Environmental Sustainability Plan

Fish and Coal Offices & Eastern Wharf Road Arches

King's Cross Central General Partner Ltd

July 2014

King's Cross

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Rev. K

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Audit Sheet

Rev.	Description	Prepared and checked by	Reviewed by	Date
A	1st draft issued for information In progress	S. Lloyd	H. Blackwell	24|05|2013
B	Issued to team – In progress	S. Lloyd	J. Godefroy H. Blackwell R. Macpherson	05|08|2013
C	Draft for planning	S. Lloyd	H. Blackwell R. Macpherson	02|09|2013
D	Updated modelling results	S. Lloyd	R. Macpherson	09|09|2013
E	Update to Condition 45	S. Lloyd	R. Macpherson	23|09|2013
F	Incorporating Design Team comments	S. Lloyd	J. Godefroy	07|10|2013
G	Incorporating comments from Argent 13.12.13	S. Lloyd	-	19|12|2013
H	Comments from Design Team 20.01.14	S. Lloyd	-	22|01|2014
I	ALW Comments 15.04.2014	S. Lloyd	R. Macpherson	06|06|2014
J	ALW Comments 14.06.2014	S. Lloyd		11|07|2014
K	Incorporating ALW comments received 18.07.2014, except overall carbon saving	J. Godefroy	-	241|07|2014

Contents

1.0 Executive Summary

This Environmental Sustainability Plan has been prepared by Hoare Lea on behalf of King's Cross Central General Partner Limited to provide a summary of the contribution that the proposed refurbishment of the Fish & Coal Offices and the 10 brick vaults below the Wharf Road Viaduct making up the 'Eastern Wharf Road Arches' will make to sustainable development. Specifically, this document addresses a number of planning conditions (17 and 45) of the King's Cross Central (KXC) Outline Planning Permission (2004/2307/P) dated 22 December 2006 and the associated sections of the Section 106 Agreement (sections AA, Y and Z) and highlights how the project team have responded to these in terms of the design of the project.

The current proposals comprise the refurbishment and re-use of the existing Fish & Coal Offices ('FCO') and Eastern Wharf Road Arches ('EWRA') as offices and retail (food and drink) uses. The buildings are located in Development Zone I of the KXC site, running parallel to the Regent's Canal and adjacent to the East and West Coal Drops and Granary Square.

The FCO and EWRA have been designed to achieve a high level of sustainability with both office and commercial space targeting at least a BREEAM Excellent rating. The key sustainability and low carbon measures proposed in relation to each relevant planning condition are summarised below.

This Environmental Sustainability Plan forms a part of the suite of documents that support the Reserved Matters submission for the FCO and EWRA, and should therefore be read in conjunction with those documents, in particular, the Urban Design Report and the Planning Compliance Report.

Condition 17 (a): Energy efficiency

The refurbishment the FCO and EWRA will introduce new energy efficient design measures whilst working with the buildings' character and heritage value in accordance with the guidance set out within Part L2B of the Building Regulations and with the Initial Conservation Plan submitted in support of the 2004 outline planning application. The proposed design includes the following design and technology energy efficiency measures:

- High levels of natural daylight from existing and new window openings to reduce reliance on artificial lighting.
- Solar gain and glare to be addressed by the installation of solar performance glazing with a low g-value fitted within new frames and occupant-controlled internal blinds.
- Building fabric to be improved to include new insulated flat and pitched roofs and the installation of new timber-framed double-glazed windows. Existing external masonry walls will be retained without internal insulation to enable the buildings to benefit from their thermal mass.
- Insulation added to the floor slab and the top of the EWRA (beneath the Wharf Road Viaduct).
- A new insulated conservatory on top of 'Block 4' of the FCO, thermally separated from the rest of the building structures.
- Mixed-mode ventilation system with mechanical and natural ventilation (openable windows) in the office and conservatory spaces.
- Inclusion of energy efficient lighting, daylight and movement sensors; zoning to be installed to ensure lights are not left on unnecessarily.
- Mechanical supply and extract ventilation with heat recovery (MVHR) in offices and commercial units.
- An efficient gas fired boiler and air cooled chiller to provide heating and cooling (repectively) on a temporary basis until the Coal Drops/Pavilion H are completed and a centralised system is developed to serve all three areas.

