there has been a step change in appropriate technologies for new developments. CHP lead energy centres no longer provide carbon savings when assessed with the new carbon factors, also the temperatures of existing CHP networks lead to very high distribution losses are not appropriate for the efficient operation of current heat pump technology operating at much lower temperatures.

6.5 The decarbonisation of existing 4th generation DHNs, and the future installation of 5th generation very low temperature or even ambient loop DHNs will mean that any future DHN would likely operate at much lower distribution temperatures compared to current CHP lead networks.

6.6 Heat pump technology will advance significantly over the coming years and with the phased development of the North Quay Masterplan up to 2029 it makes sense to install the most efficient technology available at the time of each phase.

6.7 It is therefore proposed to have distributed heat pump energy centres on each building within each phase rather than a single energy centre connected to a site wide heat network.

6.8 As an additional measure, in the case a low carbon electrically driven heat network is planned in the vicinity of the Site in the future, the site infrastructure will allow the option to connect to such a network.

Existing and Planned networks

6.9 There are no existing heat networks in the immediate vicinity that could be viably connected to the North Quay site at this time.

6.10 The only existing heat network in the area is the Barkantine Energy Centre network some c.1.5 km away, across the docks south of Canary Wharf (see map below). It incorporates a 1.4MWe CHP engine to meet the baseload heat requirements, and four 1.4MWth heat-only boilers for top-up and peak load requirements. The heat is distributed through 2.4 km of underground mains. For comparison the North Quay Indicative Scheme would require approximately 15MW of peak heat when fully built out.

6.11 We have contacted the operator of this network, Imtech Low Carbon Solutions (Part of EDF), to understand their future plans for the network. They confirmed that they are about to commence a high-level review of the network in partnership with LBTH and the BEIS (Department of Business, Energy and Industrial Strategy). Currently, due to the Barkantine network being a CHP lead system which we understand is coming to the end of its PFI contract, has limited spare capacity to serve a site as large as North Quay, plus the significant geographic obstacles, including the docks, of running pipes to the Site, a connection to this network is discounted.

6.12 There is a planned network of distributed CHP and gas boiler energy centres currently being installed at Wood Wharf on behalf of Canary Wharf Group, which is over 600m away to south-east of the Site (see map below). Due to this being a CHP lead network with no spare capacity, and again the significant geographic obstacles that exist, including the docks, of running a connection to the Site, connection to this network has also been discounted.

6.13 There is a CHP lead heat network being installed at Blackwall Reach by Swan Housing. This is located to the East of North Quay on the other side of Aspen Way approximately 750m away. We have contacted Swan Housing and understand that the heat network is being installed by an ESCO provider EON and that the Energy Centre has been sized to serve the development only. Due to tight site constraints the Energy Centre has been sized with no spare capacity or space for additional plant to serve any adjacent developments. Also, at present there are no decarbonisation plans for the network.

6.14 The London Heat map (see below) shows only one other planned network which is 750m to the east of the Site at Blackwall. The status and configuration of this planned network is unknown, and no details are available, so future connection has been discounted at this stage.

6.15 In line with the Government's goals of zero carbon developments as well as the Draft London Plan there should only be consideration for electrically powered heat networks as these have the potential to be zero carbon, unlike the majority of existing heat networks which are CHP (gas) powered.

6.16 Therefore, connection to an existing area wide heat network has been discounted for the North Quay Masterplan.

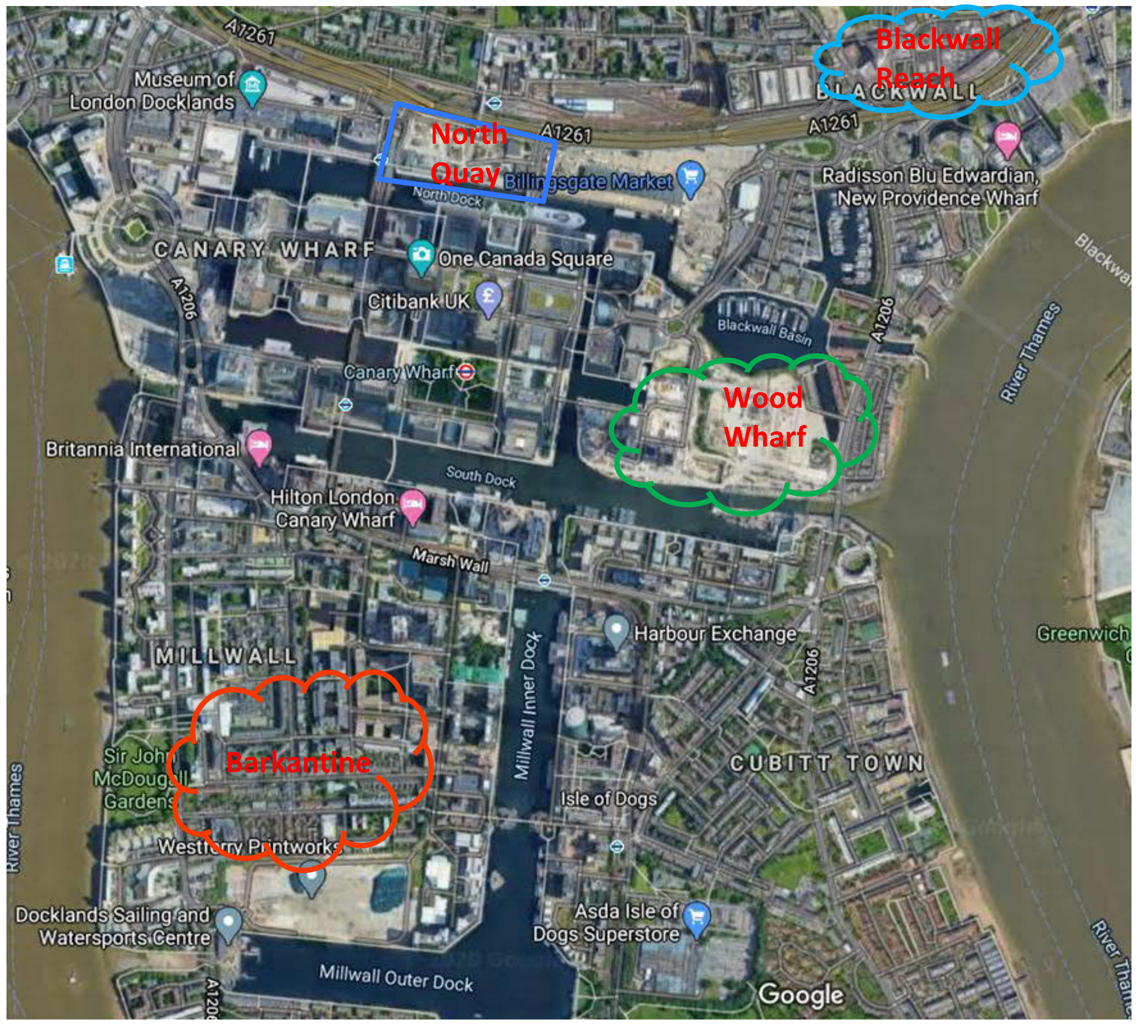


Figure 6.1 Google Map image of Canary Wharf showing the Barkantine Energy Centre and Wood Wharf Development

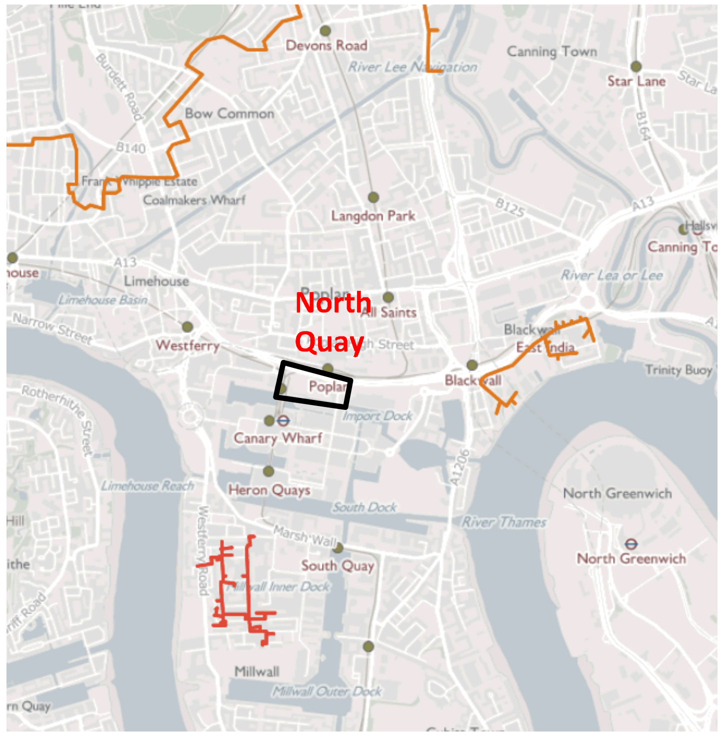


Figure 6.2: Extract from London Heat Map showing that there are no existing or planned heat networks close to the North Quay site (Red networks are existing, Orange networks are planned)

6.17 The Site is not identified as an option for the London Thames Gateway Heat Network (LTGHN) hot water heat network which is planned to run a significant distance to the North-East of the Site on its way towards Stratford. The GLA envisage sources of heat for the LTGHN to come from existing power stations, waste processing sites and industrial facilities already in operation in the London Thames Gateway and the Lee Valley, with future energy sources connecting later as they emerge, and demand grows.

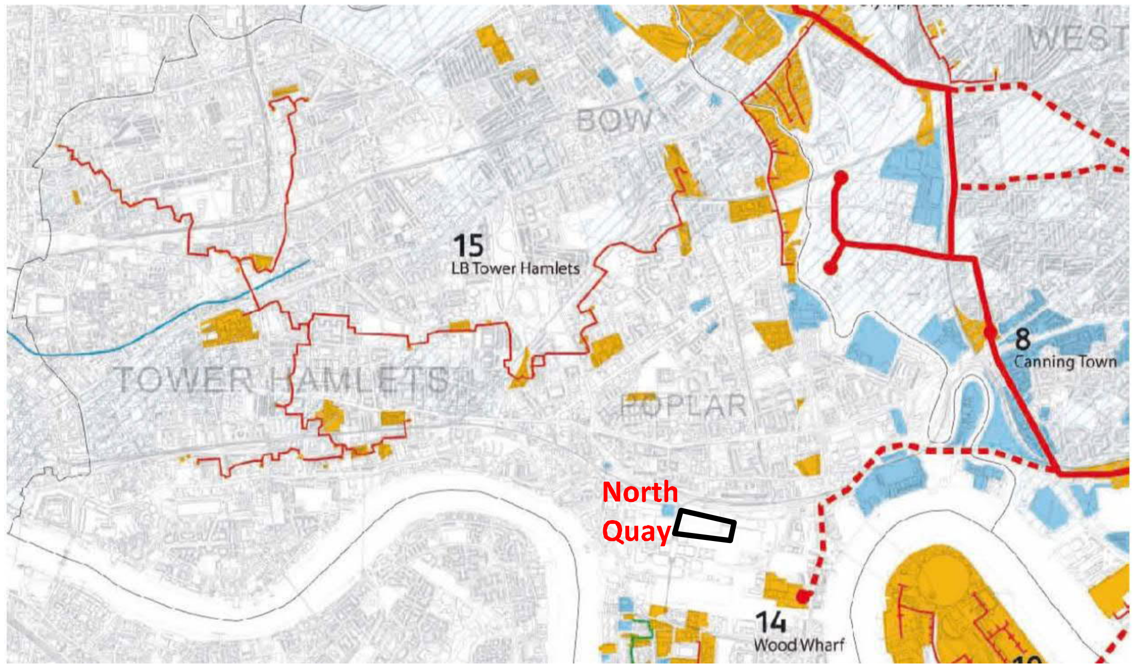


Figure 6.3: Proximity of the LTGHN to North Quay

6.18 The Site is not in an area designated by LBTH for decentralised energy generation and networks and is not one of the focus areas of the LBTH London Heat Map Study.

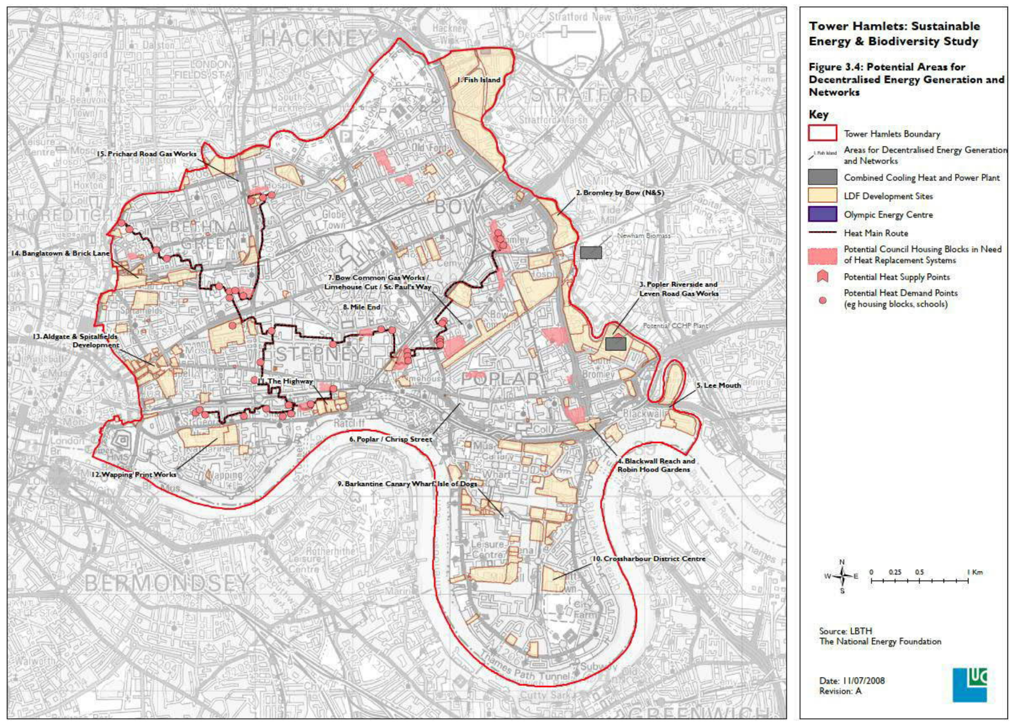


Figure 6.4: Extract from LBTH Sustainable Energy & Biodiversity Study showing that the North Quay site is not in an Area for Decentralised Energy Generation and Networks

Air Quality

6.19 As all heating and cooling generation is by electrically powered heat pumps, there are no associated local emissions to account for.

Single Energy Centre

6.20 The phasing of the North Quay masterplan up to 2029 in 4 phases with mainly commercial buildings makes a single central energy centre challenging to implement for this project.

6.21 The rapid decarbonisation of the electricity grid now favours electrically powered heat pumps for heating. Unlike a CHP and gas boiler energy centre, a heat pump energy centre requires a significantly larger amount of building roof space, which would be challenging to accommodate in any single building based on the Indicative Scheme. For the Indicative Scheme, the air source heat pump plant requirements can be spread across all buildings over all phases.

6.22 As new heating and cooling technologies are rapidly evolving it is more appropriate for each phase of the Proposed Development to utilise the latest low carbon technology most suitable for the actual building types within each phase. This strategy ensures that the Proposed Development can optimise decarbonisation as it is built out over time and respond to changes in policy and regulation as each phase is implemented. This is a better outcome for achieving the energy policy objectives.

6.23 In addition to the above it is important to note that in order to prepare the Site for development there will be a considerable amount of infrastructure required and therefore delivering a single large energy centre in Phase 1 would add further up-front costs which would make the viability of commencing the scheme at the earliest opportunity more challenging.

6.24 For the reasons set out above and as permitted in section 10.32 of the 2018 GLA Energy Guidance (and section 9.50 of the draft 2020 Guidance) a single energy centre is therefore not considered appropriate for the Proposed Development and a distributed energy centre approach is proposed instead. The following sections will explain how the network will evolve across the phasing programme. Schematics are provided showing how the network will evolve and ultimately where and how it could connect to a future area-wide low carbon heat network if one becomes available and it is viable to connect.

6.25 The following benefits are associated with a distributed energy centre solution for this development:

- Phasing – A strategy of distributed energy centres on each building allows for the scheme to be expanded in line with the proposed phasing programme.
- Adaptability – Given the scale and the length of the programme, a distributed energy centre approach will allow for adaptation to any potential changes to the scheme or the programme of the Proposed Development.
- Security of Supply – The distributed energy centre approach provides more resilience than a single energy centre located in one building, which is important for commercial buildings of the type proposed, e.g. a fire or a flood in a plantroom of the single centre could cause total failure, whereas the distributed centres would still be operational as only part of the plant would be affected.

Site Wide Heat Network

6.26 A study[1] by the Building Research Establishment Ltd (BRE) on the efficiency of installed site wide low temperature district heat networks has shown that the distribution loss factor (DLF) of these networks can be very large, and the theoretical loss factor of 1.05 used in SAP12 has significantly underestimated the losses. Typical DLF in measured networks can be over 2 and sometimes as high as 3 leading to high occupant energy costs. This has been recognised in the new SAP10 where a default DLF of 1.5 is used when district heat networks are designed and commissioned in accordance with "Heat Networks: Code of Practice for the UK"[2]

6.27 Moving to very low or ultra-low temperature heat distribution can reduce these distribution losses and deliver lower carbon emissions and energy costs to occupants. However, ultra-low temperature ambient loop heat distribution networks have yet to be developed at a district level and are currently only being delivered at a Building-Level.

6.28 As the majority of the buildings within the Indicative Scheme are non-domestic, with low heating and hot water requirements compared to their cooling energy needs, very-low or ultra-low temperature Building-Level heating networks incorporating cooling heat recovery are considered the most appropriate strategies for this type of development. Distribution losses are minimised, system performance optimisation more achievable, and billing simpler.

6.29 Also, based on the size of each building within each phase, there is already sufficient economies of scale in terms of plant and network system size within each building-level network. The buildings in the indicative scheme are up to 85,000m2 GIA.

6.30 It is therefore proposed to have distributed heat pump energy networks within each phase.

6.31 To comply with draft Policy SI 3 of the Draft London Plan, as set out in the heating hierarchy of draft GLA "Energy Assessment Guidance 2020",where technically and commercially viable, it is proposed to use surplus heat rejection from appropriate office and retail buildings as a "secondary heat source" to provide heat recovery energy to any residential and serviced apartment buildings. This reduces carbon emissions and occupant energy costs and provides site wide connections between appropriate buildings across the masterplan.

References:

1) https://www.bre.co.uk/filelibrary/SAP/2016/CONSP-04---Distribution-loss-factors-for-heat-networks---*V1_0.pdf.*

2) *'Heat Network: Code of Practice for the UK' 2015. Chartered Institute of Building Services Engineers (CIBSE) and the Association for Decentralised Energy (ADE).*

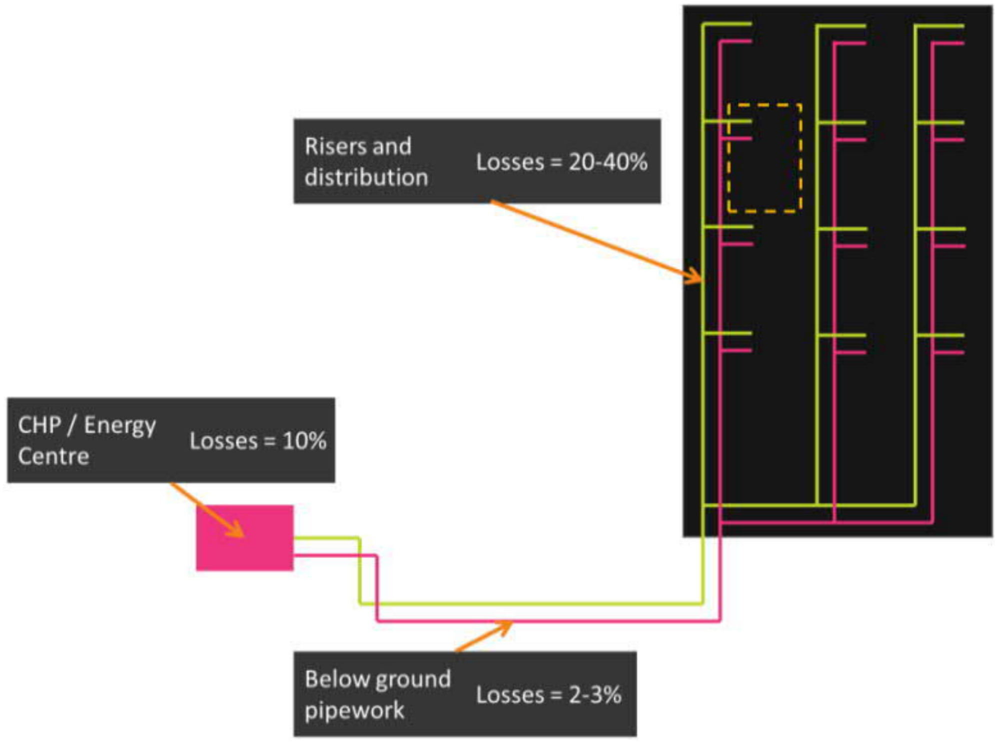


Figure 6.5: Typical losses in a Low Temperature District Heating Network designed and commissioned in accordance with "Heat Networks: Code of Practice for the UK" (70/35degC)

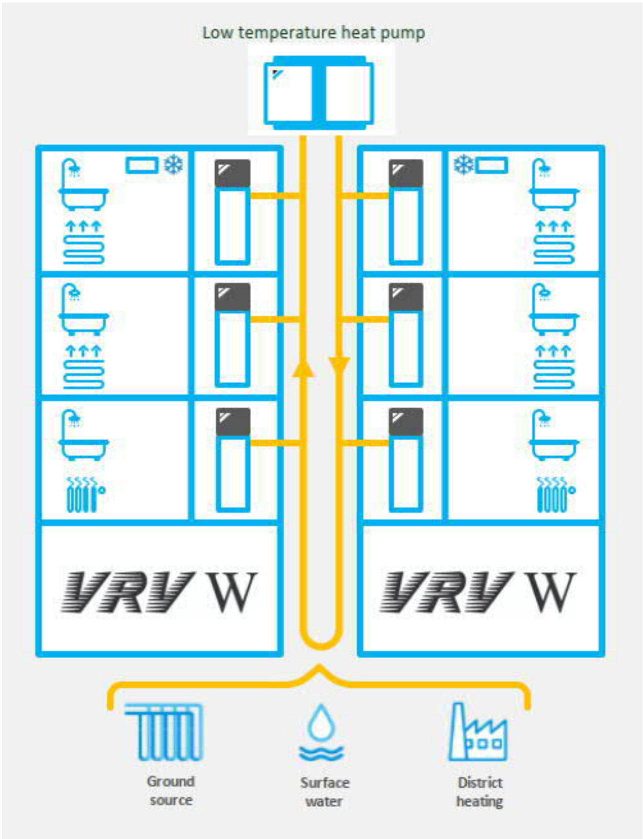


Figure 6.6: Ultra Low Temperature District Heating Network (25/20degC) – 5-10% losses (Daikin)

Heat Export from Commercial to Residential

6.32 The commercial buildings across the Proposed Development will have large cooling loads due to the building usage types and the site wide acoustic constraints. Cooling heat rejection will be used for the simultaneous production of heating and hot water via four pipe heat pump and thermal storage installations in each commercial building. This strategy significantly reduces the energy and carbon emissions of each commercial building and is one of the key Low to Zero Carbon LTZC solutions being proposed for this development.