Condition 17 (b): Reduction in carbon emissions

The energy efficiency strategy for the FCO and EWRA seeks to reduce carbon emissions as far as possible for the refurbishment of an existing, heritage building. As such, the FCO is subject to Part L2B of the Building Regulations 2010 and associated Approved Document concerned with conservation of fuel and power (existing buildings other than dwellings).

Dynamic modelling predicts a total annual carbon emission of 72.7kgCO_2/m^2/yr for the proposed development taking into account passive design and energy efficiency measures only (including the proposed gas-fired boiler and air-cooled chiller). This provides an estimated reduction in carbon emissions of approximately 10% over a Part L 2B Notional Building.

Condition 17 (c) and Condition 46: Green and/or brown roofs

Although the FCO is not identified as lying within the 'Priority Zone for Green or Brown Roofs', as set out in Parameter Plan KX021 of the Outline Planning Permission, the addition of the new conservatory above Block 4 provides an opportunity to incorporate a green roof. This makes up approximately 17% of the overall roof scape for the FCO.

Condition 17 (d): Energy supply

The proximity of the FCO and EWRA to the Coal Drops Yard and Pavilion H provides the opportunity to centralise services for all three developments, potentially bringing substantial efficiency savings compared to smaller individual systems within each building.

It is recognised however, that the FCO and EWRA are likely to be occupied before the wider infrastructure in the area around the Coal Drops and Pavilion H is finalised. This has informed our proposed approach to initially provide the FCO and EWRA with heating and cooling via a high efficiency gas fired boiler and air cooled chiller until these later buildings come forward.

A photovoltaic array is proposed on the FCO providing a further annual CO_2 saving of up to 1.2% (i.e. 11.2% for the buildings overall).

Condition 17 (e): BREEAM Rating

The pre-assessment for the proposed offices predicts an overall score of 78.84%, equating to an 'Excellent' BREEAM rating.

The pre-assessment for the retail units within the FCO and EWRA predicts an overall score of 82.11%, also equating to an 'Excellent' BREEAM rating. The project team have also identified additional credits which could achieve an 'Outstanding' rating which will be considered as the project develops.

Condition 17 (f): Ecology

As this is a refurbishment scheme and the majority of the existing structure is being retained, there is little scope for enhancing ecology through integrated features. However, the new flat roof to the conservatory on Block 4 provides an opportunity to incorporate a green roof as noted above.

It is also proposed that bird and bat boxes are incorporated at high level, away from plant and accessible areas, and in locations which are sympathetic to the heritage nature of the buildings.

Condition 45: Drainage

The FCO and EWRA form part of the site-wide surface and foul water disposal strategy, and more specifically within the North West Drainage Infrastructure Area (one of three areas which cover the King's Cross Central site). Peak discharge flows for the buildings included in this application are 10l/s and 1.2l/s for surface water and foul water, respectively. These flows contribute towards to the site wide 2292l/s discharge limit and to an overall 10% reduction (1 in 30 year storm) in surface and foul peak flows across the King's Cross Central (KXC) development.

S106- Section AA: Water

Rainwater collection and re-use is proposed from the pitched roofs on the FCO providing a reduction in potable water consumption of approximately 13 – 14%. It is currently estimated that the building will achieve 92% of the available water credits under both BREEAM schemes (5 of 6 credits - office, 8 of 8 credits - retail) with the potential to achieve 100% of the credits in both assessments. This will be achieved with the provision of a water meter with a pulsed output, sanitary supply shut off systems, major leak detection and water efficient sanitary ware.

106- Section Y: Construction materials and waste

The development project team intends that best practice will be followed and surpassed where possible, in order to maximise resource efficiency. Careful planning will reduce waste of material, including careful handling, storage, timely delivery and avoidance of packaging where possible.

The creation of the new canal level plantroom will create waste sub-soil which will be appropriately excavated and disposed of offsite due to the potential contamination risk. Furthermore, the project contractor will apply its own corporate construction targets to the proposed development.

S106- Section Z: Waste

A sustainable waste strategy will be applied to the refurbished building, through the provision of segregated refuse storage at basement level, and the provision of Waste Information Packs to all occupiers. The refuse storage will be conveniently located and will provide sufficient space for general and recycled waste. The waste strategy will be monitored regularly to encourage waste minimisation.