6.33 To comply with the heating hierarchy of draft Policy SI 3 in the Draft London Plan we have investigated the opportunity to use surplus heat rejection associated with the large cooling loads of the retail and commercial buildings to provide a secondary waste heat source to the heating and hot water networks within the residential buildings across the Proposed Development. This surplus heat is generated simultaneously by the commercial 4-pipe multifunction heat pumps when providing cooling to these buildings.

6.34 It is proposed where technically and commercially viable to connect appropriate commercial building very-low temperature heating networks via heat exchangers to the ultra-low temperature ambient loop residential building heating networks, with the heat elevated at point of use by the in-apartment water source heat pumps. The initial energy modelling predicts that this strategy could potentially reduce the carbon emissions of the residential buildings by an order of 15%. This strategy is also in-line with section 9.37 of the draft GLA "Energy Assessment Guidance 2020".

6.35 Thermal storage will be used to smooth out non-coincident heating and cooling energy demands within and between buildings, and to reduce peak loads on each system.

6.36 These proposed connections between the commercial and residential buildings in each phase are shown in the detailed phasing diagrams.

Distributed Energy Centre Phasing

6.37 As outlined earlier a single energy centre is not considered feasible for the North Quay Masterplan.

6.38 As required by the section 10.32 of the 2018 GLA Energy Guidance (and section 9.50 of the draft 2020 Guidance) the following diagrams explain how the network will evolve across the development's phasing programme. Also refer to the detailed phasing schematics presented in Appendix B – Drawings.

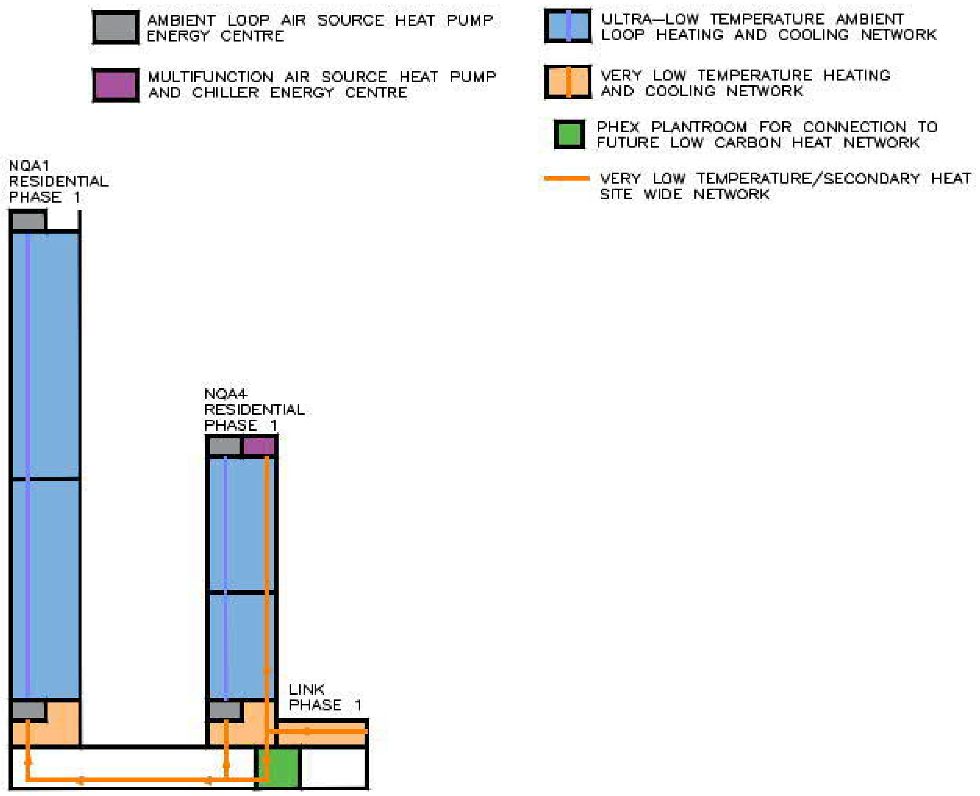


Figure 6.7: Phase 1. Residential Building NQA1 and NQA4

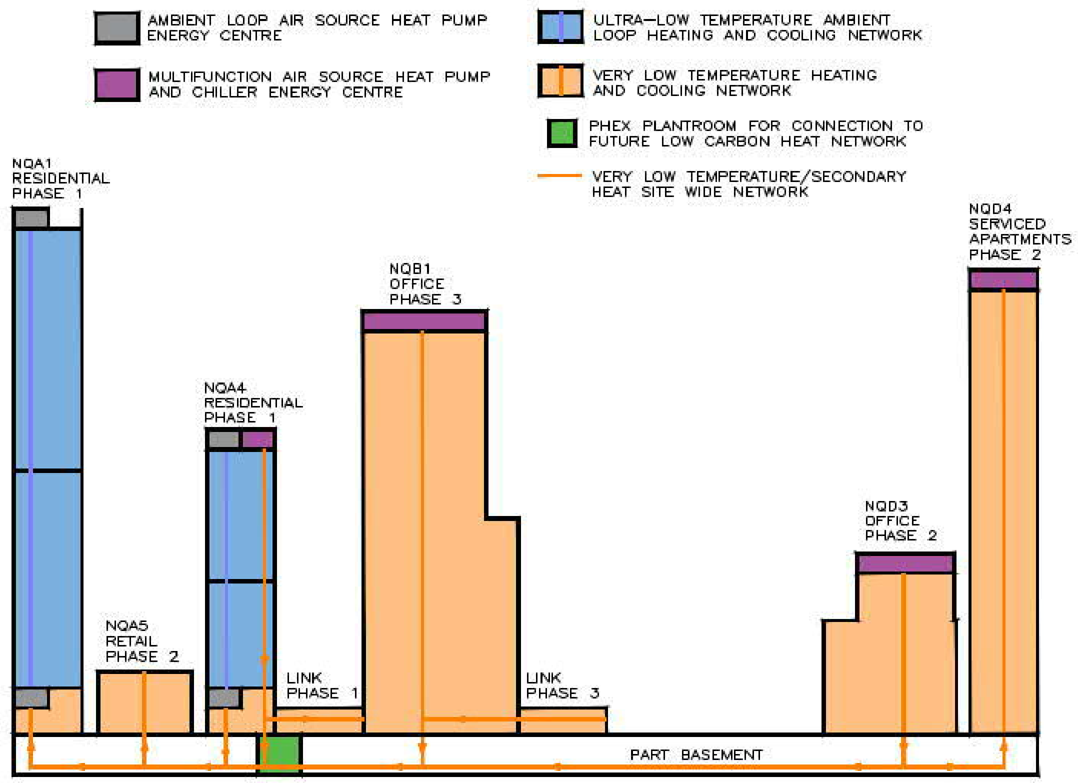


Figure 6.9: Phase 3. Office Building NQB1

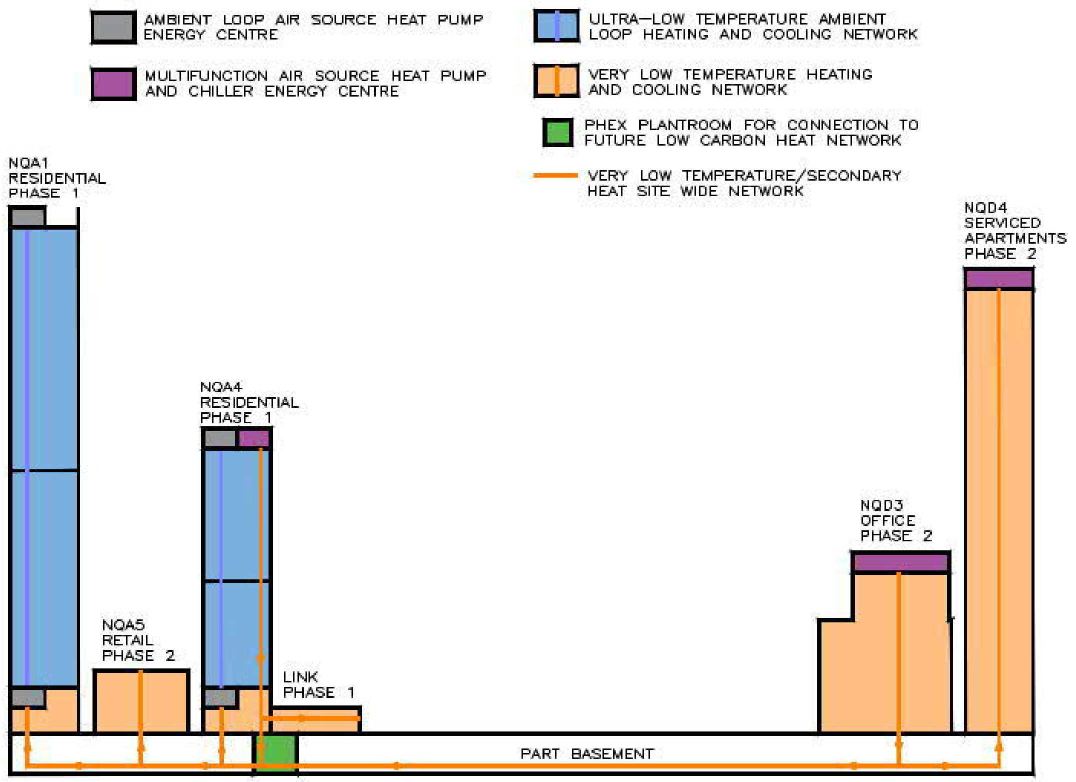


Figure 6.8: Phase 2. Retail Building NQA5, Office Building NQD3, and Serviced Apartment Building NQD4

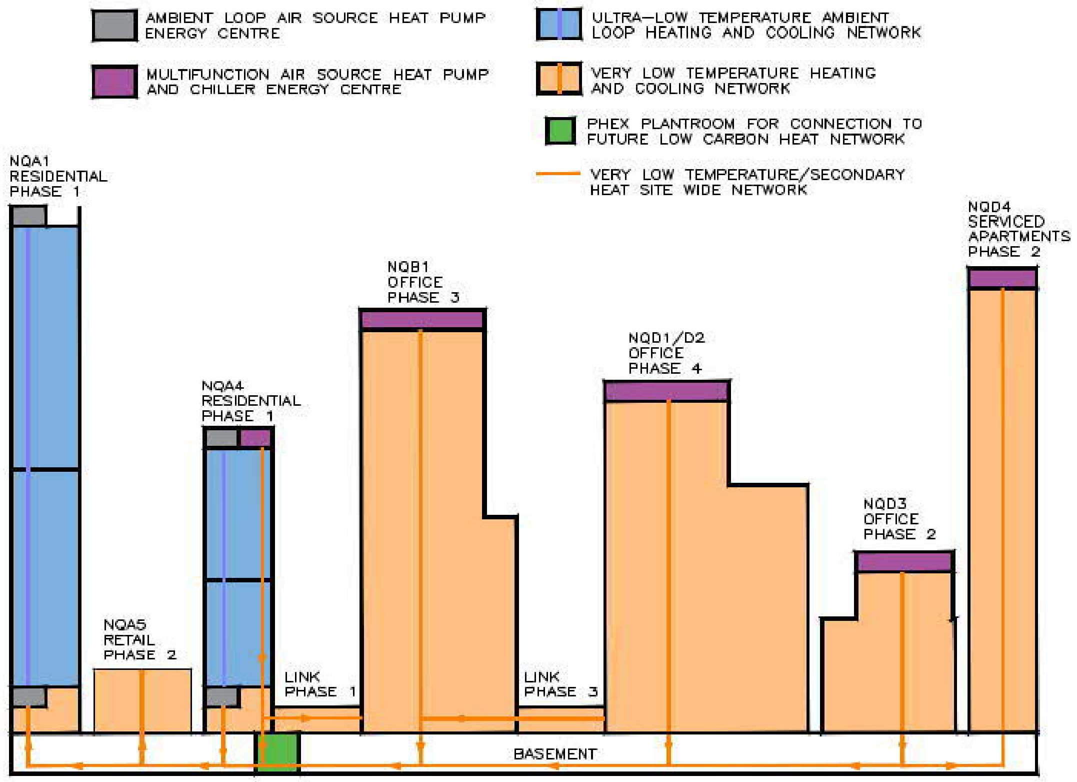


Figure 6.10: Phase 4. Office Building NQD1/D2

Future Connection to Low Carbon District Heating Network (DHN)

6.39 The Proposed Development will be future proofed to allow a single point of connection to a wider low carbon low temperature DHN if one becomes available in the vicinity of the North Quay development in the future and it is feasible to do so. The secondary heat network connecting the buildings across the Site would become the heat distribution network for such a future DHN connection

6.40 The decarbonisation of existing 4th generation DHNs, and the future installation of 5th generation very low temperature or even ambient loop DHNs will mean that any future DHN if connected to the Development would likely operate at much lower distribution temperatures compared to current CHP lead networks, and closer to the proposed very-low temperature and ultra-low temperature networks proposed. Such DHNs are likely to use low carbon heat sources and other secondary waste heat sources producing low grade heat, such as from Data Centres and other industrial waste heat.

6.41 Ambient loops can take heat from current well designed 4th generation DHNs operating at optimised lower flow and return temperatures by using high Delta T heat exchangers. The DHN provides the heat required by the ambient loop with the in-apartment WSHP stepping up the heat with minimal losses compared to well-designed conventional LTHW distribution networks through the building.

6.42 The ambient loop when connected to such a DHN can still make use of any heat recovery directly where there is a cooling requirement and of any on-site secondary heat from commercial buildings, thus delivering the lowest carbon emissions for the Development.

6.43 Any future or decarbonised DHNs in the local area should take account of the energy strategies of all planned new developments including North Quay during their feasibility and planning design stages as part of their viability assessments. This will include the requirement for lower temperature networks where required as part of a low carbon strategy for these networks.

6.44 Therefore, we consider ambient loops fully compatible with any well designed decarbonised 4th generation DHN and all future 5th generation DHNs.

6.45 Refer to drawing Z[--]098 for the location of the future heat network connection plantroom and the route for the site heat network pipework through the basement of the development.

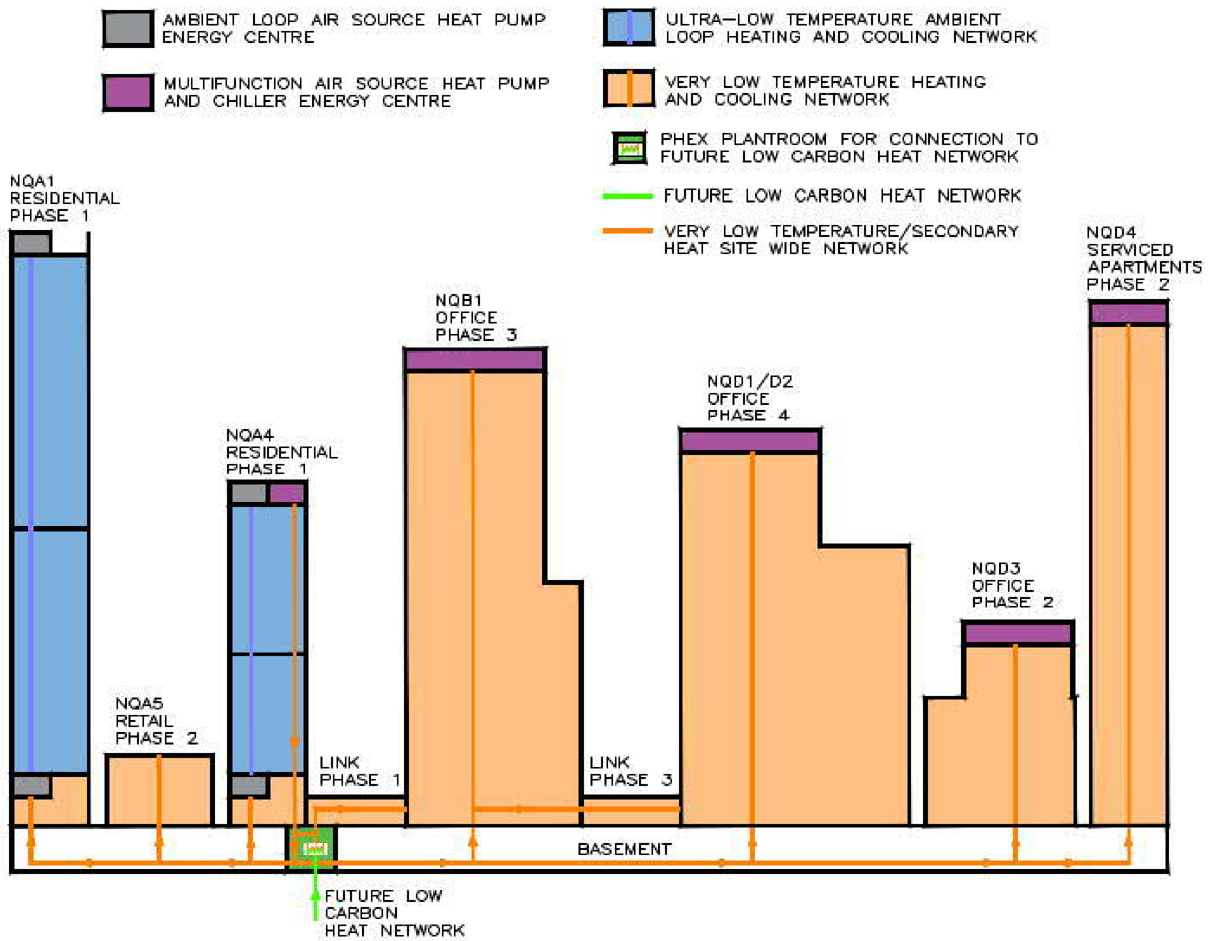


Figure 6.11: Future Low Carbon Heat Network Connection

MAX FORDHAM

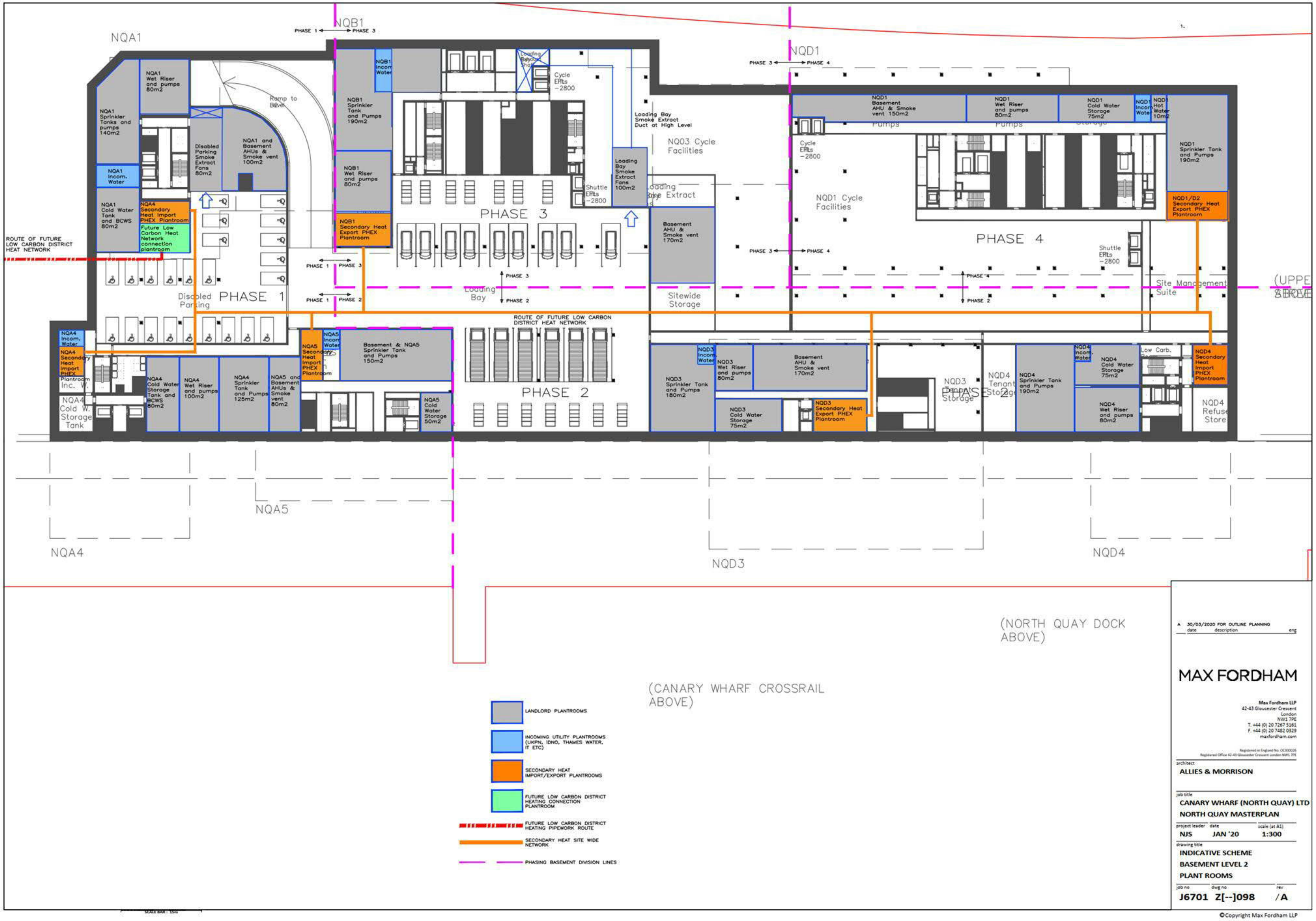


Figure 6.12: Future Low Carbon Heat Network Connection Plantroom and Site Wide Secondary Heat Network and Connection Plantrooms at Basement Level 2

7.0 'BE GREEN' - RENEWABLE ENERGY

7.1 In line with Policy 5.7 of the London Plan, a renewable energy assessment will need to be produced to confirm which renewable energy technologies are considered both practical and viable to serve each Major Development.