2.0 Introduction

2.1 Purpose of the Plan

This Environmental Sustainability Plan ('ESP') describes the sustainability measures and strategies that have been included in the design of the Fish & Coal Offices and Eastern Wharf Road Arches in order to satisfy the Planning Conditions of the King's Cross Central ('KXC') Outline Planning Permission dated 22 December 2006 (ref. 2004/2307/P). The document seeks to demonstrate how the building achieves a high standard of sustainability, notwithstanding that the proposals relate predominantly to the refurbishment of an existing heritage building.

The document first addresses Conditions 17 (a) through to (f) of the Outline Planning Permission, with particular attention to the design and technology energy efficiency measures adopted in the building, along with the resulting carbon reductions. This includes the provision of green and brown roofs; the proposed energy supply; the BREEAM rating; and the incorporation of wildlife features. The document also contains information regarding drainage infrastructure to satisfy Condition 45 of the same permission.

Additionally, reference is made to the actions taken in the design of the building to meet the obligations of the KXC Section 106 Agreement, specifically Sections Y, Z and AA relating to construction materials, waste and water, respectively.

This Environmental Sustainability Plan forms a part of the suite of documents that support the Reserved Matters submission for the Fish & Coal Offices ('FCO') and Eastern Wharf Road Arches ('EWRA'), and should therefore be read in conjunction with those documents, in particular, the Urban Design Report and the Planning Compliance Report.

2.2 Description of the existing Fish & Coal Building

The FCO and EWRA are located in Development Zone I of the KXC development site, located to the south-west of Granary Square opposite the Grade II listed Granary Building/Western Transit Shed and the future 'Pavilion H', and on the south-easterly approach to the Coal Drops Yard. The Regent's Canal and towpath run along the south façade of the FCO and EWRA with the back wall of the building rising sheer from the towpath. Neither building is listed but they both lie within the Regent's Canal Conservation Area.

Wharf Road runs along the north façade of the FCO, on a viaduct located over the EWRA. The EWRA are located below the FCO at canal level, occupying the 10 easternmost brick arches of a larger group of 24 arches (collectively known as the 'Wharf Road Arches').

The FCO, shown in Figure 2.1, is a group of five Victorian masonry buildings, forming part of the former King's Cross Goods Yard. Its location in the context of the KXC illustrative masterplan is shown in Figure 2.2. The FCO was constructed at various stages in the mid-1800s to provide accommodation for the clerical staff needed to handle the paperwork generated by the coal trade associated with the goods yard. During the 20th century the offices were also used to administer the onward distribution of fish brought by train from ports on the east coast of England and Scotland.

The existing north elevation showing the five buildings, referred to in this document as 'Blocks 1-5', is provided as Figure 2.3. It is thought the FCO was built in phases between c1851 and 1860. The tallest building, Block 2, was built first, circa 1851, as part of the wider development of the Goods Yard. The adjacent two storey building to its east, Block 1, was either built at the same time or slightly later. Block 3

was built initially as a single storey building, with the first and second floors added at a later date. Blocks 4 and 5 were added last.

The offices had fallen into disuse by the early 1980's, when they were gutted by fire. The fire has had the greatest impact on the removal of original fabric, such as timber floors, staircases and roofs, and the stripping out of the buildings after the fire has left few fixtures and fittings. The buildings were repaired structurally and made weatherproof in the late 1990's and are currently vacant.

The arches of the EWRA originally acted as stables with a small amount of office space within the bays immediately beneath the FCO under Blocks 3 to 5. They were built circa 1850 and have historically performed as a multi-functional structure acting not only as retaining walls to the canal but also as support to Wharf Road at a higher level, held over 24 brick vaults.

In the late 20th century, several arches under the south-east end of the viaduct were converted into a nightclub. Some of the arches to the north-west of the night-club (outside the scope of this submission) became small offices and garages and some remained empty.

Figure 2.1: Photograph of Fish & Coal Offices from the South.

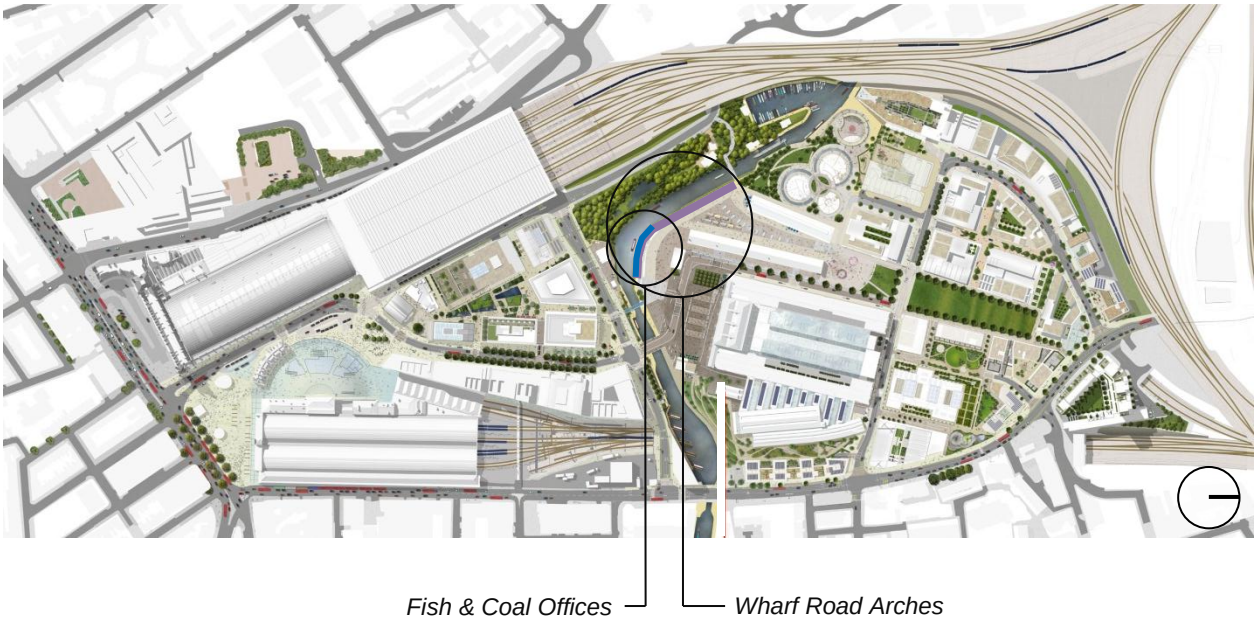

Figure 2.2: FCO (blue) and Wharf Road Arches (purple, 10 of which are included in the scope of this submission) within the context of the illustrative King's Cross Central Masterplan

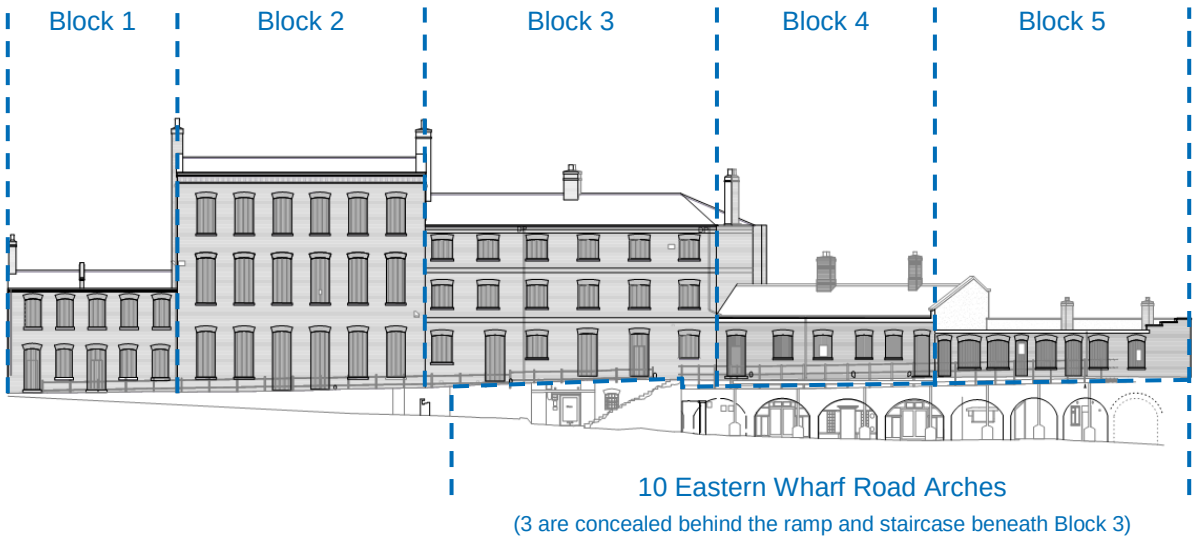

Figure 2.3: Existing North Elevation of the FCO identifying separate Blocks and seven of the EWRA (the remainder sit behind the staircase and ramp down to the Coal Drops Yard).