> **"Policy 5.7 Renewable Energy**
> *Major development proposals should provide a reduction in expected carbon dioxide emissions through the use of on-site renewable energy generation."*

7.2 Beyond their general viability there are two other key drivers within the London Plan to consider the installation of renewable energy systems. These are the general requirement of the GLA to have on-site emissions levels 35% lower than the Build Regulations TER and Policy 5.7 which states that 'There is a presumption that all major development proposals will seek to reduce carbon dioxide emission by at least 20% through the use of on-site renewable energy generation wherever feasible.'

7.3 With the revised SAP 10 carbon factor for grid electricity at 0.233kgCO2/kWh almost equal to gas at 0.216kgCO2/kWh, the best performing low carbon heat source is now an electrically powered heat pump. Heat pumps do not burn combustion fuel so they have no detrimental impact on local air quality. This is particular important given current regulation on air quality in London.

Low and Zero Carbon Technologies (LZTC)

7.4 The Site's suitability for connection to an existing heating or cooling network has been assessed in the previous section in line with the GLA's recommended hierarchy for selecting a heat source. Since this has been deemed unfeasible, the second option in the GLA hierarchy is to use a zero-emission or low carbon heat source.

7.5 The proposed buildings in the North Quay masterplan will be served by all-electric Air and Water Source Heat Pump systems, located on the roofs or within the buildings.

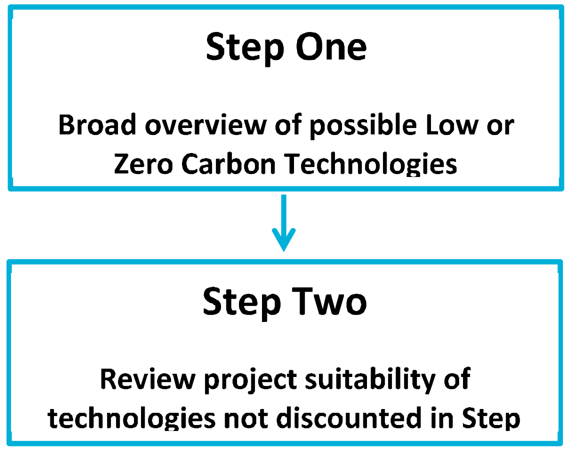
7.6 The site infrastructure will enable buildings across the Proposed Development to connect together to form a site wide network allowing secondary heat from commercial buildings to be used by residential buildings. In addition, space for a plantroom has been allocated to allow a single point of connection to a low carbon District Heat Network (DHN) in the future should one become available and it is viable to connect to it.

Inclusion of the carbon savings relating to the heat network in the energy hierarchy

7.7 As described in section 11.5 of the 2018 GLA guidance on preparing energy assessments the energy hierarchy has been produced taking into account the carbon dioxide emission reductions from connection to the proposed building-level heat networks served by heat pumps.

7.8 An assessment of renewable energy technologies has been made bearing in mind stages one and two of the energy hierarchy.

7.9 The list of possible Low and Zero Carbon Technologies (LZCTs) was reduced down to a short list of the most viable options following the following steps:



Step one identifies those LZCT that were discounted from the outset due to Site constraints. This reduced the initial list down to a size where more detailed information can be supplied in step two.

Step two looked in more detail how each LZCT suited the Site and the proposed building.

Step One

7.10 The following table shows which low or zero carbon technologies were discounted. The criteria used to determine the suitability of these technologies included the London Planning guidance, local planning criteria (Tower Hamlets) and whether they fitted with the measures proposed in stages one and two of the energy hierarchy. For some LZC technologies there are fundamental site constraints that make their use impractical or impossible. Where a technology is not selected for further analysis then a short explanation is provided to explain why.

7.11 The revised SAP10 carbon emission factors are used for the purposes of this LZC study.

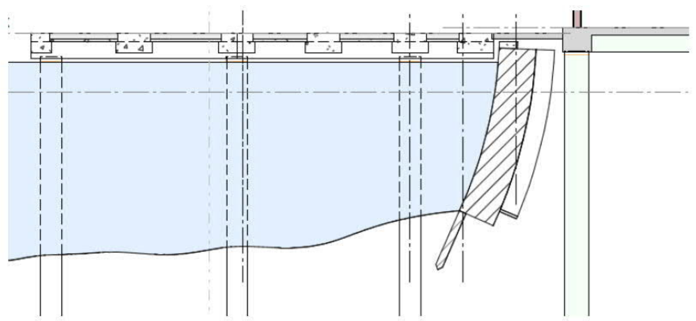
Proposed Technology	Initial Feasibility	Suitability
Combined Heat & Power (CHP)	The Draft London Plan and updated carbon factors mean this technology is no longer viable if carbon emissions targets are to be met. The air quality concerns are also an issue in dense areas such as Canary Wharf.	No
Energy from Waste (EfW)	There is no waste heat source in the vicinity of the Site which would be suitable.	No
Heat Recovery from Foul Drainage	There is potential to recover heat from the foul waste drainage systems in each building.	Yes
Photovoltaic Panels (PVs)	PV panels produce high grade energy. They are proposed at this OPA assessment stage. Refer to the detailed assessment in the next section.	Yes
Solar Thermal Panels	Solar thermal technologies will not work well in conjunction with the ambient loop ASHP systems for the residential or the 4-pipe heat pump solution for the commercial, so they have been discounted. They also compete for space on the roof for PVs.	No
Wind Power	Wind turbines produce high grade energy. There are visual and vibration issues which would arise, and as the Site is under a flight path this technology has not been considered further.	No
Biomass	The Site is in an inner-city area and an air quality management zone. Fuel would need to be sourced at a great distance from the Site and delivered to site by HGV. Biomass combustion and the emissions required to transport fuel to Site will likely result in an increase in local air pollution through the increased production and emission of particulates and NOx gases. Site constraints makes locating such an installation difficult, especially with the pressure on space for landscaping, gardens, and play areas. Therefore, this technology is not proposed to be investigated further.	No
Dock Cooling	It is not proposed to use dock water for heating and cooling for the following reasons: • the barrier of the listed banana dock wall creates an obstacle to running the pipework from the dock to the development;  • limitations set by the Environment Agency on the water temperature differential, the maximum return water temperature (25degC), and draw-off rates means there is limited capacity from the dock water compared to the size of the Proposed Development. • In particular in peak summer the water differential will be close to 3degC resulting in a small contribution compared to the overall development cooling requirements; • the dock is saltwater, due to the tidal influence of the River Thames, so the heat exchangers would need to be protected against this and so likely to require the use of expensive titanium systems.	No
Ground Water Cooling and Heating	There is potential for using this technology subject to detailed ground investigations into suitability of the ground water and to determine suitable locations that do not impact on basement functions. This would need to be considered under each RMA. There are a number of existing dewatering boreholes which connect to the chalk aquifer below the Site. These may be suitable for connecting to water source heat pumps for both heating and cooling purposes. The discharge water could also potentially be used for WC flushing and irrigation.	Maybe
Ground Source Heat Pump (GSHP)	A ground source heat pump installation requires a large ground array of boreholes which would be complicated to fit onto this constrained Site, especially with the additional constraint of the historic dock banana wall running across the south side of the Site. Also, as this is a commercially lead scheme there is a very large mismatch between heating and cooling loads which could result in the system performance reducing rapidly over time. Since Multifunction Air Source Heat Pumps can easily be incorporated and there is potential for ground water abstraction it is not proposed to review this technology further.	No
Air Source Heat Pump (ASHP)	Air source heat pump systems would be able to supply high efficiency heating, DHW and cooling to the residential and commercial spaces. Space is available on the roofs of the buildings to site this heat rejection plant externally. Heat recovery and ambient loop solutions make this technology the most cost effective and with the lowest embodied carbon	**Yes**
Anaerobic Digestion	Anaerobic digestion plant requires high level of maintenance to keep it running smoothly. Site constraints makes locating such an installation difficult, especially with the pressure on space for landscaping, gardens, and play areas. Therefore, this technology is not proposed to be investigated further.	No
Hydrogen Fuel Cells	Hydrogen Fuel Cells have limited market availability and they are commercially unproven in the UK. Hydrogen fuel supplies are not available at the scale for this development. Therefore, this technology has not been selected at this OPA stage. For later phase RMAs this could be reassessed.	**Maybe**

Table 7.1: Low and Zero Carbon Technologies feasibility assessment (Step One)

Step Two

7.12 This summary table sets out the advantages, disadvantages and project suitability of the LZCTs deemed credible from Step One.

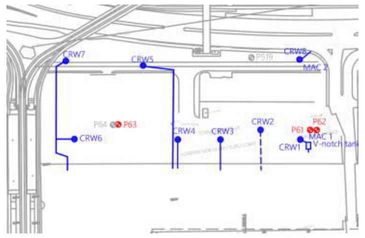
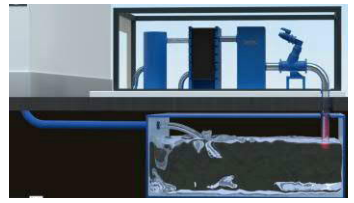
					
Technology Name	**Photovoltaic (PV) Panels**	**Air Source Heat Pump (ASHP)**	**Ground Water Cooling**	**Water Source Heat Pump (WSHP)**	**Heat Recovery from Foul Drainage Waste**
Location	External building mounted, roof level, where unshaded	Externally to achieve the highest possible efficiencies	Abstraction boreholes at perimeter of basement to the north of the Site. Discharge to dock.	Internal plantroom of the building or utility cupboard of residential building	At the base of each building drainage network.
Load	Generates electricity, feeding into the building's electricity supply	Generates Low Temperature Hot Water (LTHW) which can be used for heating and Domestic Hot Water (DHW), and cooling	Used for cooling system heat rejection. Can also be used for heating system heat extraction.	Takes heat from ambient loop or ground water to heat refrigerant. Used for either higher grade heat for domestic hot water or for heating and cooling.	Recovers heat from wastewater otherwise sent to sewer.
Advantages	• Easy to install • Easy to connect services • Light weight, low plant space requirements • Zero carbon electricity • Easy 'bolt on' renewable technology • Modular, so additional PV panels can be added in the future	• Potentially High efficiency method of producing heat, especially if used within an ambient loop system with in-apartment secondary heat pumps. • Can be reversible to provide both cooling and heating during summer months from the same plant area, ideal given mixed-use proposals for the Site. • Can provide simultaneous heating and cooling giving very high efficiencies	• Very high efficiencies for heating and cooling via water cooled chillers and water source heat pumps. • Can be used directly for ambient loop systems. • Free source of heat rejection • Plant is internal so concealed from view and noise control. • Water can also be used for WC flushing (dependent on water quality).	• Heat is extracted from a water source or ambient loop to heat/cool the building and to generate hot water. • Very low system losses. • Plant is internal so concealed from view and noise control. • Can provide simultaneous heating and cooling giving very high efficiencies.	• Free source of heat from wastewater • Easy to connect to drainage on tall buildings • Compatible with low temperature heat networks
Disadvantages	• Relatively low efficiency compared to other LZCT technologies e.g. solar thermal • High capital cost • Large area of panels required to generate a meaningful amount of electricity • Requires direct sunshine to function efficiently • Competes with roof space for public amenity uses.	• Higher capital costs • Units generate noise which must be assessed to ensure it does not create a nuisance • Takes up external space which could be used for other functions • Lower efficiencies when generating DHW	• Borehole installations are expensive • Abstraction flow rates can change over time. • EA limits on return temperatures to aquifer or dock	• Requires consistent water source that can be an ambient loop or external water source if available. • Ambient loop systems are fairly new technology.	• New technology • Small scale reference projects
Project Suitability	• There are a number of roof areas on the commercial buildings across the masterplan that can be used for the installation of PV arrays. • The ambient loop ASHP system's efficiency means that no further renewable technologies are needed for the residential buildings to achieve the target carbon emissions reductions. Therefore, PVs are not proposed on the residential buildings.	• This technology is ideally suited to this Site, and units can be located on the roofs of each building and also ducted units can also be installed on plant floors on the residential buildings.	• There are a number of existing dewatering boreholes on Site that may be suitable to be converted to abstraction boreholes for heating and cooling use.	• Domestic WSHP can generate heating, cooling and hot water at each apartment in the residential buildings with minimal heat losses. • Depending on ground water suitability could be a secondary heating and cooling source for the commercial buildings.	• Relatively easy to integrate into drainage network and integrate into building-level low heat networks or the site wide secondary heat network, so likely to be suitable.
Proposed?	**To be considered on an individual building basis subject to over-shading assessment**	**Yes**	**Maybe, subject to further investigations within each Reserved Matters Application.**	**Yes**	**To be considered on an individual building basis in each Reserved Matters Application.**

Table 7.2: Advantages, disadvantages and project suitability of the LZCTs deemed credible from Step One

Solar Photovoltaic Panels

7.13 The GLA Planning Energy Assessment Guidance (October 2018) states:

"11.2 The GLA expects all major development proposals to maximise on-site renewable energy generation. This is regardless of whether a 35 per cent target has already been reached through earlier stages of the energy hierarchy. In particular, solar PV should be maximised on roof spaces."

7.14 A low carbon and renewable technology feasibility study has been undertaken for the Indicative Scheme. The study concluded that solar PV panels were an appropriate technology for the buildings to reduce the carbon emissions and comply with planning requirements for onsite energy generation.

7.15 In response to the GLA guidance the current energy strategy maximises the available roof area for PV panels over the unshaded roof areas of the buildings within the Indicative Scheme.

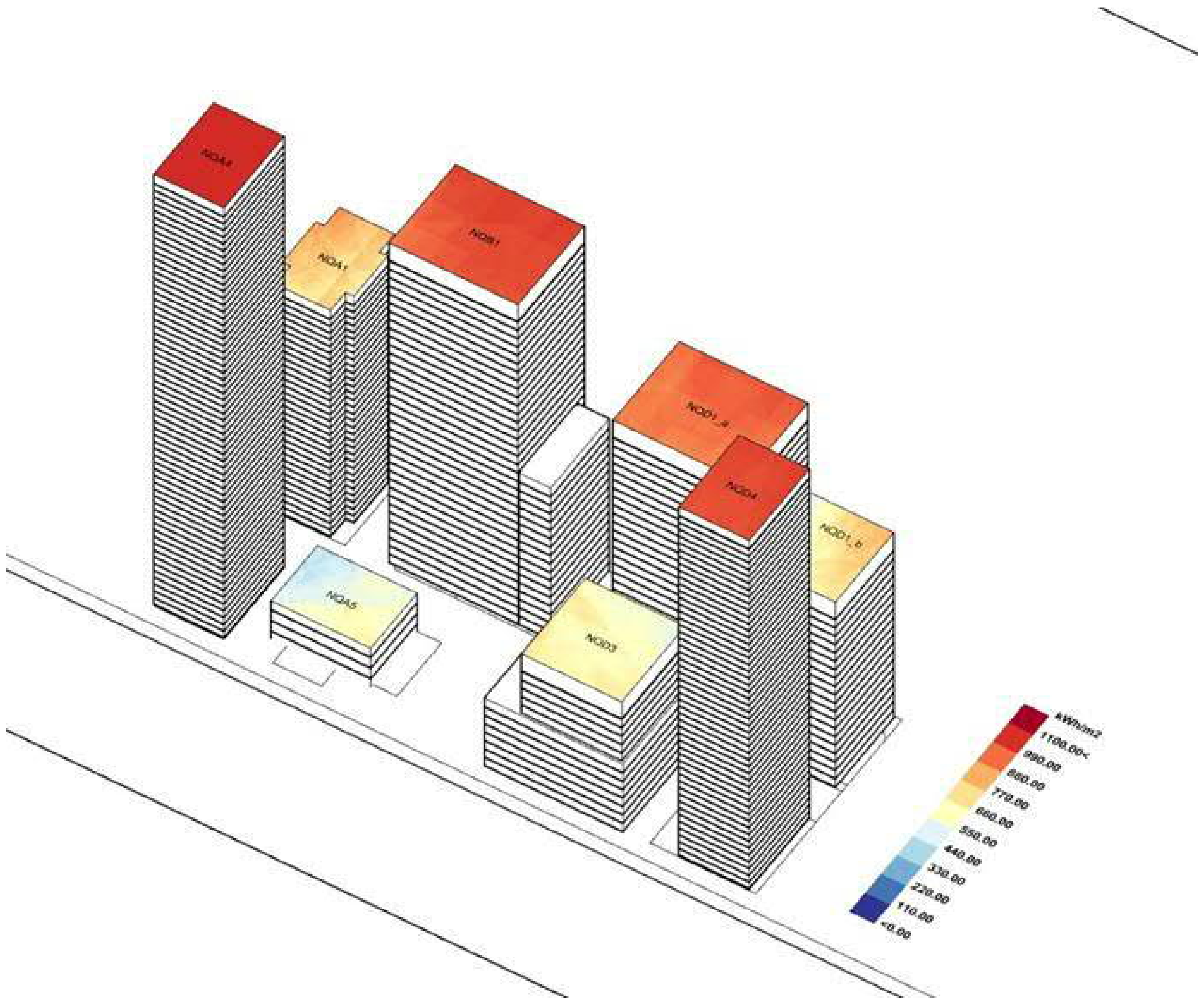


Figure 7.1: 3D coordinated view of external areas suitable for PV installation

Plant Data	Roof Area (m²)	5828
	PV Area (m²)	2910
	Annual Energy Generated (kWh/m²)	117
	Annual Energy Generated (kWh)	341,143
	Pitch (°)	10
CO_2 Emissions	Net CO_2 Saving (tCO_2/year)	11.9
	Net CO_2 Saving (% Regulated Load)	0.17

Table 7.3: Summary of key results from site-wide Photovoltaic Potential.

7.16 The layout in figure 7.2 shows the roof areas on each building within the Indicative Scheme suitable and available for the installation of PV panels. Other roof areas are either not suitable due to overshadowing, are used as roof terraces for public access, or are used for ASHP and Chiller unit installation. Refer to drawing Z[--]131 in Appendix B for further details.

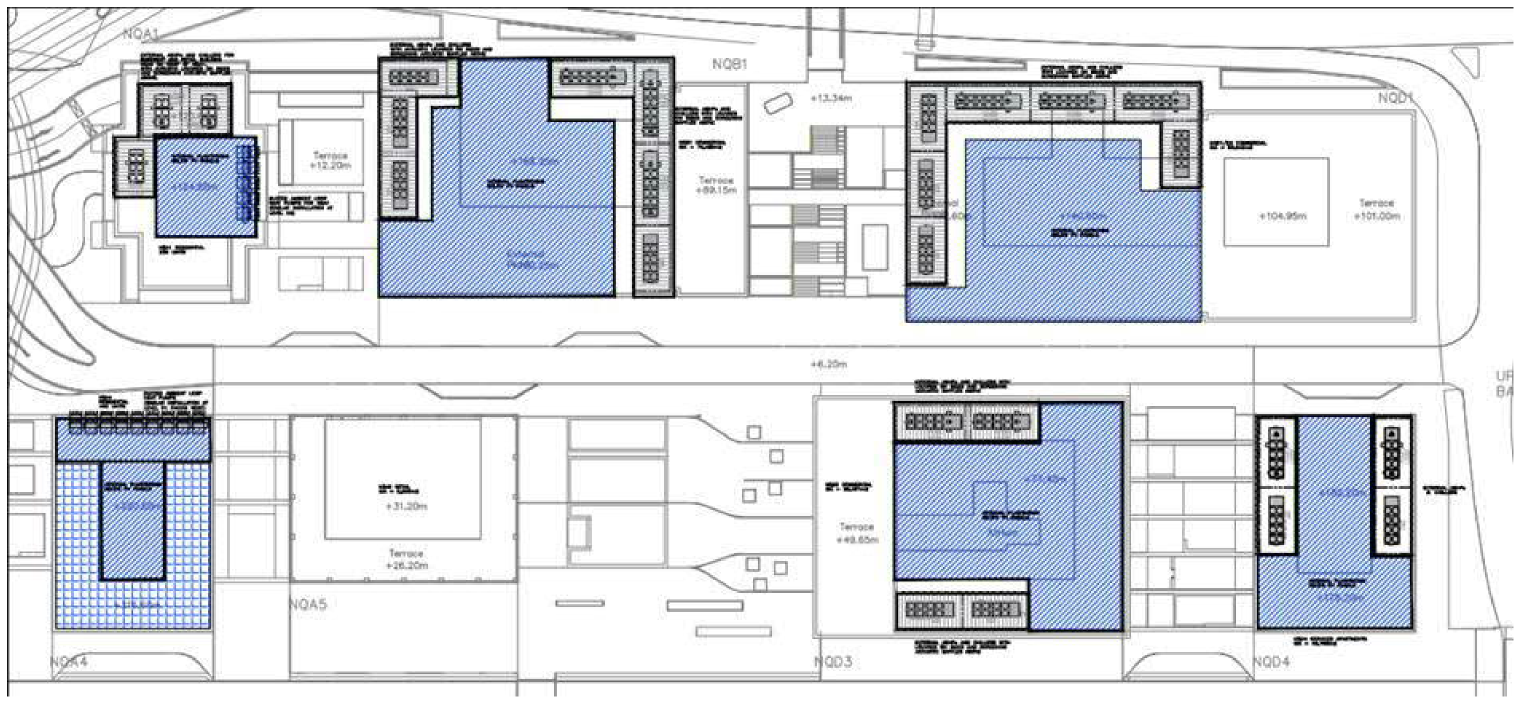


Figure 7.2: Roof areas on each building of the Indicative Scheme available and suitable for PV installation (in blue)

Residential Buildings Air Source Heat Pumps (ASHP)

7.17 The heating energy strategy for each residential building within the masterplan is to use Ultra-Low Temperature water heat distribution to local water-cooled heat pumps. This approach involves ASHPs which produce heat for an ultra-low temperature building level heat network.

7.18 Local water source heat pumps within each dwelling produce space heating and hot water (with option for cooling) at appropriate temperatures.