The existing buildings have the following key characteristics:

Walls	Solid Brick. Not insulated
Roof	Pitched slate roofs on the Fish & Coal Offices (Renewed after fire damage in the 1980s, except Block 5 where the roof is now flat). Un-insulated above the Eastern Wharf Road Arches.
Windows	No existing windows in the Fish & Coal Offices or Eastern Wharf Road Arches.
Ground Floor	Concrete, heritage granite setts. Not insulated.
Heating	No heating system installed – buildings currently vacant post fire damage in the 1980s.
Cooling and Ventilation	No cooling or ventilation system installed – buildings currently vacant post fire damage in the 1980s.

Table 2.1: Key characteristics of the existing FCO and EWRA

2.3 Proposed development

This Reserved Matters submission will see the refurbishment of the existing FCO and EWRA to accommodate office and restaurant/bar uses. A separate planning application is submitted in parallel to that submission for the removal of the existing roof of Block 4 and the construction of a new conservatory extension. The whole building will be taken by a single tenant, Jamie Oliver Limited, who will base its headquarters in the building and operate the food and drink outlets.

The offices will be located at all levels of Blocks 1, 2 and 3 and within two of the EWRA. Two restaurant/bar spaces will be located within the commercial units located at ground floor level of Blocks 4 and 5 of the FCO, the new conservatory and eight of the EWRA.

The design team has sought to preserve the heritage and character of the FCO and EWRA, allowing a few carefully focussed interventions to repurpose the buildings for modern use. Whilst retaining the strong identity of each block, the floor plates will be opened up and made more accessible by restoring the central stair in Block 2 and providing an open double sided lift between Blocks 2 and 3. The narrow curving floor plates of Blocks 4 and 5 create an opportunity for restaurant space that will enjoy views over the Regent's Canal towards Camley Street Natural Park and the city. It is proposed to increase this sense of activity on the canal frontage by providing new restaurant floor space within a modern conservatory structure on the roof of Block 4. This new structure will also deal with the functional necessities of providing a passenger lift within the restaurant/bar and accommodate the consolidated kitchen extract plant for all of the food and drink uses within the FCO/EWRA, thus minimising interventions across the rest of the building. The proposed conservatory will also provide access to an open air terrace on the reinstated flat roof of Block 5.

The proposed works will also include the following alterations to the existing building:

1. Insertion of new services and associated risers, for example, mechanical and electrical services, WCs and kitchenettes;

2. Refurbishment and making safe, of the existing stone staircase within Block 2 of the FCO, and;

3. Fabric and energy efficiency improvements which are sympathetic to the historic interest of the building while securing it for a viable, long-term use.

2.4 Building Regulations

Design work commenced on the FCO and EWRA in January 2013 and Camden Building Control Department confirmed receipt of the application for the development of the FCO and EWRA on the 27th Feb 2014, prior to the release of the 2013 edition of The Building Regulations that came into effect on the 6th April 2014. As such the FCO and EWRA development is designed to meet the Building Regulations 2010. Reference in this document to the Building Regulations should therefore be taken to mean the 2010 edition unless otherwise stated.

As this is predominantly a refurbishment project, it is therefore subject to Part L2B of the Building Regulations 2010 and associated Approved Document concerned with *'Conservation of Fuel and Power in Existing Buildings other than Dwellings'*. The building is considered to fall under the section *'Material Change of Use and Energy Status'* as this addresses for example *'a previously unheated building, or parts of the building that have been designed and altered to be used separately and are to be heated in the future'*. Under these regulations, minimum thermal insulation standards apply to thermal elements (walls, floors etc.) and 'controlled fittings' (e.g. fenestration, roof windows, etc.). The regulations also further impose minimum energy efficiency requirements on plant and equipment used in building services.