- Main heat source: Air source heat pumps
- Distribution: Ultra low temperature water
- Secondary heat source: Water source heat pumps (can provide heating, DHW, and cooling)

7.19 The system uses an external air source heat pump to generate warm water. This warm water is then circulated around the building at low temperatures (circa 25°C). The distribution losses are therefore significantly lower than a conventional system (which would have water temperatures around 55-70°C, depending on the system choice), and once a space reaches 25°C they become zero. As these losses are lower, the risk of overheating in corridors and other circulation spaces is significantly reduced.

7.20 In-apartment water to water heat pumps then produce warm water at suitable temperatures for both domestic hot water production and space heating. These in-apartment proprietary units contain a hot water tank, water to water heat pump, and associated controls.

Benefits:

- Configuration of dispersed heat pumps is done entirely by manufacturer;
- Heat pumps fairly optimised providing good efficiencies;
- Negligible distribution losses in communal network;
- Easy to adapt to provide cooling in warmer/future climates or due to acoustic constraints;
- Benefits from heat recovery where cooling is installed;
- Not manufacturer specific - easy to adapt infrastructure to emerging heat pump technology:
- Compatible with very low temperature secondary heat networks, low carbon heat district networks and ground water networks.

7.21 Ultra-Low Temperature Ambient Water heat distribution has a lower total COP compare to a Heat Pump District System as there are two heat pump stages, but the overall system losses are only 2.5-5% of the district system which can be up to 50% of the total heat delivered to an apartment. The COP of the Ambient Loop system increases significantly when there is a simultaneous heating and cooling demand, as is the case on the Site due to noise levels from Aspen Way and the DLR lines.

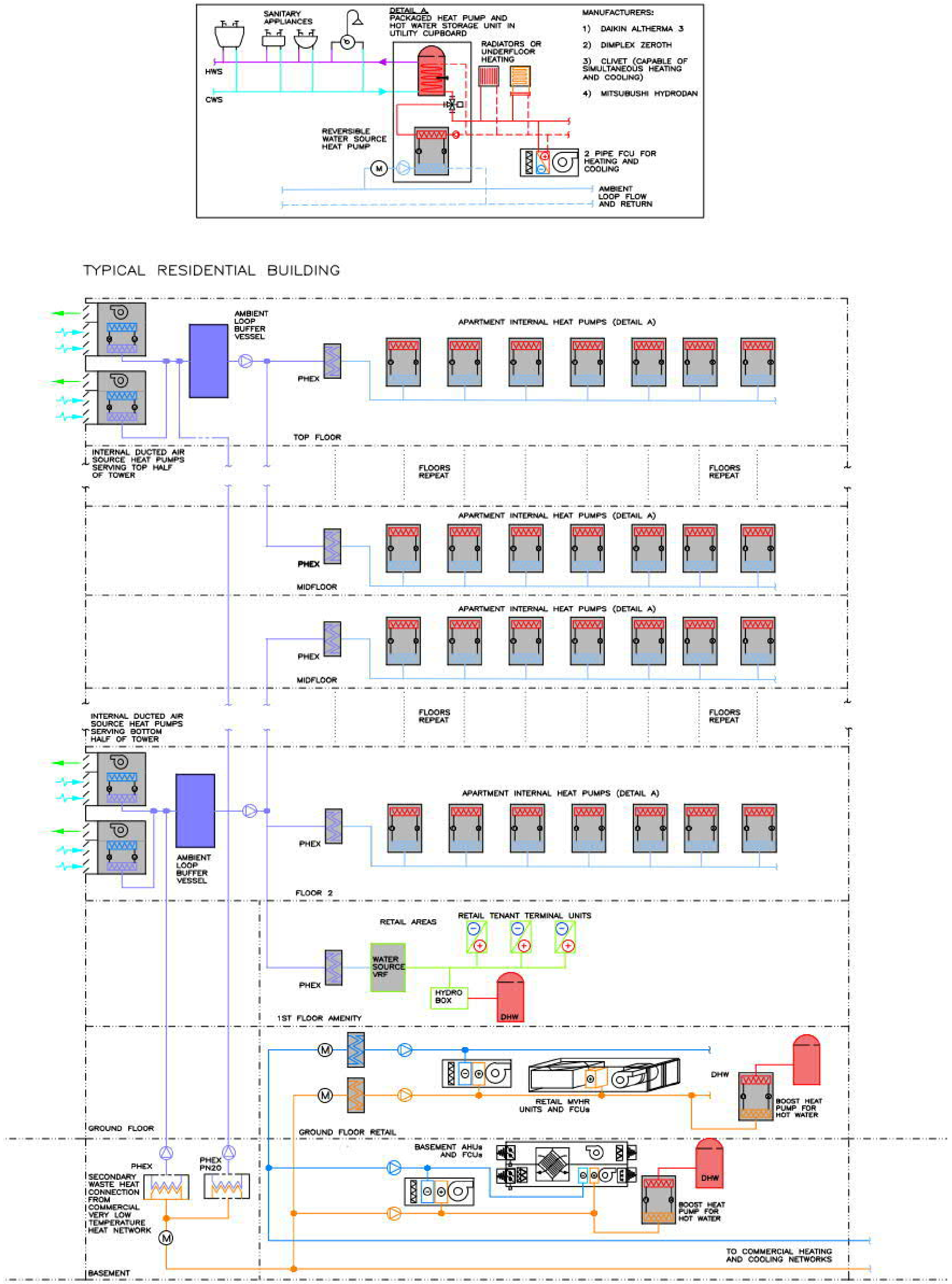


Figure 7.3: Principles of the Ultra-Low Temperature Water Ambient Loop System for a Typical Residential Building

Commercial Buildings Multifunction Air Source Heat Pumps (ASHP)

7.22 It is proposed that the heating and cooling to the commercial and retail buildings is provided by building-level heating and cooling networks using multi-function 4-pipe Air Source Heat Pumps located on the roof of each building, together with high efficiency reversible heat pumps and chillers for peak loads.

7.23 The multifunction heat pump technology provides simultaneous heating and cooling thus delivering very high seasonal efficiencies. For commercial buildings there is a simultaneous demand for much of the year due to the significant cooling loads from internal people and equipment casual gains etc. Surplus secondary waste heat can be exported to the residential buildings within the Proposed Development.

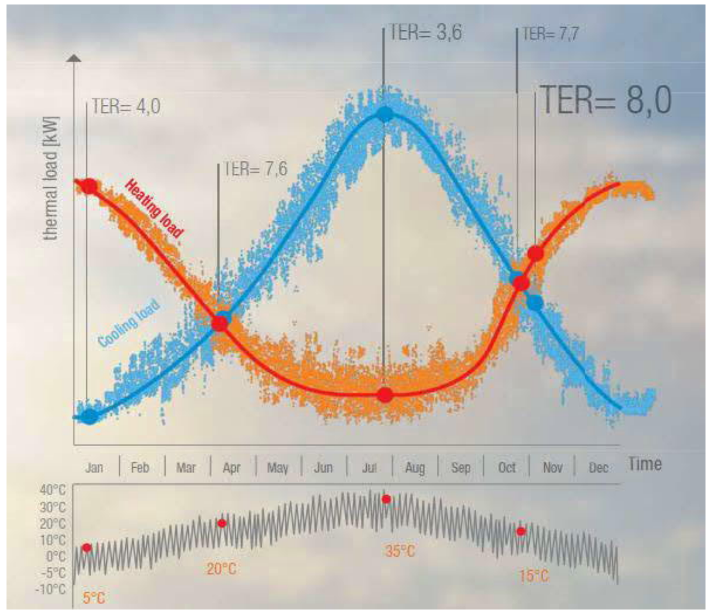


Figure 7.4: Multifunction Air source heat pump *principle of operation (Mitsubishi/Climaveneta Integra)*

7.24 The heat pumps and chillers could also be selected with inverter technology with continuous variable speed which can provide significant improvements in part load efficiency compared to fixed speed multi-purpose units.

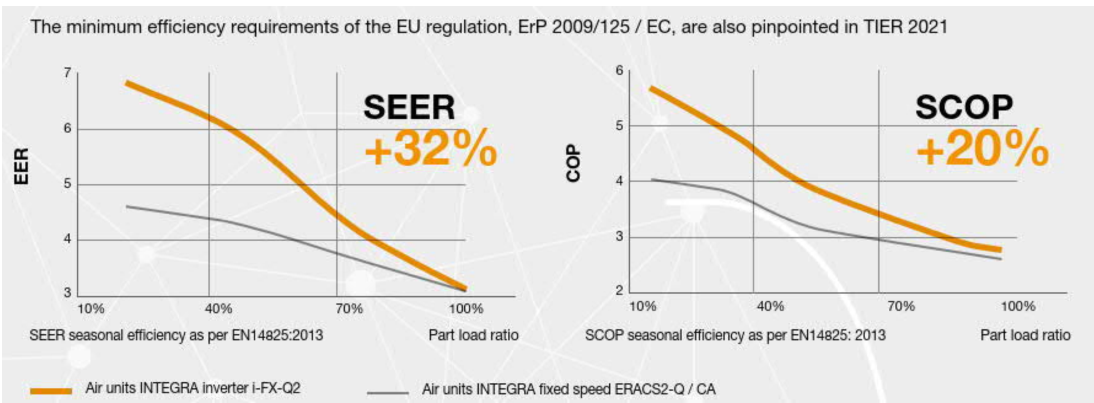


Figure 7.5: Air Source Heat Pump part load efficiencies using inverter technology (Mitsubishi/Climaveneta Integra)

7.25 Selections will consider innovative green refrigerants to minimise environmental impact (very low GWP).

7.26 Selections will consider acoustic casings and screening to minimise noise break-out to external receptors and to any residential buildings within the Proposed Development.

7.27 High temperature Water to Water Heat Pump boosters could be used for the hot water production and high temperature heating emitters. The hot water heat pump condenser circuits would connect to the low grade LTHW network generated by the 4-pipe multifunction water source heat pumps. With this type of solution hot water production can be generated anywhere in the building with high efficiencies. The distribution of heat within the building at a very low temperature significantly reduces the system losses.

7.28 4-pipe heat pumps have a smaller footprint compared to equivalent separate cooling chillers and heating heat pumps, so plant space is optimised. 4-pipe heat pumps can also be fitted with connections on the condenser to allow very hot water to be produced increasing the over system efficiency.

7.29 Thermal storage will be used to smooth out non-coincident heating and cooling energy demands within and between buildings, and to reduce peak loads on each system.

7.30 Figure 7.6 presents the principles of the Very-Low Temperature Heating and cooling network for a typical large office for the Indicative Scheme. Refer also to the phasing outline schematic drawings in Appendix A for details of the network configurations in each building and the secondary heat connections between buildings.

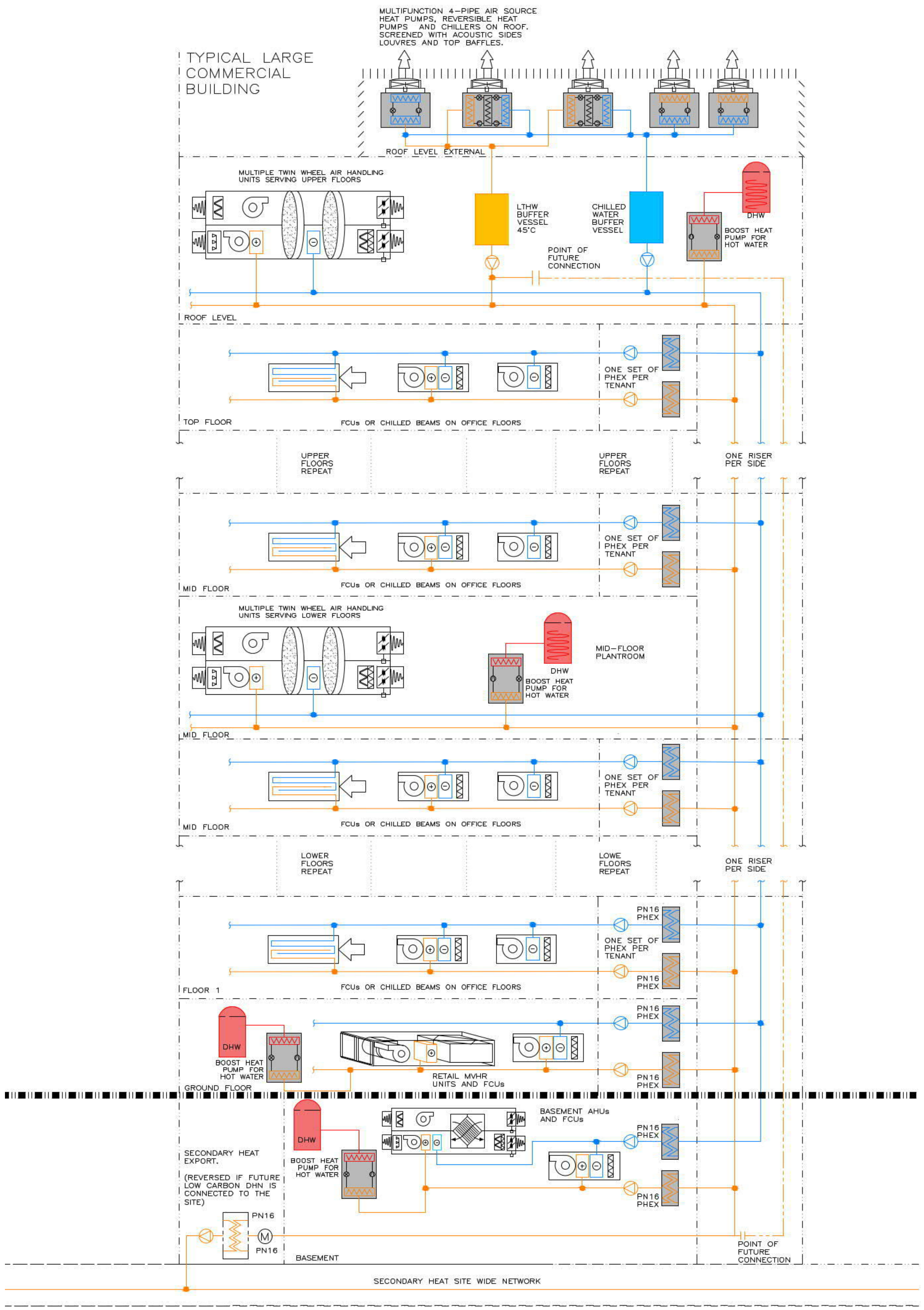


Figure 7.6: Principles of the Very-Low Temperature Heating System for a Typical Large Commercial Building

Serviced Apartment Building Air Source Heat Pumps

7.31 The heating and cooling energy strategy for the flexible use buildings is similar to the commercial buildings.

7.32 Multifunction air source heat pumps and chillers will generate the heating and cooling water, with water source boost heat pumps or separate Q-ton CO2 heat pumps producing the hot water centrally. Each serviced apartment or student study room would have a two pipe Fan Coil Unit or radiant ceiling system for comfort heating and cooling.

7.33 The Q-ton is an air-to-water heat pump using CO2 gas as a refrigerant (so has a Global Warming Potential GWP = 1). These ASHPs are designed specifically for buildings such as hotels, serviced apartments and student accommodations where heating energy is dominated by the supply of sanitary hot water. It has a two-stage compressor (combining rotary and scroll technology) so maintains very high efficiency at high temperatures and low outside air temperatures compared to other technologies. It has a COP of 4.3 in the intermediate season when delivering hot water at 65degC and a COP of 2.8 at -7degC when delivering hot water at 90degC.

Ground Water

7.34 There are a number of existing dewatering boreholes on the Site which draw ground water from the chalk aquifer below the Site. These boreholes may be suitable for providing part of the heating and cooling loads for some of the buildings within development via water source heat pumps, subject to testing and approval of a change of use by the Environment Agency. The viability would need to be established under each RMA.

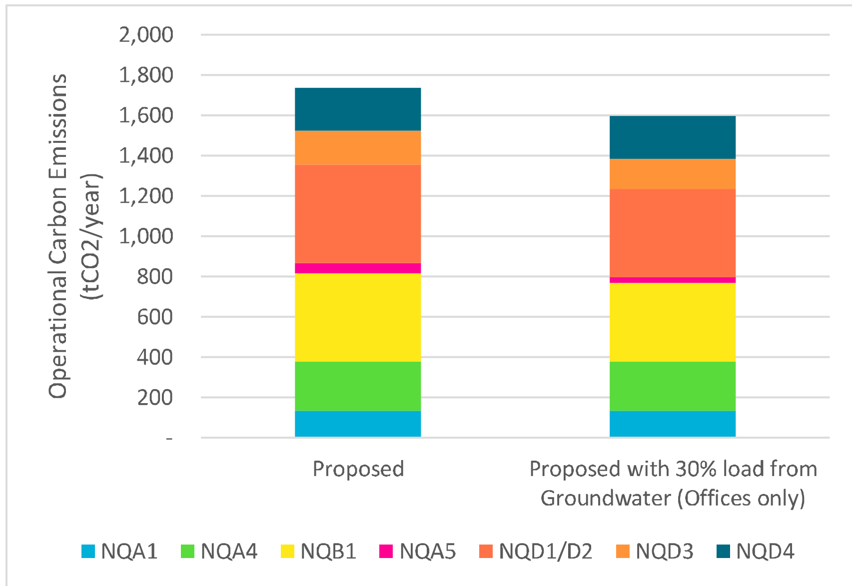


Figure 7.7: Potential benefit of using ground water for 30% of the heating and cooling load for the offices within the Indicative Scheme.

8.0 "Be Seen" Energy Monitoring

Smart Controls and Energy Metering

8.1 All buildings will have smart metering installed to measure heat, electricity and water usage.

8.2 Residential dwellings will have their own individual heating, ventilation and cooling controls. These controls should allow for zoning within the dwellings and include timers.

8.3 Good intuitive well set-up control is central to the low energy strategy of the commercial buildings.

8.4 Comprehensive metering of all electrical, heating and cooling energy use to all areas of each building will give the Facilities Management team clear sight of what is drawing power or heat, to allow ongoing improvements. This could be linked to a Soft Landings commissioning approach to ensure that the building operates as originally intended by the design team.

8.5 The controls could be extended to monitoring occupancy by using the WiFi signals from smartphones etc to further optimise the running of the building systems based on actual usage patterns during each season.

8.6 The buildings could incorporate converged building network set-up with intelligent systems. This would look at a network of control interfaces (including apps), meeting room and resources booking systems, analytics tools associated with data pulled from smart devices.

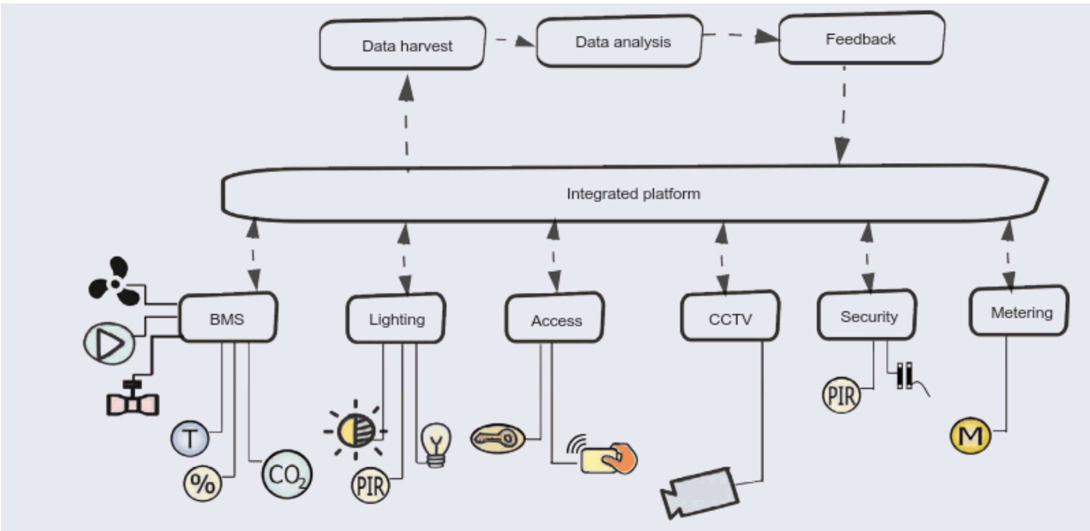


Figure 8.1 Diagram of a converged building systems approach.

8.7 All major items of plant equipment will be monitored and the systems will be monitored to enable a minimum of 90% of the energy used in the building to be easily attributed to an end use, including the provision of meters to allow separate metering of lighting and small power, to comply with Building Regulations Part L.

9.0 Building Properties

9.1 The tables below outline the prescriptive requirements and industry recommended values for the properties of various building elements and building services (insulation, air tightness, equipment efficiencies etc.). This is then followed with details of the actual building element properties proposed for the development to exceed these requirements. The exact performance specifications for each building will depend upon factors such as the detailed facade design but the intention at RMA stage is to aim to achieve or exceed the proposed values set out in these tables.

Residential

Element	Building Regulations Part L1A Notional Building	Proposed North Quay Residential Buildings
External Wall U-value W/(m2.K)	0.18	0.14
Floor U-value W/(m2.K)	0.13	0.11
Roof U-value W/(m2.K)	0.13	0.11
Window U-value W/(m2.K)	1.4	1.0-1.2 (including framing)
G-value (%)	0.63	0.4
Light transmittance (%)	0.8	0.7
Air permeability m3/(m2.hour)	5	3
Y-value (thermal bridging)	0.15	0.10
Ventilation Type	Mechanical Extract Ventilation MEV and natural ventilation for summer comfort	Mechanical Ventilation with Heat Recovery MVHR.
Cooling	None	Due to noise levels across the site cooling will be required.