The proposed new conservatory will fall under the *'Extensions'* section of Part L2B. It is anticipated that the thermal elements will meet the standards for extensions, specifically achieving compliance with the requirements for conservatories regarding effective thermal separation of this space from adjoining spaces. The building services in this area will also comply with the requirements and the minimum standards set out in the current *Non Domestic Building Services Guide*.

The approach towards compliance with the relevant part of the Building Regulations 2010 is addressed as part of our response to the relevant outline planning conditions in this plan.

3.0 Response to Planning Conditions

3.1 Condition 17 (a): Energy efficiency

Explain how the proposed building design realises opportunities to include design and technology energy efficiency measures.

Although the FCO and EWRA are not listed, Annex E of the Main Site Development Specification and the Initial Conservation Plan submitted in support of the outline planning application in 2004 set out the necessary works to facilitate the buildings' future use and the refurbishment principles and parameters, including a requirement that *"the existing form and fabric of the former offices and arches would be substantially retained."* Consequently, the project team has sought to maximise energy efficiency through retrospective measures which are sensitive to the building's architectural heritage. Details of these measures are set out in the following paragraphs.

The energy efficiency strategy for the refurbishment of the buildings has been developed following a hierarchical approach, as shown below in Table 3.1 below. The strategy aims to reduce energy demands by first incorporating suitable passive design measures, followed by proposed enhancements to provide an efficient building fabric (where feasible), and finally, the installation of highly efficient systems and controls (active design) to reduce energy consumption when the building is in use.

1.	Optimised Environmental Design	
	– Solar design	[Limited due to existing building form]
	– Building form and layout	[Limited due to existing building form]
	– Natural ventilation	
	– Daylight access	
	– Thermal mass	
2.	Efficient Building Fabric	
	– Thermal properties (u-values)	[Limited due to existing building form]
	– Air tightness	[Limited due to existing building form]
	– Accredited construction details	
3.	Highly Efficient Systems and Controls	
	– Lighting and appliances	
	– Ventilation systems	
	– Heating and hot water systems	
	– Cooling systems	

Table 3.1: Hierarchical approach to energy efficiency

Physical form of the building

As noted in Section 2.2, the FCO and EWRA are broadly orientated on an east-west axis, with Blocks 3 through to 5 following the sweeping curve of the Regent's Canal in a north-west direction (see Figure 3.2). The buildings are relatively exposed in their location, particularly to the south which is open to the canal and Camley Street Natural Park.

The buildings sit in the south-west corner of Granary Square opposite the refurbished Grade II listed Granary Building. Together with the new Pavilion H to the north, the FCO forms a gateway into the intended future retail development within the Coal Drops Yard and the beginning of an elevated public walkway, the Wharf Road Viaduct, leading to the re-erected Gasholders and other new buildings to the west.

Figure 3.1: Fish & Coal North Façade

Figure 3.2: Orientation of Fish & Coal

Building envelope specification and thermal performance

Whilst the external envelope of a building can act as an important climatic modifier by significantly reducing heat demand, the scope for improvements to the FCO and EWRA fabric is limited due to the desire to preserve the buildings' heritage. Nonetheless, the thermal performance of the building's envelope will be greatly enhanced through sensitive retrospective measures such as the installation of new double glazed, timber framed windows (the building currently has no windows; the openings are boarded up), the provision of new insulated external doors and the addition of insulation to the roofs and floor slabs. In addition, airtightness will be improved by sealing and draft stripping the window frames. These measures serve to reduce air leakage and will reduce the amount of space heating energy lost through the fabric thus reducing the buildings' energy usage.

Insulation is not proposed to the walls for the following reasons:

- External insulation, which would mean wrapping and re-cladding the building, would not be suitable as this would alter the character of the building, and would result in the loss of historic architectural detailing.
- Adding layers of insulation internally would require the removal or concealment of any remaining original interior details.
- The existing structure would have to be strengthened before insulation could be added.
- Adding insulation would result in the loss of the exposed thermal mass provided by the masonry walls.

On balance, it is considered that the financial cost of installing wall insulation and the loss of character/surviving original features outweighs the environmental benefits that the insulation would bring.