Table 9.1: Proposed Domestic Building Fabric Performance

Service	Building Services Compliance Guide (2013 with 2018 amendments)	Proposed Development Values	Notes
Ventilation	70% Heat Recovery; 1.5W/l/s	85% Heat Recovery; 1.3Wl/s	
Heating	Efficiency 88% (gas boiler)	COP 2.39	Ambient Loop with second stage. Distribution Loss Factor DLF= 1.05
Cooling	EER 2.4	EER 2.32 (excluding heat recovery)	Ambient Loop with second stage
DHW	Efficiency 88% (gas boiler) COP 2.0 for ASHPs	COP 2.1 (excluding heat recovery from cooling)	Ambient Loop with second stage. Distribution Loss Factor DLF= 1.05
Lighting	Efficiency 45 lumens/W	Efficiency 60 lumen/W	

Table 9.2: Domestic Building Services Properties

Commercial and Retail

Element	Building Regulations Part L2A Notional Building	Proposed North Quay Commercial Buildings
External Wall U-value W/(m2.K)	0.35	0.15
Floor W/(m2.K)	0.25	0.13
Roof U-value W/(m2.K)	0.25	0.13
Windows and transparent curtain walling (whole window, i.e. inc. frames) W/(m2.K)	2.2	1.2
Roof windows and glazed roof-lights (whole window, i.e. including frames) W/(m2.K)	2.2	1.2
High-usage entrance doors	3.5	2.20
g-value	n/a	0.15 to 0.27
Light transmittance %	n/a	50 to 60%
Rooflight g-value	n/a	0.22
Rooflight light transmittance	n/a	0.50
Air permeability ($m^3/(h.m^2)$) at 50 Pa)	10.0	3.0
Linear thermal transmittance (W/(m.K))	n/a	10% of U-value equivalent

Table 9.3: Proposed Non-Domestic Building Fabric Performance

Service	Building Services Compliance Guide (2013)	Notional Building	Proposed Development Value	Notes
Ventilation	Central: 1.6 W/l/s Terminal 0.5W/l/s Heat Recovery 65%	Central 1.8W/l/s Terminal 0.3W/l/s	Central: 1.6 W/l/s Terminal 0.3W/l/s Heat Recovery 85%	
Heating	91% (gas boiler) COP 2.5 for ASHP	91% (gas boiler)	COP 4.5	4-pipe heat pump
Cooling	EER 2.6 (air cooled)	SEER 4.5 SSEER 3.6	EER 4.5	4-pipe heat pump
DHW	90% (gas boiler)	90% (gas boiler)	COP 2.4	4-pipe heat pump with second stage
DHW (NQD4)	90% (gas boiler)	90% (gas boiler)	COP 3.7 DLF 10%	High Temperature CO2 ASHP
Lighting	Efficiency 60 lumens/W	60 lumens/W	Efficiency 100lumens/W	

Table 9.4: Non-Domestic Building Services Properties

9.2 A number of ancillary spaces are located in the proposed basement. All accommodations areas in the basement are currently proposed to have the same building services installed as the above ground commercial areas. Other spaces in the basement are treated as follows:

- The car parking and loading bay are untreated spaces;
- Electrical plant rooms have cooling only;
- All other plant rooms are heated for frost protection;
- Front of house rooms, such as lift lobby areas, are provided with heating and cooling.

4-Pipe Heat Pump Annual Performance Calculation

9.3 The performance of the 4pipe system is dependent upon the coincident heating and cooling demand. Consequently, a study was undertaking to predict the performance of a system at a block level based on the predicted heating and cooling loads. The assessment took an entire year's load profiles and correlated this against typical performance data. This was then weighted against the size of load and averaged for an entire year to determine the average COP.

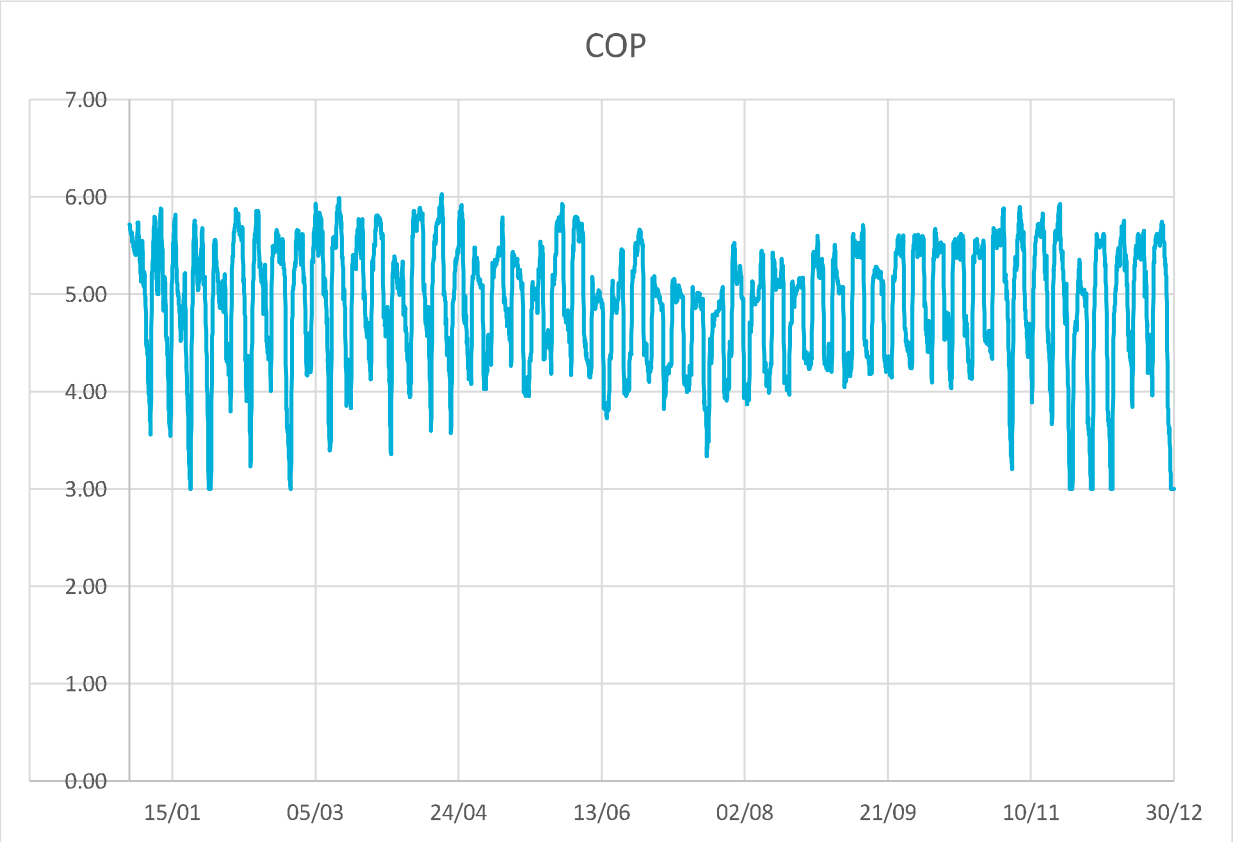


Figure 9.1: Daily Average COP of performance based on the relative loading for a typical office.

10.0 Carbon Emissions Results

Carbon Factors

10.1 CO2 emissions have been calculated in line with the GLA 2018 guidance.

- Building Regulations Part L Compliance used SAP 2012 carbon factors
- The London Plan Energy Hierarchy used SAP10 carbon factors

Fuel type	Fuel Carbon Factor (kgCO2/kWh)	
	SAP 2012	SAP 10
Natural Gas	0.216	0.210
Grid Electricity	0.519	0.233

Table 10.1: Natural Gas and Electricity Carbon Emission Factors for SAP12 and SAP 10

10.2 The current building regulations methodology was used to estimate the energy performance against Part L 2013. The outputs were then converted with the SAP 10 emissions factors using the GLA spreadsheet. The spreadsheet is included in Appendix C.

10.3 These emission rates may change over the life of the development build out as the UK electricity grid continues to decarbonise and this would change the overall emissions produced by the buildings.

Methodology

10.4 A BER has been calculated in line with the Building Regulations Part L 2013 methodology and the National Calculation Method (NCM).

10.5 The carbon factors used to calculate these figures have then been converted using the latest version of the GLA spreadsheet. This incorporates the revised carbon factors stated earlier in the report.

Building Type	Building Area	Energy Modelling Software Used
Commercial	Office including retail	IES
Residential	Typical Apartments	SAP10
Retail	Standalone and in residential	IES
Basement	Plantrooms, cycle facilities, leisure, offices, facilities.	IES

Table 10.2: Energy Modelling Software used for each building type.

10.6 Energy modelling for Compliance was carried out using IES VE 2019 VE-Compliance. Details of the results of these calculations can be found in Appendix C for the 'Be Lean' and 'Be Green' stages respectively.

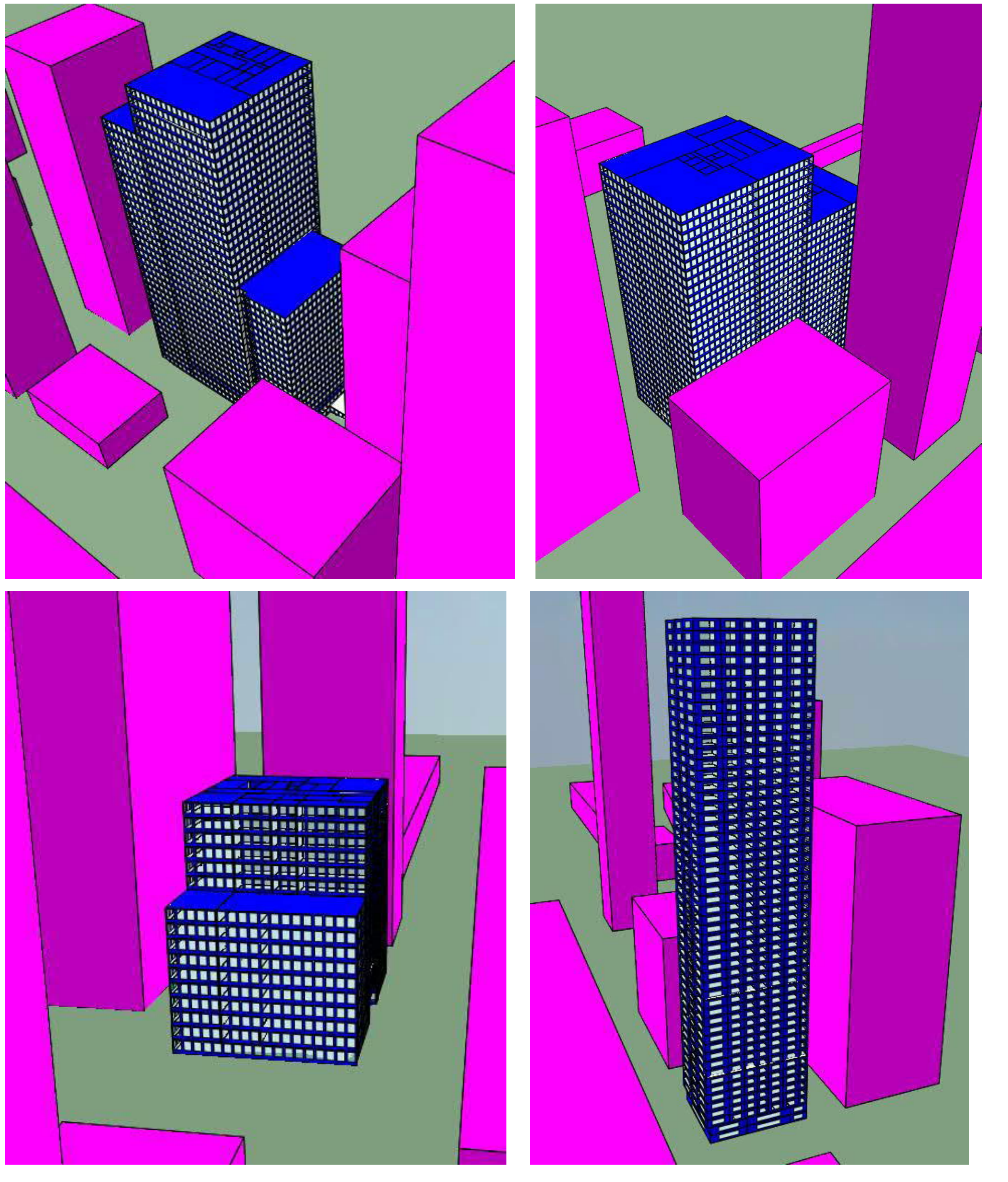


Figure 10.1 Views of the IES non-domestic thermal model. For NQB1, NQD1/D2, NQD3 and NQD4
Note each block was calculated separately.

Summary of Energy Assessment Results

Non-domestic.

10.7 As can be seen in the tables below, the target of 15% carbon emissions reduction at 'Be Lean' has been achieved. However, the percentage savings achieved at 'Be Green' stage are far higher than the minimum 35% required by the London Plan. The current non-domestic emissions savings following 'Be Green' stage is 47%.

	Regulated non-domestic carbon dioxide savings	
	(Tonnes CO_2 per annum)	(%)
Be Lean: Savings from energy demand reduction	443	18
Be Clean: Savings from heat network	-	0
Be Green: Savings from renewable energy	709	29
Cumulative on-site savings	1,151	47
Carbon Shortfall	1,292	
	(tonnes CO2)	
Cumulative savings for offset payment	38,760	
Cash-in-lieu contribution (£95 tonne CO2)	£3,682,200	

Table 10.3: Regulated Carbon Dioxide Savings for the Indicative Scheme Non-domestic buildings at each stage of the energy hierarchy. Buildings NQA5, NQB1, NQD1/D2, NQD3 and NQD4

	Carbon Dioxide Savings (tonnes CO_2 per annum)	
	Regulated	Unregulated
Baseline: Part L 2013 of the Building Regulations Compliant Development	2,443	1,737
After energy demand reduction (be lean)	2,000	1,737
After heat network connection (be clean)	2,000	1,737
After renewable energy (be green)	1,292	1,737

Table 10.4: London Plan Energy hierarchy table for regulated and unregulated carbon dioxide savings (non-domestic)

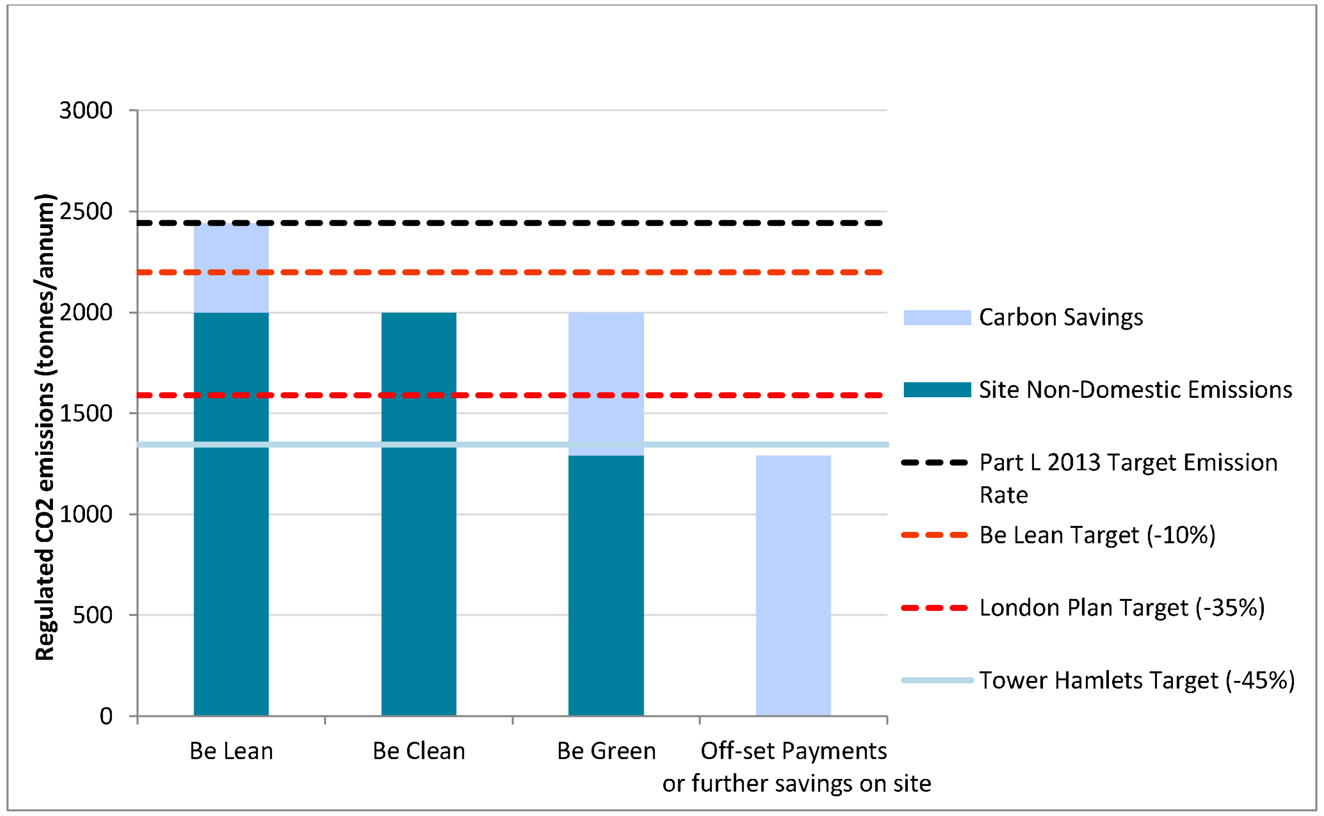


Figure 10.2: Site-wide energy hierarchy graph and targets (non-domestic)

Building Regulations Part L2A (Non-domestic) Results

10.8 The energy modelling shows that the overall development passes the requirement for Building Regulations Part L2A Compliance (SAP2012 carbon factors).

Part L 2013 BER (building emission rate)	BER kg/CO2/m2/y	TER kg/CO2/m2/y	Result BER < TER	Reduction
	23.5	14.9	Y	47%

Table 10.5: Building Regulations Part L2 Results – kg/CO2/m2/year

Domestic

10.9 As can be seen in the tables below, the target of 10% carbon emissions reduction at 'Be Lean' has been achieved. However, the percentage savings achieved at 'Be Green' stage are far higher than the minimum 35% required. The current domestic emissions savings following 'Be Green' stage is 53%. This increases to 64% including the energy contribution from the secondary waste heat from the commercial buildings.

	Regulated domestic carbon dioxide savings	
	(Tonnes CO_2 per annum)	(%)
Be Lean: Savings from energy demand reduction	90	13%
Be Clean: Savings from heat network	-	0%
Be Green: Savings from renewable energy	269	40%
Cumulative on-site savings	**360**	**53%**
Carbon Shortfall	314	-
	(tonnes CO2)	
Cumulative savings for offset payment	**9,424**	
Cash-in-lieu contribution (30 years @ £95 tonne CO2)	**£895,249**	

Table 10.6: Regulated Carbon Dioxide Savings for the Indicative Scheme Domestic buildings at each stage of the energy hierarchy. Buildings NQA1 and NQA4

	Regulated domestic carbon dioxide savings	
	(Tonnes CO_2 per annum)	(%)
Be Lean: Savings from energy demand reduction	90	13%
Be Clean: Savings from heat network	-	0%
Be Green: Savings from renewable energy (including secondary waste heat contribution from commercial buildings)	340	40%
Cumulative on-site savings	430	**64%**
Carbon Shortfall	243	
	(tonnes CO2)	
Cumulative savings for offset payment	**7,301**	
Cash-in-lieu contribution (30 years @ £95 tonne CO2)	**£693,585**	

Table 10.7: Regulated Carbon Dioxide Savings for the Indicative Scheme Domestic buildings at each stage of the energy hierarchy (including energy contribution from the secondary waste heat from the commercial buildings). Buildings NQA1 and NQA4

	Carbon Dioxide Savings (tonnes CO_2 per annum)	
	Regulated	Unregulated
Baseline: Part L 2013 of the Building Regulations Compliant Development	674	458
After energy demand reduction (be lean)	584	458
After heat network connection (be clean)	583	458
After renewable energy (be green)	314	458

Table 10.8: London Plan Energy Hierarchy table for regulated and unregulated carbon dioxide savings (Domestic)

	Target Fabric Energy Efficiency (MWh/year)	Design Fabric Efficiency (MWh/year)	Improvement (%)
Development total	35.27	25.41	28%

Table 10.9: Building Regulations Part L Results – kg/CO2/m2/year

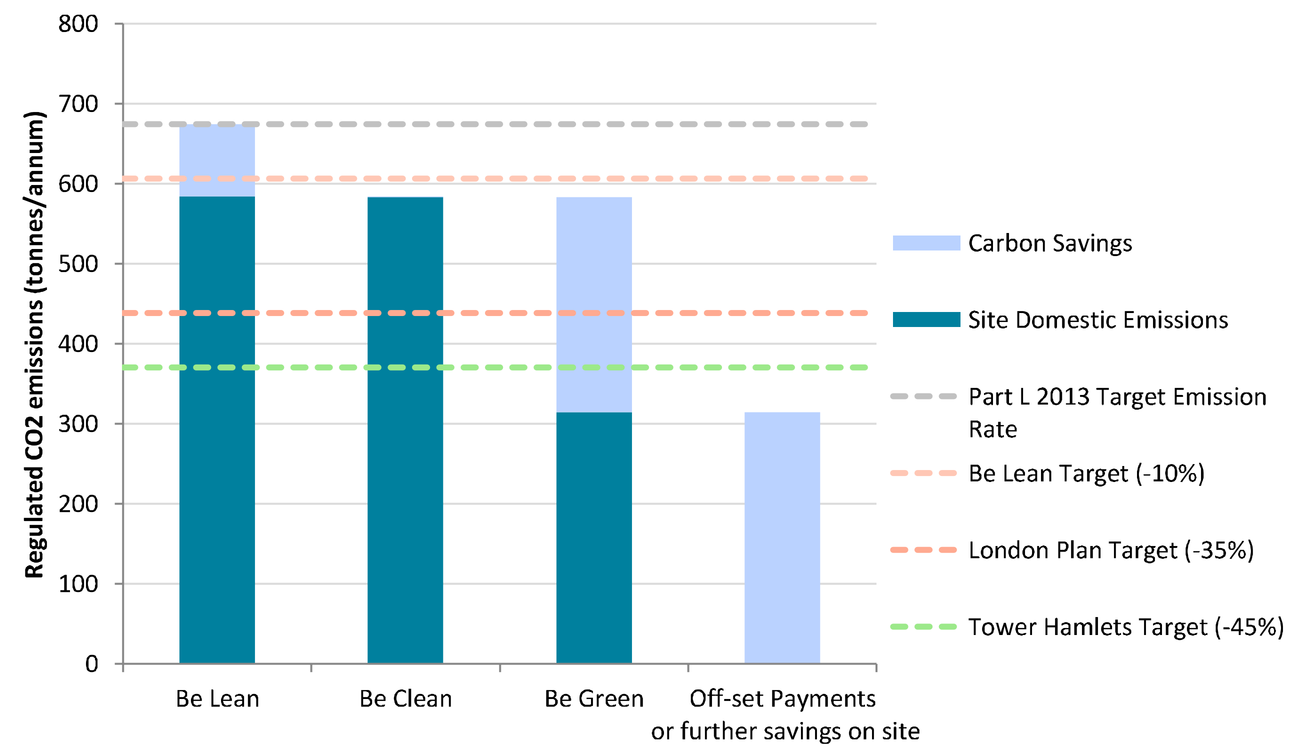


Figure 10.3: Domestic Site-wide energy hierarchy graph and targets.

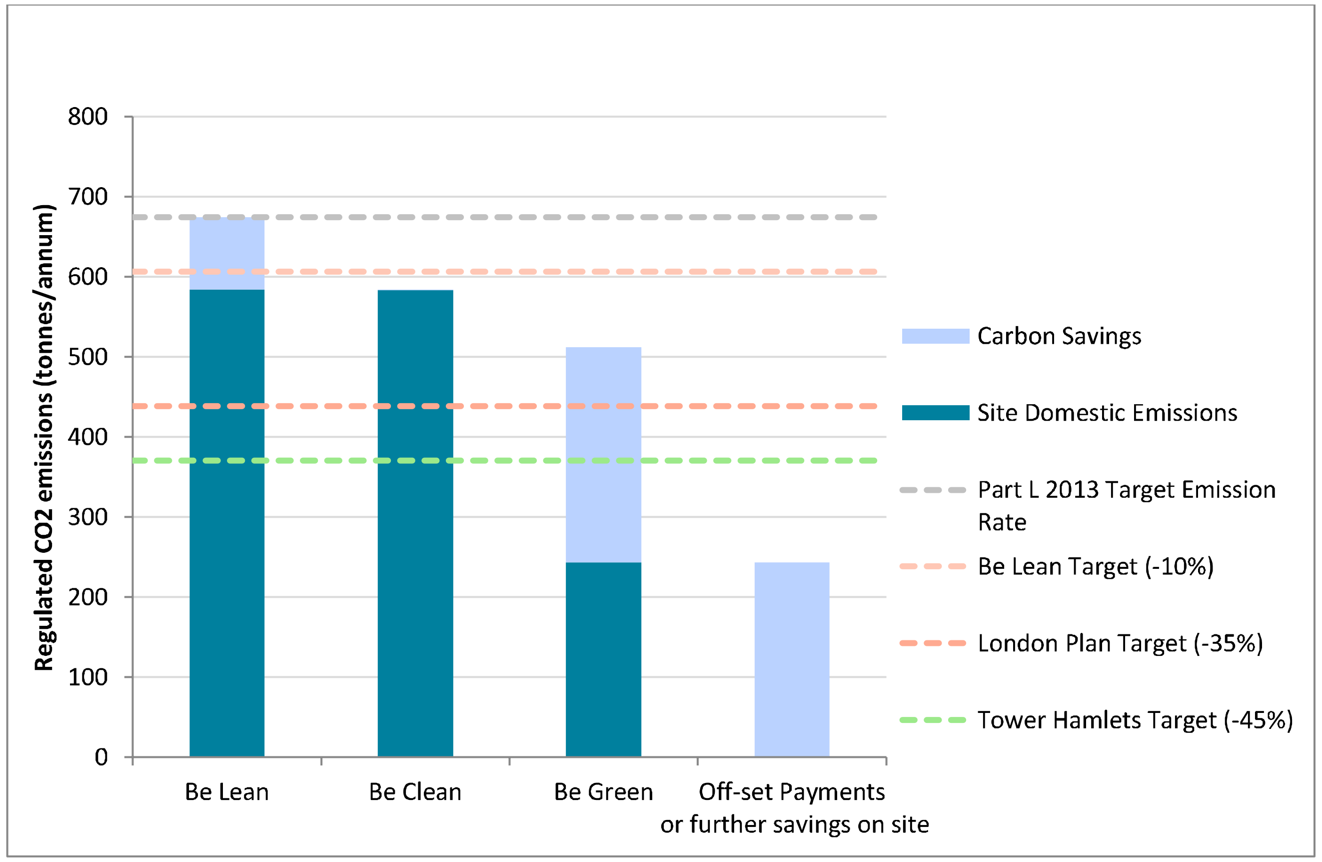


Figure 10.4: Domestic Site-wide energy hierarchy graph and targets (including secondary waste heat from non-domestic buildings).

Carbon Offsetting Strategy

10.10 Following the implementation of the London Plan energy hierarchy, a 35% CO2 saving has to be met on-site. The London Borough of Tower Hamlets local policy requires a 45% saving on site target. In accordance with the draft London Plan any shortfall in the CO_2 on site savings can be delivered via a carbon offset cash-in-lieu contribution payment into the offset fund administered by LBTH or through the purchase of verified emission reductions from carbon offset projects.

10.11 The final offsetting approach will be agreed with the LBTH Energy Officer at the time of each RMA.

11.0 Cooling and Overheating

11.1 Climate change means London is experiencing higher average air temperatures. This combined with the urban heat island effect means new developments must manage heat risk by minimising internal heat gains and the impact of the urban heat island.

11.2 The following figure summarises some of the documents available to assess the overheating risk in new buildings in London.

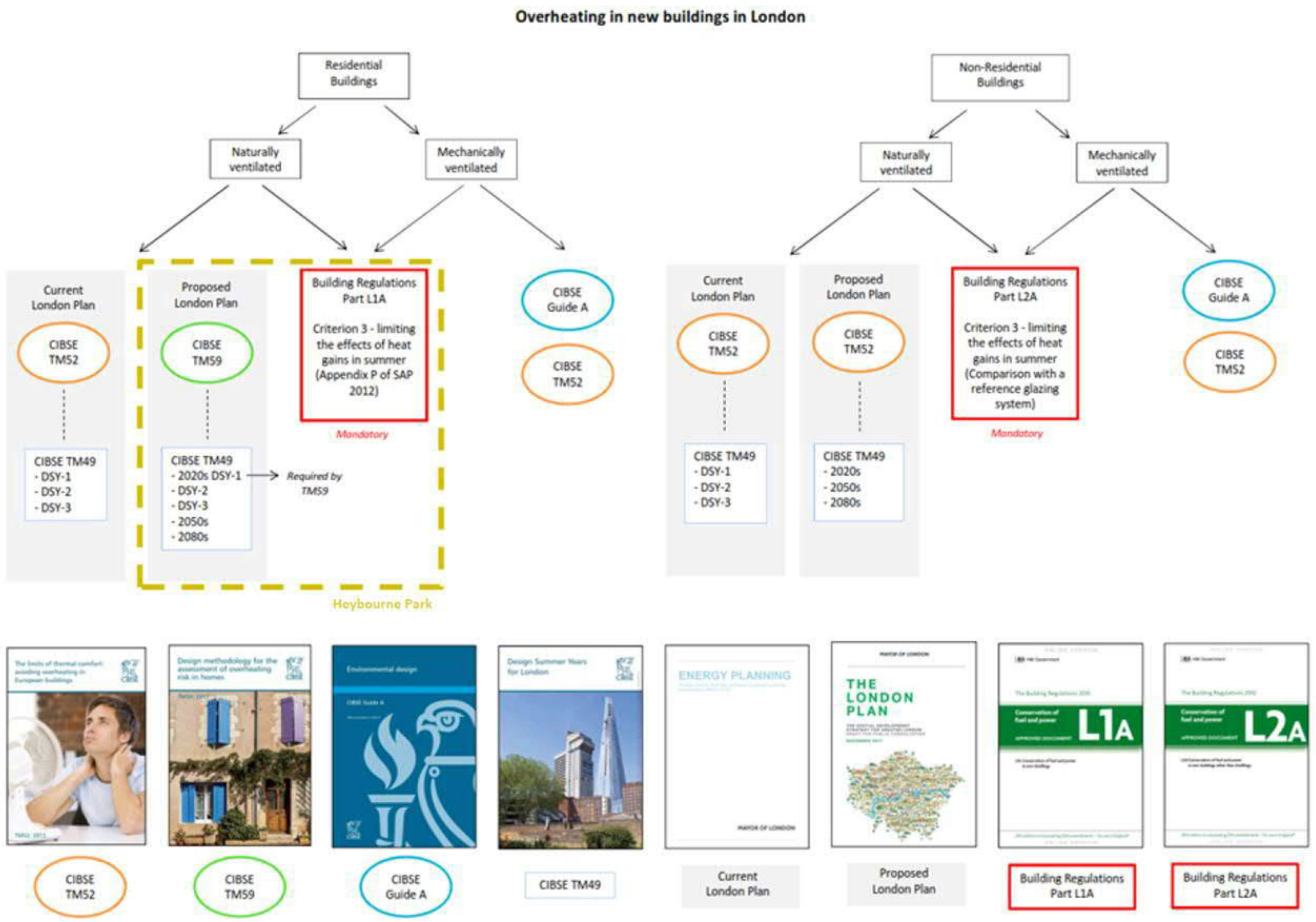


Figure. 11.1: Regulations and technical guides for overheating analysis in new buildings in London

The Cooling Hierarchy

11.3 In line with Policy SI 4 of the Draft London Plan, the cooling hierarchy has been applied to the Indicative Scheme.

11.4 The following measures are proposed to reduce the demand for cooling across The Masterplan:

11.5 **Reducing the amount of heat entering the building in summer:**

The Indicative Scheme considers external shading on all buildings on critical facades. High performance solar control glazing will be selected as appropriate for each building type, balancing solar gain with daylighting. Final proposals will be developed in each RMA.

11.6 **Minimising internal heat gains through efficient design:**

Ultra-low temperature ambient loop networks for residential buildings and very low temperature distribution networks for commercial buildings will reduce heating system heat gains to internal spaces.

11.7 **Manage the heat within the building.**

Consideration of exposed thermal mass and night-time purge ventilation on appropriate buildings will be considered in each Reserved Matters Applications. Connection points for future installation of ceiling fans could be considered.

11.8 **Passive ventilation:**

Noise levels across the Site means that mechanical ventilation and active cooling will be required on all buildings to control overheating.

Residential buildings will have opening windows to allow mixed mode ventilation and for future proofing for potential reductions in noise levels across the Site.
There may be the possibility to consider mixed mode strategies on some of the commercial buildings on facades facing south and these will be considered within RMAs for each building and phase.

11.9 **Mechanical ventilation:**

All apartments in the residential buildings will be mechanically ventilated via Mechanical Ventilation with Heat Recovery within each dwelling.

All commercial buildings will consider the latest high efficiency heat, coolth and latent recovery Air Handling Units as part of the "Be Lean" energy strategy.

11.10 **Provide active cooling systems**

The use of the ambient loop heat pump solutions for heating and hot water production for the residential buildings allows active cooling to apartments from the same distribution network, thus providing heat recovery opportunities for hot water production.

4-pipe multifunction heat pumps for retail and commercial buildings allow for simultaneous heating, cooling, and hot water preheat, and for secondary heat export to residential buildings.

Overheating Risk Analysis

11.11 As required by the Building Regulations, each residential building will need to be tested in the RMAs against Criterion 3 of Part L1A of the Building Regulations, which relates to limiting the effect of solar heat gains in the summer.

11.12 In order to help identify potential overheating risks dynamic simulation modelling will be undertaken in line with the guidance in CIBSE TM59 and TM49 and as required by the GLA in the Energy Assessment Guidance (2020).

Domestic overheating checklist

11.13 The GLA energy assessment guidance document (October 2018) requires that a domestic overheating checklist is completed. The checklist is divided into 2 sections to be filled in at different stages of the project. Section 1 serves as an early warning to be developed during concept design. Both sections are included below.

Section 1 - Site features affecting vulnerability to overheating		
Site Location	Urban – within central London or in a high density conurbation	Urban
	Peri-urban – on the suburban fringes of London	
Air Quality and/or Noise sensitivity	Busy roads / A roads	Yes
	Railways / Overground / DLR	Yes
	Airport / Flight path	Yes
	Industrial uses / waste facility	No
Proposed building use	Will any buildings be occupied by vulnerable people (e.g. elderly, disabled, young children)? Are residents likely to be at home during the day (e.g. students)?	Yes This will include people who may be home during the day. As with all potential developments.
Dwelling aspect	Are there any single aspect units?	Multi-storey dwellings. The Proposed Development will also include a number of single aspect dwellings.
Glazing ratio	Is the glazing ratio (glazing: internal floor area) greater than 25%?	Yes, glazing ratio may be greater than 25% to comply with daylighting guidance
	If yes, is this to allow acceptable levels of daylighting?	
Security	Single storey ground floor units	None
	Vulnerable areas identified by the Police Architectural Liaison Officer or Other	TBC

Table 11.1: Domestic Overheating Checklist Section 1

Section 2 - Design features implemented to mitigate overheating risk		
Landscaping	Will deciduous trees be provided for summer shading (to windows and pedestrian routes)?	No
	Will green roofs be provided?	A number of green roofs are proposed.
	Will other green or blue infrastructure be provided around buildings for evaporative cooling?	The development is adjacent to North Dock.
Materials	Have high albedo (light colour) materials been specified?	To be developed in RMAs
Dwelling aspect	% of total units that are single aspect	To be developed in RMAs
	% single aspect with N / NE / NW orientation % single aspect with E orientation % single aspect with S / SE / SW orientation % single aspect with W orientation	To be developed in RMAs
Glazing ratio	N / NE / NW	To be developed in RMAs
	E	To be developed in RMAs
	S / SE / SW	To be developed in RMAs
	W	To be developed in RMAs
Daylighting	What is the average daylight factor range?	Will be established at RMA stage.
Window opening	Are windows openable?	Windows are openable
Window opening – Openable area	What is the average percentage of openable area for the windows?	Will be established at RMA stage.
Window opening – extent of opening	Fully openable/ Limited (e.g. for security, safety, wind loading reasons)	Will be established at RMA stage.
Security	Where there are security issues (e.g. ground floor flats) has an alternative night-time natural ventilation method been provided (e.g. ventilation grates)?	There are no ground floor flats. Other security aspects will be established at RMA stage.

Table 11.2: GLA (2018) Domestic Overheating Checklist Section 2

12.0 Estimate of the Costs to Occupants

12.1 The Applicant has modelled the preliminary annual fuel costs for the Indicative Scheme as required by the current GLA Energy Assessment Guidance (2018) and the draft April 2020 version. The purpose of this comparison is to show that the energy strategy as proposed in this OPA is not uneconomical for the domestic occupants.

12.2 Comparisons have been made with a gas boiler communal heat network. The as proposed communal Air Source Heat Pump Ambient Loop network is approximated as communal ASHP.

12.3 The preliminary modelling is intended to provide a high-level comparison of the potential annual fuel costs. Full assessments would be carried out at the time of each RMA.

12.4 Fuel Cost Data has been taken from taken from the Etude: "Low Carbon Heat: Heat Pumps In London" report produced for the GLA in 2018.

Fuel Cost Data

	System	Fuel costs	Maintenance cost/charge	Replacement cost/charge	Metering/billing charge	Other charges
0	Individual gas boiler	3.6p/kWh for gas	£150/year	Equivalent annual cost of £113/year based on £1,860 and 11.2 years lifespan	n/a	n/a
1	Direct electric	14.4p/kWh for electricity	£50/year	Equivalent annual cost of £26/year based on £500 and 30 years lifespan (replacement of cylinder after 20 years)	n/a	n/a
2	Individual ASHP	14.4p/kWh for electricity	£200/year	Equivalent annual cost of £190/year based on £3,000 and 12.5 years lifespan (replacement of cylinder after 20 years)	n/a	n/a
3	Communal gas boiler	3.6p/kWh for gas	£120/year (including HIU)	£90/year (sinking fund)	£125/year	n/a
4	Communal ASHP	14.4p/kWh for electricity	£140/year (including HIU)	£110/year (sinking fund)	£125/year	n/a
5	Communal ground loop, individual HP in each unit	14.4p/kWh for electricity	£150/year	Equivalent annual cost of £150/year based on £3,500 and 17.5 years lifespan (replacement of cylinder after 20 years)	£20/year	n/a
6	District heating (gas boiler + CHP)	2.2p/kWh for gas 5p/kWh for electricity export	£110/year	£90/year (sinking fund)	£110/year	£110/year
7	District heating (gas boiler + high temperature HP)	5.7p/kWh for electricity	£110/year	£110/year (sinking fund)	£110/year	£110/year

Table 12.1: Table App K.01 – Overview of key assumptions, taken from the Etude: "Low Carbon Heat: Heat Pumps in London" report produced for the GLA in 2018 "

Cost Analysis of the proposed Ambient Loop system versus the Benchmark System.

	Index	As-Designed Communal Ambient Loop Heat Pump networks	Benchmark Communal Boilers
0	Fuel cost GBP/(year.dwelling)	£84	£110
1	Maintainence cost GBP/(year.dwelling)	£140	£120
2	Replacement cost GBP/(year.dwelling)	£110	£90
3	Metering/billing cost GBP/(year.dwelling)	£125	£125
4	Saving from RHI payback for ASHP	-£56	0
5	**Total annual operational cost (GBP)**	**£403**	**£445**

Table 12.2: Table comparing the Ambient Loop Heat Pump Energy Strategy with the benchmarked system.

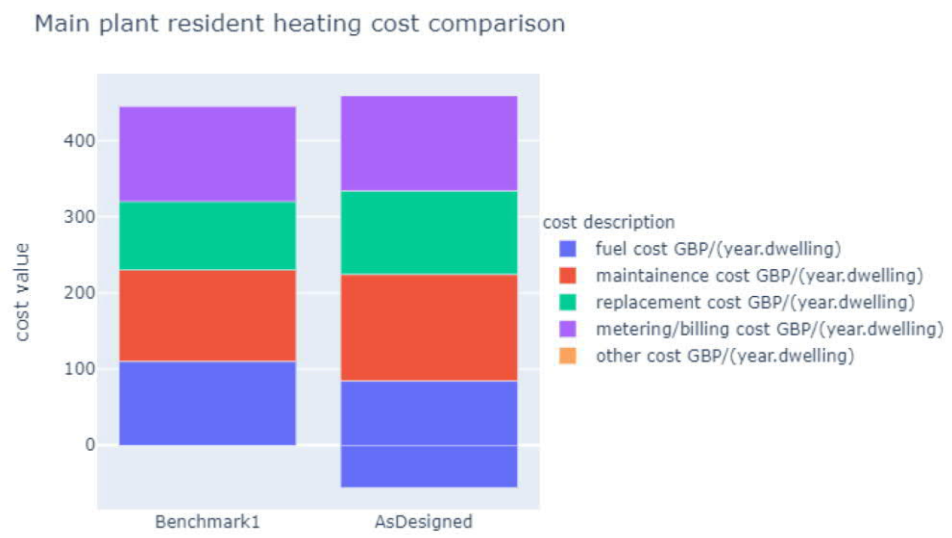


Figure 12.1: Graphs comparing the Ambient Loop Heat Pump Energy Strategy with two benchmarked systems

12.5 The fuel cost comparison shows that in pure fuel input costs the ASHP energy strategy is potentially less expensive to run than an equivalent communal gas boiler installation, but once O&M, plant replacement and metering is factored in then is it approximately the same. However, if potential payments from the RHI (Renewable Heat Incentive) scheme are taken into account the ASHP based approach is potentially more cost effective in the end. There is current uncertainly regarding any future RHI funding going forward, so this potential benefit cannot be relied upon.

12.6 The calculations are based on an estimate of fuel costs for a typical flat from our energy modelling data. However, this is not a straight-forward comparison to do because a system based on boilers alone or with CHP and boilers would not meet the onsite carbon emissions reduction of 35% using SAP10 required by the new London Plan or the 45% reduction required by the LBTH Local Plan.

13.0 Appendix A - Correspondence

13.1 Correspondence with Swan Housing on 12/06/2020 regarding the Blackwall Reach Regeneration project.

From Swan Housing Project Director:

Thank you for your enquiry about the Blackwall Reach Regeneration Project and the capacity of the proposed phased communal district heating network.

Blackwall Reach is a housing led, mixed use and mixed tenure regeneration project led by Swan Housing Association in partnership with the London Borough of Tower Hamlets (LBTH) and the Greater London Authority (GLA). It is transforming a key area part of the East End of London, creating 1,575 much needed new homes, an expanded school, replacement faith building, commercial premises, high quality open spaces and community facilities.

Heat and hot water to all new homes will be provided via a combined heat and power system (CHP) which has been procured through an Energy Service Company (ESCo) arrangement with Eon Energy. The development is being delivered in phases with 340 homes completed to date, a further 268 currently being constructed on site and the rest in early planning stages. The Eon energy centre was provided as part of the second phase of works and the CHP plant is currently in the process of being installed.

The CHP/gas boiler energy centre is sized to serve the development only. It has an installed capacity of 4.4 MW with operating temperatures of 80 degree Centigrade. Once all 1,575 apartments are connected we will have a peak load of ~4.4 MW. Therefore I can confirm that due to tight site constraints the Energy Centre has been sized with no spare capacity or space for additional plant to serve any adjacent developments. Also at present there are no immediate decarbonisation plans for the network. This is being discussed and plans/ strategies are being discussed Eon but this will take a little time, so there is nothing I am able to share at this point.

I am sorry cannot be of more help on this occasion but wish you every success with the development of North Quay.

13.2 Correspondence with Imtech Low Carbon Solution, the operators of the Barkantine Heat and Power heat network on 30/04/2020:

From Strategy PMO:

Thank you for enquiring about the potential to connect to the Barkantine's district heating network and energy centre (Barkantine) for the proposed developments at North Quay.

I understand that you are preparing a planning application for the proposed developments and that you wished to understand the potential to connect.

During our call, I explained the current status of Barkantine and the intentions going forwards. These are summarised below.

Current Status

Barkantine has capacity to accommodate additional heat demand; connections can be developed through a connection study, which will require additional details from you in terms of the required heat demand and the proposed location for heat substations.

Barkantine is a natural-gas-fired energy centre which operates a combination of CHP and boilers. It has been operating for almost twenty years and serves over 700 homes, a leisure centre and a school. It has also connected various commercial buildings since its initiation in 2000. It currently produces heat with a carbon factor of circa 0.2kgCO2/kWh. Any new connection would need to check that this carbon factor would meet the development's overall carbon strategy and cover the costs for connection and supply.

Decarbonisation and Expansion of Barkantine

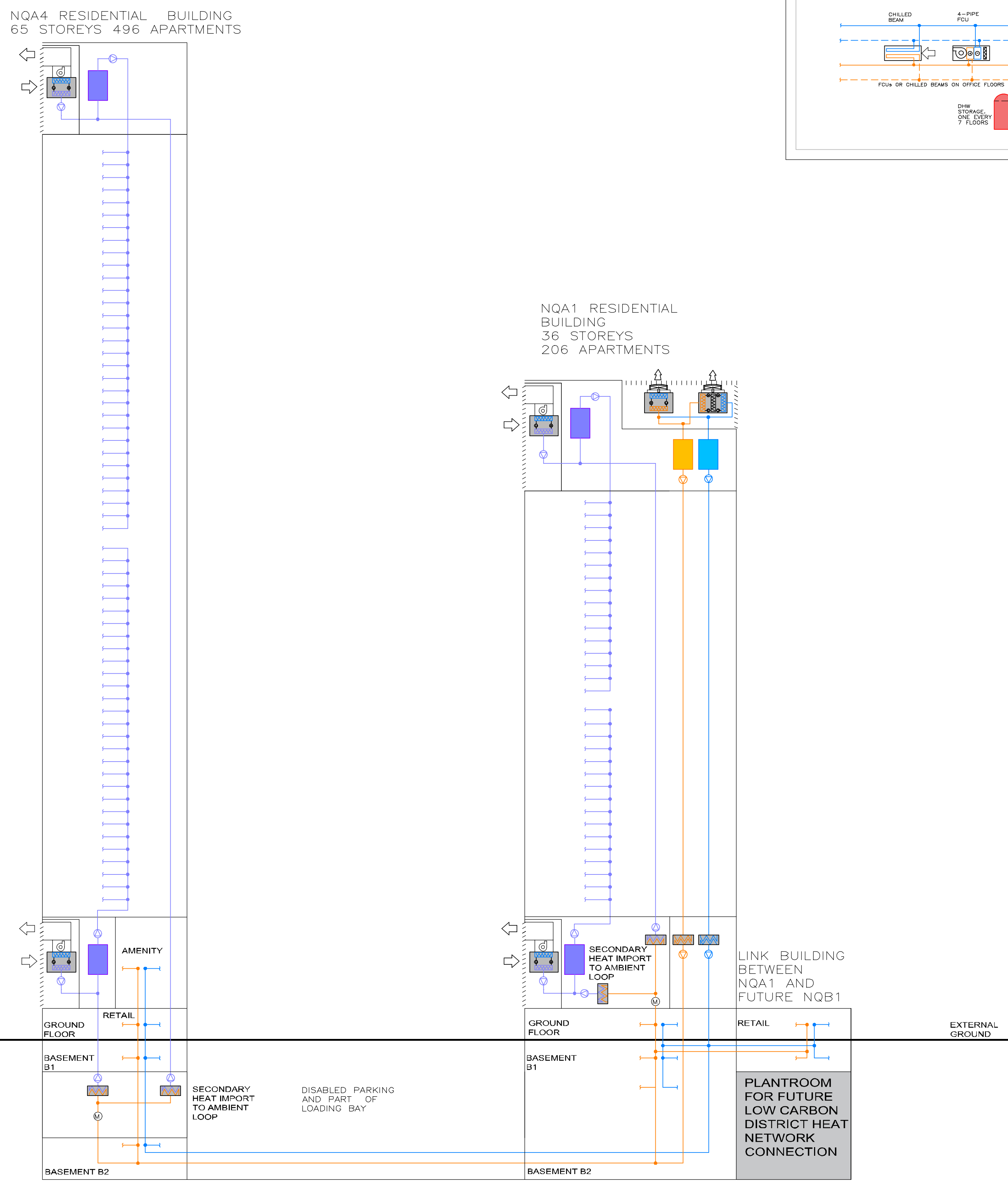
We are currently working with London Borough of Tower Hamlets on a programme to expand Barkantine's heat distribution capability and to decarbonise heat production. The intention here is to develop an approach which aligns with Tower Hamlet's ambitious plans for decarbonisation and improvement of air quality with the Borough and qualifies for any necessary financial support from the Government's Heat Networks Investment programme. This programme is at a techno-economic feasibility stage and we are seeking to develop a final solution by mid-2021 before commencing detailed design and construction. The study is considering the pipeline of potential connections that have been identified so that it can be expanded accordingly. Once the next phase of the study has been completed, we will have a clearer understanding of the carbon intensity of the heat produced and we will be in a better position to inform your development process.

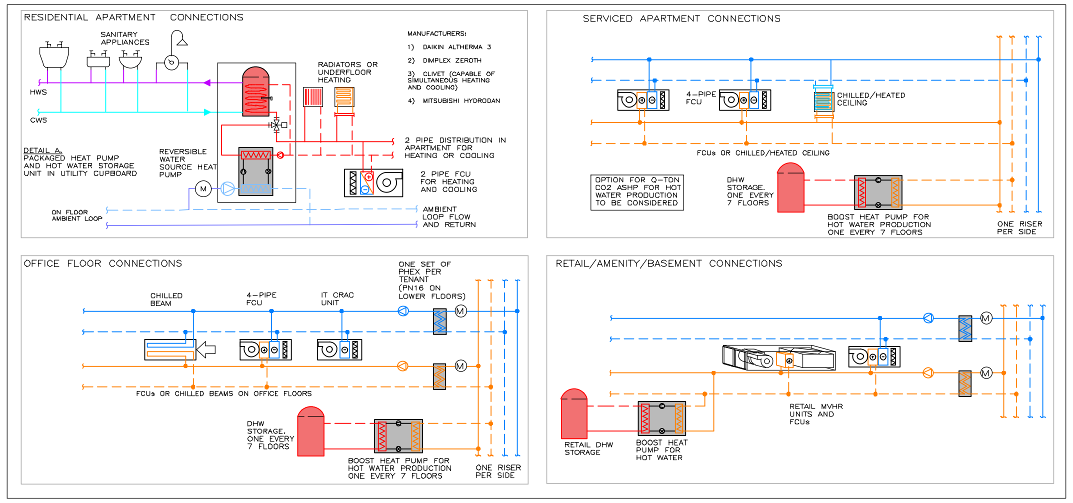
I hope this note provides you with what you require. Please let me know if you require anything further.

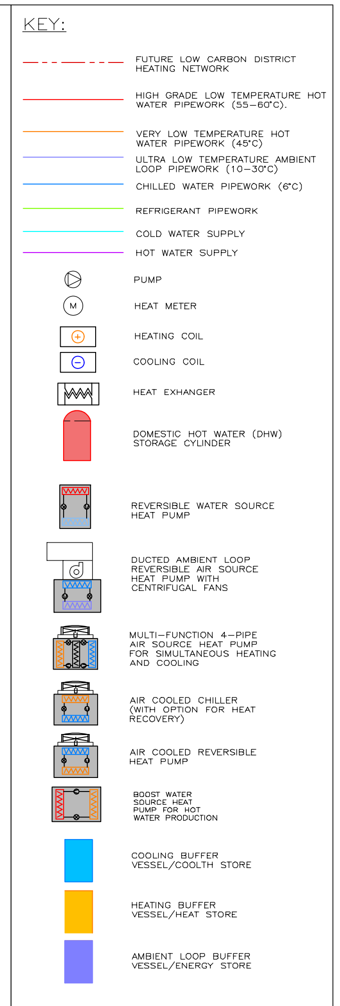
14.0 Appendix B – Drawings

NORTH QUAY MASTERPLAN — INDICATIVE SCHEME

PHASE 1







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MAX FORDHAM

Max Fordham LLP
42-43 Gloucester Crescent
London
NW1 7PE
T. +44 (0) 20 7267 5161
F. +44 (0) 20 7482 0329
maxfordham.com

Registered in England No. OC300026
Registered Office 42-43 Gloucester Crescent London NW1 7PE

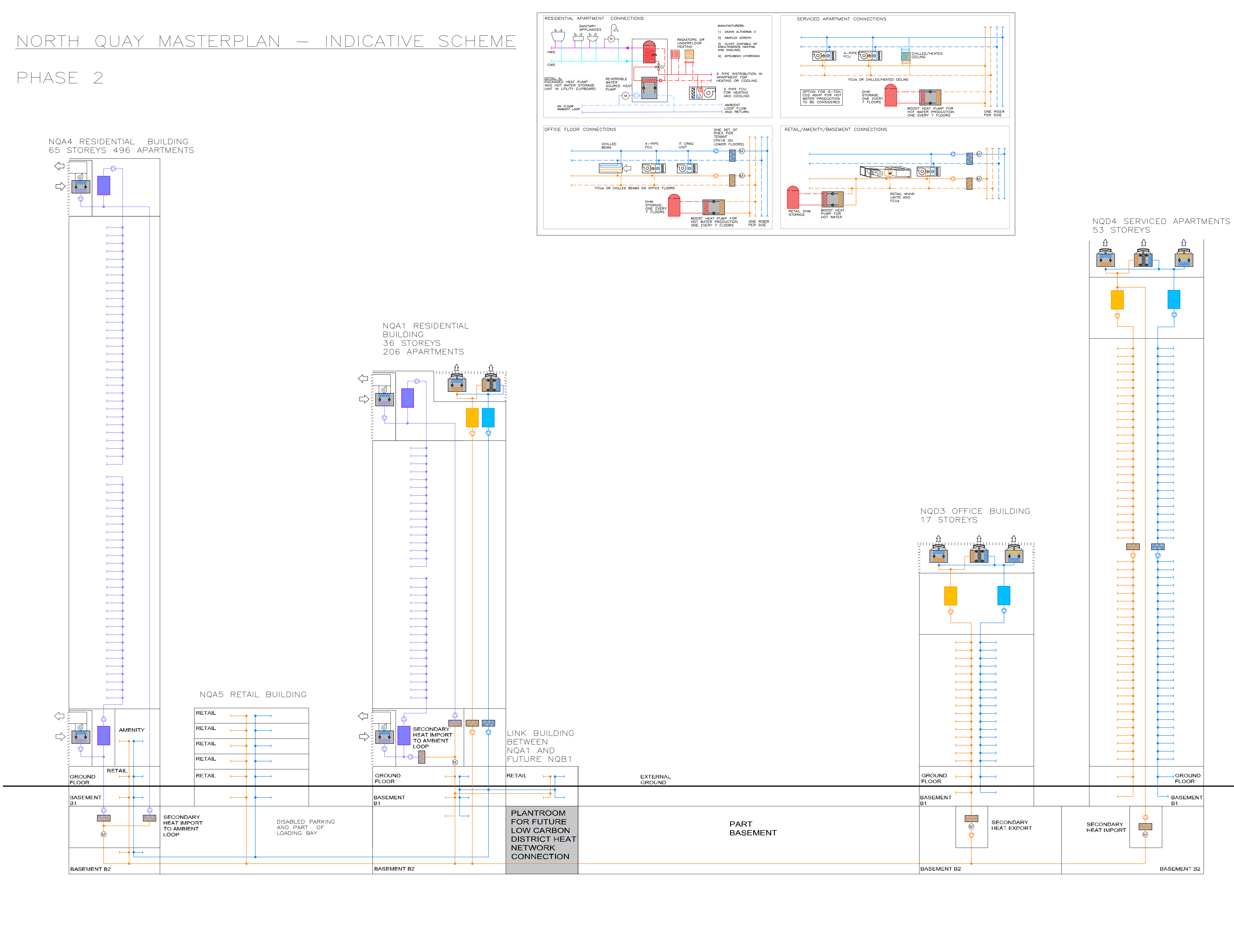
architect
ALLIES & MORRISON

job title
CANARY WHARF (NORTH QUAY) LTD
NORTH QUAY MASTERPLAN

project leader	date	scale (at A1)
NJS	**OCT 19**	**NTS**

drawing title
INDICATIVE SCHEME - PHASE 1
HEATING AND COOLING OUTLINE
SINGLE LINE SCHEMATIC

job no	dwg no	rev
J6701	**T[--]301**	**/A**



KEY:

- FUTURE LOW CARBON DISTRICT HEATING NETWORK
- HIGH GRADE LOW TEMPERATURE HOT WATER PIPEWORK (55–60°C)
- VERY LOW TEMPERATURE HOT WATER PIPEWORK (45°C)
- ULTRA LOW TEMPERATURE AMBIENT LOOP PIPEWORK (10–30°C)
- CHILLED WATER PIPEWORK (6°C)
- REFRIGERANT PIPEWORK
- COLD WATER SUPPLY
- HOT WATER SUPPLY
- PUMP
- HEAT METER
- HEATING COIL
- COOLING COIL
- HEAT EXCHANGER
- DOMESTIC HOT WATER (DHW) STORAGE CYLINDER
- REVERSIBLE WATER SOURCE HEAT PUMP
- DUCTED AMBIENT LOOP REVERSIBLE AIR SOURCE HEAT PUMP WITH CENTRIFUGAL FANS
- MULTI-FUNCTION 4-PIPE AIR SOURCE HEAT PUMP FOR SIMULTANEOUS HEATING AND COOLING
- AIR COOLED CHILLER (WITH OPTION FOR HEAT RECOVERY)
- AIR COOLED REVERSIBLE HEAT PUMP
- BOOST WATER SOURCE HEAT PUMP FOR HOT WATER PRODUCTION
- COOLING BUFFER VESSEL/COOLTH STORE
- HEATING BUFFER VESSEL/HEAT STORE
- AMBIENT LOOP BUFFER VESSEL/ENERGY STORE

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MAX FORDHAM

Max Fordham LLP
42-43 Gloucester Crescent
London
NW1 7PE
T. +44 (0) 20 7267 5161
F. +44 (0) 20 7482 0329
maxfordham.com

Registered in England No. OC300026
Registered Office 42-43 Gloucester Crescent London NW1 7PE

architect
ALLIES & MORRISON

job title
CANARY WHARF (NORTH QUAY) LTD
NORTH QUAY MASTERPLAN

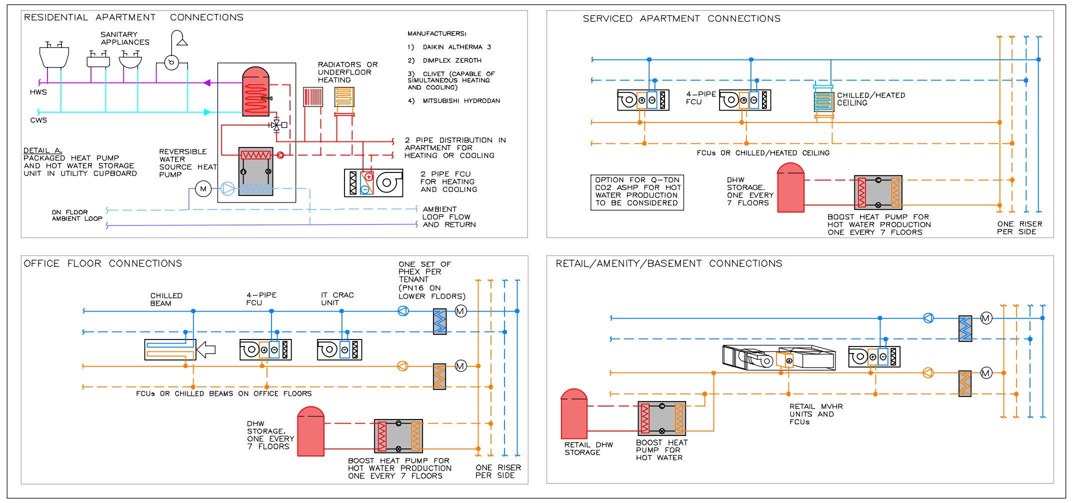
project leader: **NJS** | date: **OCT 19** | scale (at A1): **NTS**

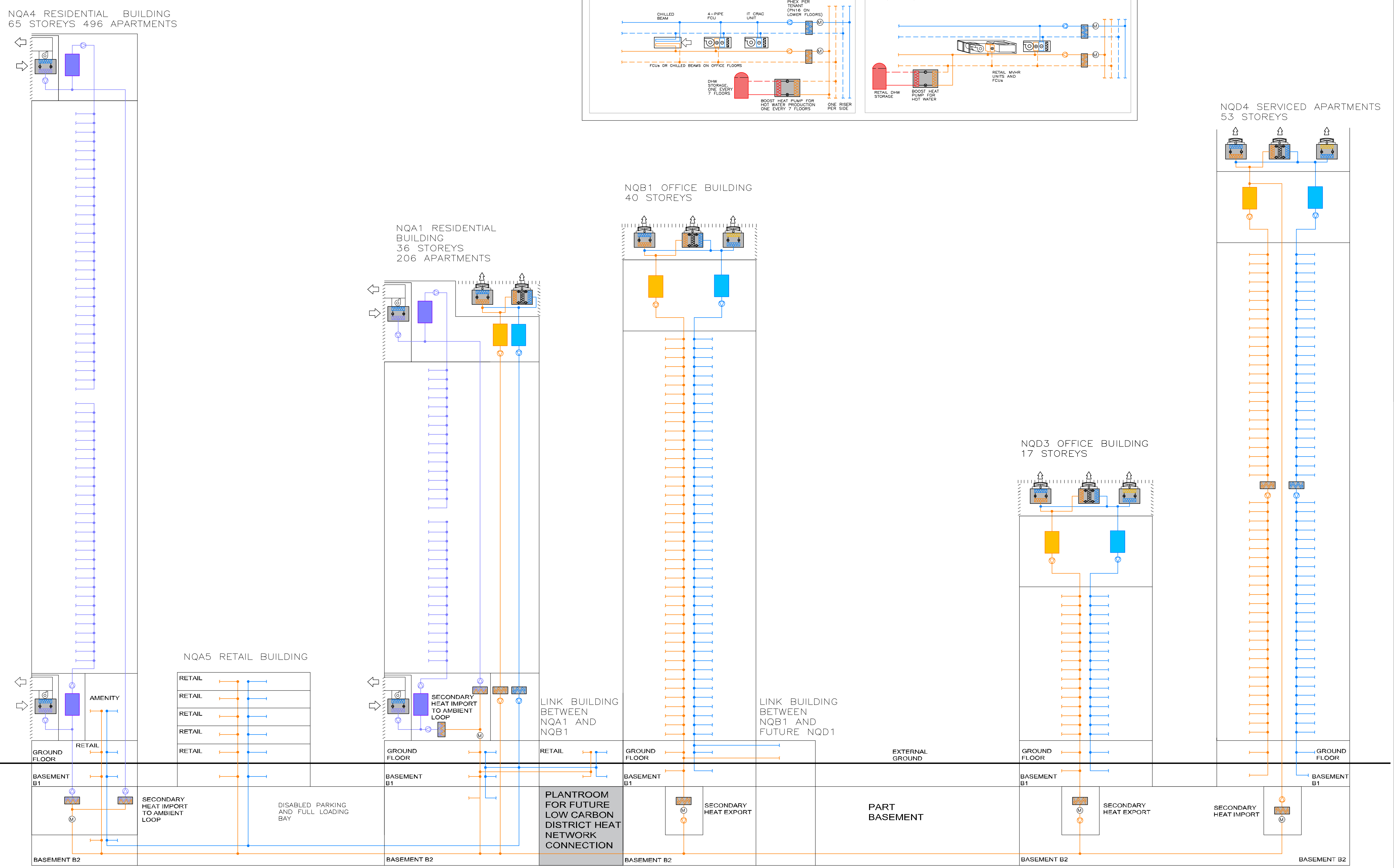
drawing title
INDICATIVE SCHEME - PHASE 2
HEATING AND COOLING OUTLINE
SINGLE LINE SCHEMATIC

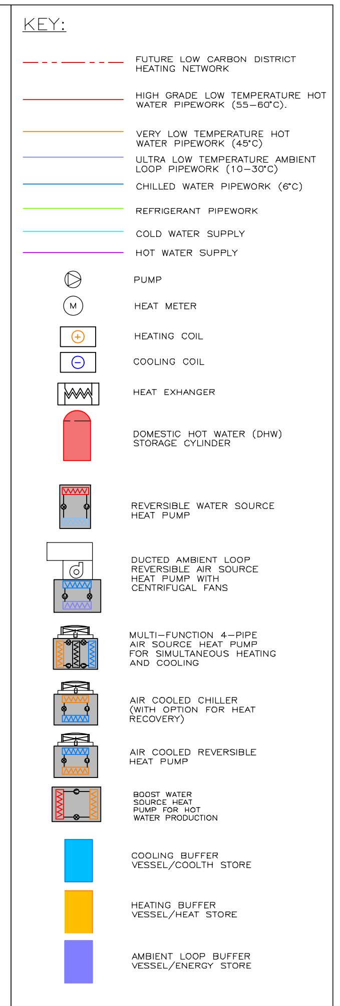
job no: **J6701** | dwg no: **T[--]302** | rev: **/A**

NORTH QUAY MASTERPLAN – INDICATIVE SCHEME

PHASE 3







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MAX FORDHAM

Max Fordham LLP
42-43 Gloucester Crescent
London
NW1 7PE
T. +44 (0) 20 7267 5161
F. +44 (0) 20 7482 0329
maxfordham.com

Registered in England No. OC300026
Registered Office 42-43 Gloucester Crescent London NW1 7PE

architect
ALLIES & MORRISON

job title
CANARY WHARF (NORTH QUAY) LTD
NORTH QUAY MASTERPLAN

project leader	date	scale (at A1)
NJS	**OCT 19**	**NTS**

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INDICATIVE SCHEME - PHASE 3
HEATING AND COOLING OUTLINE
SINGLE LINE SCHEMATIC

job no	dwg no	rev
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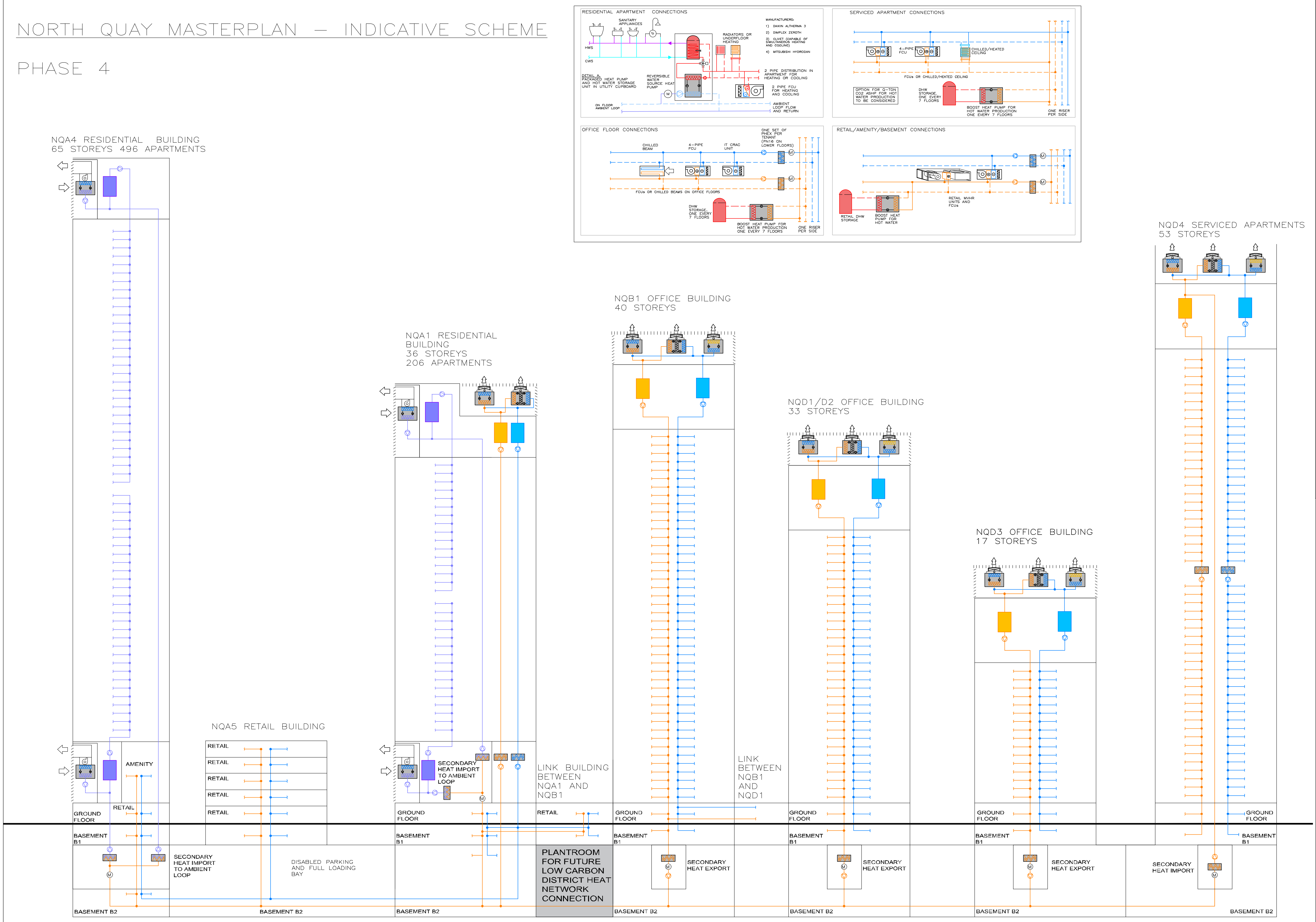
NORTH QUAY MASTERPLAN – INDICATIVE SCHEME

PHASE 4



KEY:

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MAX FORDHAM

Max Fordham LLP
42-43 Gloucester Crescent
London
NW1 7PE
T. +44 (0) 20 7267 5161
F. +44 (0) 20 7482 0329
maxfordham.com

Registered in England No. OC300026
Registered Office 42-43 Gloucester Crescent London NW1 7PE

architect
ALLIES & MORRISON

job title
CANARY WHARF (NORTH QUAY) LTD
NORTH QUAY MASTERPLAN

project leader	date	scale (at A1)
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drawing title
INDICATIVE SCHEME - PHASE 4
HEATING AND COOLING OUTLINE
SINGLE LINE SCHEMATIC

job no	dwg no	rev
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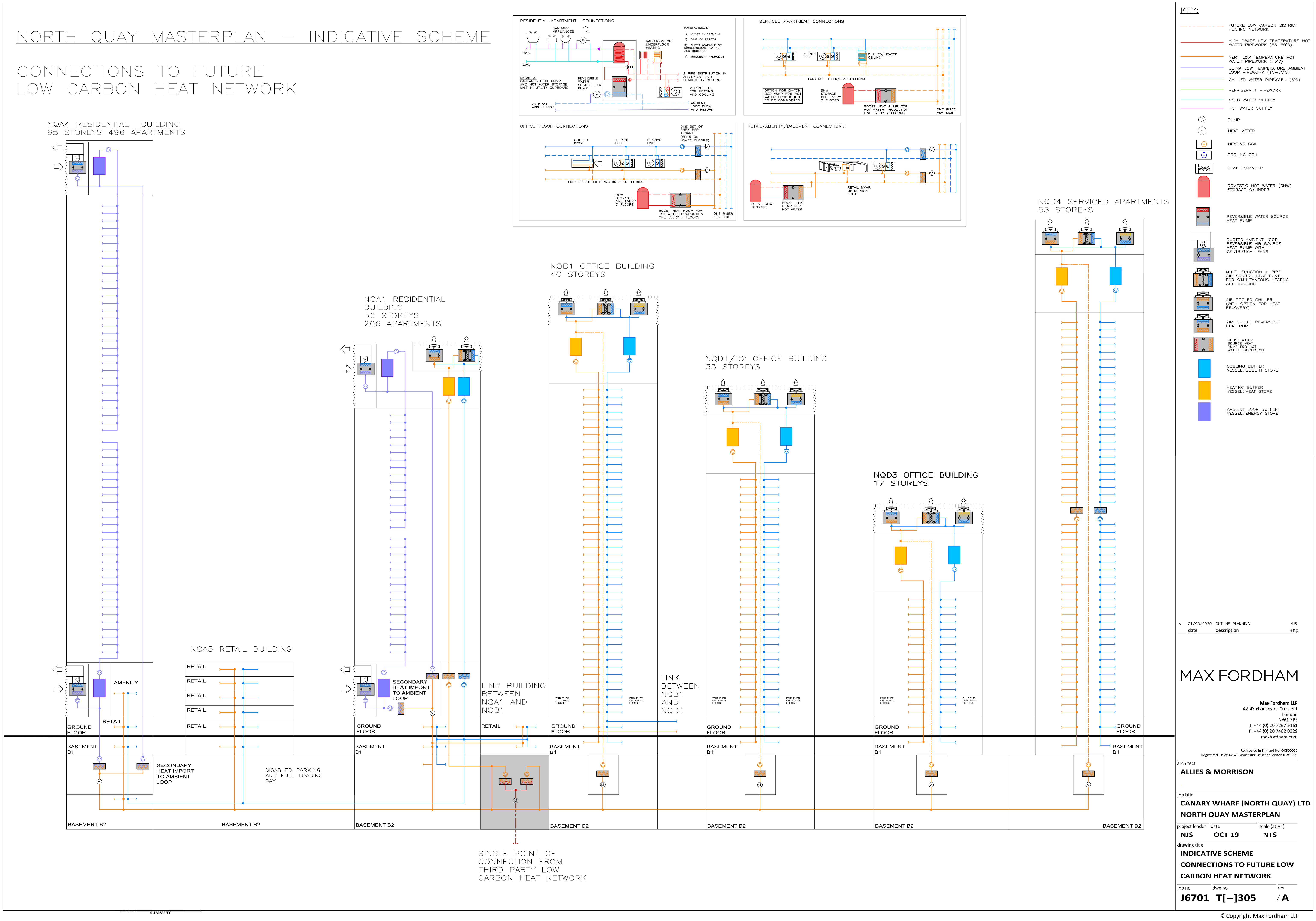
NORTH QUAY MASTERPLAN – INDICATIVE SCHEME
CONNECTIONS TO FUTURE LOW CARBON HEAT NETWORK
RESIDENTIAL APARTMENT CONNECTIONS
SERVICED APARTMENT CONNECTIONS
OFFICE FLOOR CONNECTIONS
RETAIL/AMENITY/BASEMENT CONNECTIONS
NQA4 RESIDENTIAL BUILDING
65 STOREYS 496 APARTMENTS
NQA1 RESIDENTIAL BUILDING
36 STOREYS
206 APARTMENTS
NQB1 OFFICE BUILDING
40 STOREYS
NQD1/D2 OFFICE BUILDING
33 STOREYS
NQD3 OFFICE BUILDING
17 STOREYS
NQD4 SERVICED APARTMENTS
53 STOREYS
NQA5 RETAIL BUILDING
AMENITY
RETAIL
GROUND FLOOR
BASEMENT B1
BASEMENT B2
SECONDARY HEAT IMPORT TO AMBIENT LOOP
DISABLED PARKING AND FULL LOADING BAY
LINK BUILDING BETWEEN NQA1 AND NQB1
LINK BETWEEN NQB1 AND NQD1
SINGLE POINT OF CONNECTION FROM THIRD PARTY LOW CARBON HEAT NETWORK
KEY:
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A 01/05/2020 OUTLINE PLANNING NJS
date description eng
MAX FORDHAM
Max Fordham LLP
42-43 Gloucester Crescent
London
NW1 7PE
T. +44 (0) 20 7267 5161
F. +44 (0) 20 7482 0329
maxfordham.com
architect
ALLIES & MORRISON
job title
CANARY WHARF (NORTH QUAY) LTD
NORTH QUAY MASTERPLAN
project leader NJS
date OCT 19
scale (at A1) NTS
drawing title
INDICATIVE SCHEME
CONNECTIONS TO FUTURE LOW CARBON HEAT NETWORK
job no J6701
dwg no T[--]305
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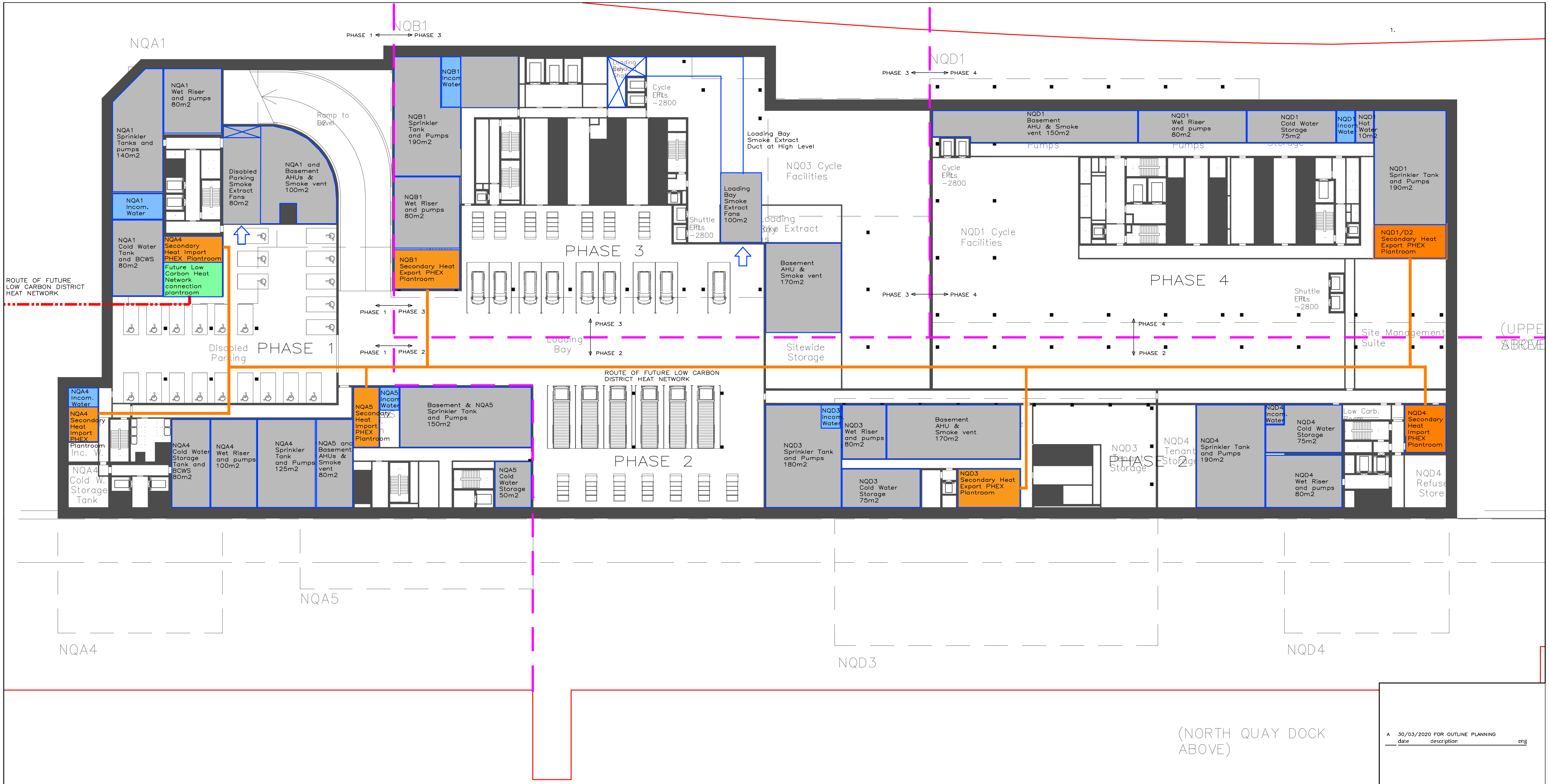

LANDLORD PLANTROOMS

INCOMING UTILITY PLANTROOMS (UKPN, IDNO, THAMES WATER, IT ETC)

SECONDARY HEAT IMPORT/EXPORT PLANTROOMS

FUTURE LOW CARBON DISTRICT HEATING CONNECTION PLANTROOM

FUTURE LOW CARBON DISTRICT HEATING PIPEWORK ROUTE

SECONDARY HEAT SITE WIDE NETWORK

PHASING BASEMENT DIVISION LINES

rev	date	description	eng
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MAX FORDHAM

Max Fordham LLP
42-43 Gloucester Crescent
London
NW1 7PE
T. +44 (0) 20 7267 5161
F. +44 (0) 20 7482 0329
maxfordham.com

Registered in England No. OC300082
Registered Office 42-43 Gloucester Crescent London NW1 7PE

architect
ALLIES & MORRISON

job title
CANARY WHARF (NORTH QUAY) LTD
NORTH QUAY MASTERPLAN

project leader	date	scale (at A1)
NJS	JAN '20	1:300

drawing title
INDICATIVE SCHEME
BASEMENT LEVEL 2
PLANT ROOMS

job no	dwg no	rev
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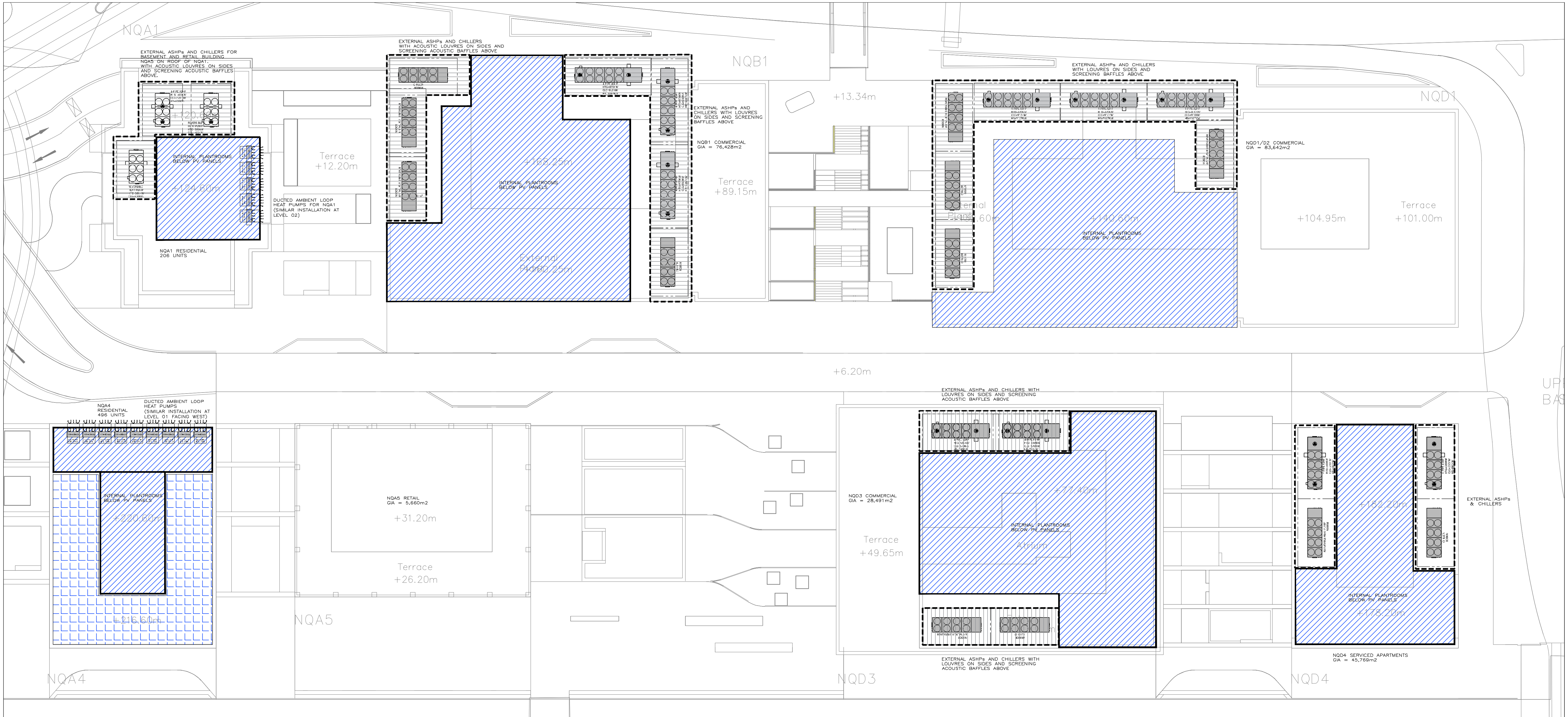

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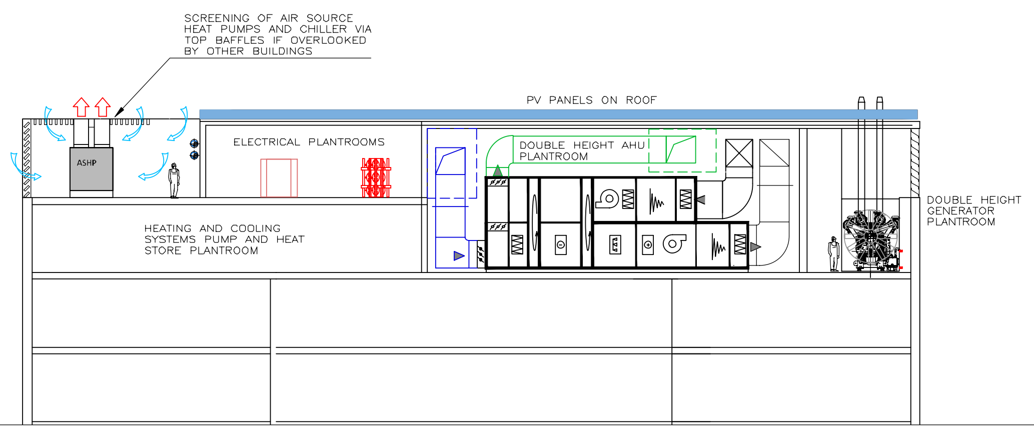
B	06/03/2020	FOR INFORMATION	NJS
A	07/02/2020	FOR INFORMATION	NJS
	date	description	eng

TYPICAL SECTION THROUGH OFFICE BUILDING ROOF PLANTROOMS.

SCALE 1:200



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NOTES:

1. PHOTOVOLTAIC PANELS TO BE MOUNTED ON PROPRIETARY FRAMES ON TOP OF ENCLOSED ROOF PLANTROOM AREAS ON BUILDINGS AS SHOWN.
2. ALL EXTERNAL AIR SOURCE HEAT PUMPS AND CHILLERS TO HAVE PROPRIETARY ACOUSTIC KITS/CASINGS.
3. SCREENING OF AIR SOURCE HEAT PUMPS AND CHILLER VIA TOP BAFFLES ON BUILDINGS OVERLOOKED BY OTHER BUILDINGS ACROSS THE MASTERPLAN.
4. NEED FOR ACOUSTIC TREATMENT OF LOUVRES OR BAFFLES TO BE DETERMINED IN RESERVED MATTER APPLICATIONS.

INTERNAL PLANTROOMS WITH PHOTOVOLTAIC PANELS ON ROOF

EXTERNAL PLANT AREAS WITH LOUVRES ON SIDES SCREENING BAFFLES ON TOP.

EXTERNAL PLANT AREAS WITH PHOTOVOLTAIC PANELS AT HIGH LEVEL MOUNTED ON SUPPORT FRAME

MAX FORDHAM

Max Fordham LLP
42-43 Gloucester Crescent
London
NW1 7PE
T. +44 (0) 20 7267 5161
F. +44 (0) 20 7482 0329
maxfordham.com

Registered in England No. OC300082
Registered Office 42-43 Gloucester Crescent London NW1 7PE

architect
ALLIES & MORRISON

job title
CANARY WHARF (NORTH QUAY) LTD
NORTH QUAY MASTERPLAN

project leader	date	scale (at A1)
NJS	OCT 19	1:300

drawing title
INDICATIVE SCHEME
ROOF LEVEL PHOTOVOLTAICS
AND ROOF PLANT AREAS

job no	dwg no	rev
J6701	Z[--]131	/C

15.0 Appendix C – Modelling Output

IES Energy Modelling BRUKL – Indicative Scheme Non-domestic “Be Lean”

15.1 Submitted as separate documents for each non-domestic building for the Indicative Scheme.

Part 2 Building NQA5 Be Lean brukl
Part 3 Building NQB1 Be Lean brukl
Part 4 Building NQD1D2 Be Lean brukl
Part 5 Building NQD3 Be Lean brukl
Part 6 Building NQD4 Be Lean brukl

IES Energy Modelling BRUKL – Indicative Scheme Non-domestic “Be Green”

15.2 Submitted as a separate document with the “Be Green” BRUKL for each non-domestic building for the Indicative Scheme.

Part 7 Building NQA5 Be Green brukl
Part 8 Building NQB1 Be Green brukl
Part 9 Building NQD1D2 Be Green brukl
Part 10 Building NQD3 Be Green brukl
Part 11 Building NQD4 Be Green brukl

Domestic SAP12 Worksheets – Indicative Scheme

15.3 Submitted as a separate document with the SAP12 worksheets for the domestic buildings NQA1 and NQA4 with and without secondary heat from commercial buildings.

Part 12 Domestic SAP12 Worksheets
Part 13 Domestic_SAP12 Worksheets with secondary heat import

GLA Carbon Emissions Reporting Spreadsheets – Indicative Scheme

15.4 Submitted as separate Excel Spreadsheets with and without secondary heat from commercial buildings.

Part 14 GLA Carbon Emission Reporting Spreadsheet without secondary heat
Part 15 GLA Carbon Emission Reporting Spreadsheet with secondary heat