The above approach is consistent with the approved guidance for historic buildings within Part L2B (2010) of the Building Regulations which requires: *'the improvement of energy efficiency as far as is reasonably practical,'* providing that *'the work should not prejudice the character of the host building or increase the risk of long-term deterioration to the building fabric or fittings.'*

The details of the proposed upgrades to building fabric and their respective anticipated U-values based on the 2010 Building Regulations are outlined in Table 3.2 below and illustrated in Figure 3.3.

Element	Estimated current U-values (W/m^2k)	Part L2B 2010 U-values (W/m^2k)	Proposed U-values for Fish & Coal (W/m^2k)	Comments
New high specification double-glazed units to all window openings	*4.6 – 5.0 Single Glazed*	1.8	1.4	*There are currently no windows in the building. A single glazed unit has therefore been assumed for the purposes of estimating a current u-value. The U-value is for the full unit – frame and glazing, not a centre panel value.*
New Roof Windows/glazed roof lights	-	1.8	1.6	*The U-value is for the full unit – frame and glazing, not a centre panel value.*
Pedestrian doors, including glazed doors	*2.0 – 3.0*	1.8	1.8	*This may be improved on depending on the level of glazing required in the door.*
New Pitched roof – insulated at ceiling level	*2.5 – 3.2*	0.16	0.16	
New Pitched Roof – insulated at rafter level	*2.5 – 3.2*	0.18	0.18	
Flat roof	*1.5 – 1.9*	0.18	0.18	
New Basement slab	*0.5 – 1.0*	0.22	0.22	*Where feasible. It is expected that near existing structural elements the proposed U-value may be difficult to achieve without risking the integrity of the existing structure or affecting the character of the host building*
External Walls	*1.3 – 3.0*	0.30	No change	*Heritage reasons explained above.*
External Walls - newly constructed	-	0.28	0.28	*Separating wall to unconditioned plant space in roof of Block 2 of the Fish & Coal Offices*
Above Eastern Wharf Road Arches *(where adjacent to the external environment.)*	*1.3 – 3.0*	0.18 - 0.28	~0.18	*Insulation may be added above the arches where it is technically feasible.*

Table 3.2: Proposed Building Fabric U-values for the Refurbished FCO and EWRA

The proposed new conservatory structure on Block 4 of the FCO, as described in Section 2.3 and shown illustratively in Figure 3.6, will be enclosed by glazing on three sides (south, west and north) set within a lightweight steel frame. On the north and west façades, full height glazing will provide panoramic views

across the KXC site and the city beyond. In contrast, the south elevation has a narrower band of glazing reflecting the height and curvature of the existing parapet.

The conservatory structure will support a green roof, which is further described in Section 3.3.

Under Part L2B of the Building Regulations 2010 the proposed conservatory is required to be thermally separated from the existing building with independently controlled heating and cooling systems. The conservatory design therefore utilises draught proof doors to the same standard as the refurbished building (including the door between Block 3 and the conservatory) as well as treatment to thermally separate the conservatory floor/ceiling interface to Block 4 as if it were an externally exposed floor.

The wall with which the conservatory adjoins Block 3 of the FCO will receive the same treatment as the external walls described in Table 3.2.

The proposed new conservatory on Block 4 of the FCO will meet the U-value standards shown in Table 3.3 below and illustrated in Figure 3.3.

Element	Part L2B 2010 New Element U-values (W/m^2k)	Proposed U-values for Fish & Coal (W/m^2k)	Comments
Existing wall separating Block 3 and the conservatory space	-	No change	*Heritage reasons explained above.*
Newly constructed Solid Walls	0.28	0.28	
New high specification double-glazed units	1.8	1.4	*The U-value is for the full unit – frame and glazing, not a centre panel value.*
Roof Windows	1.8	1.6	
Pedestrian doors, including glazed doors	1.8	1.8	*Pedestrian doors, including glazed doors – to outside AND through thermal separation (e.g. flanking wall, stairs)* *This may be improved on depending on the level of glazing required in the door.*
New flat roof	0.18	0.18	
Separating floor – to existing building below	0.22	0.22	*There will be a beneficial effect from the sheltering of the conservatory, reducing insulation thickness for a given conductivity*

Table 3.3: Proposed Building Fabric U-values for the new conservatory

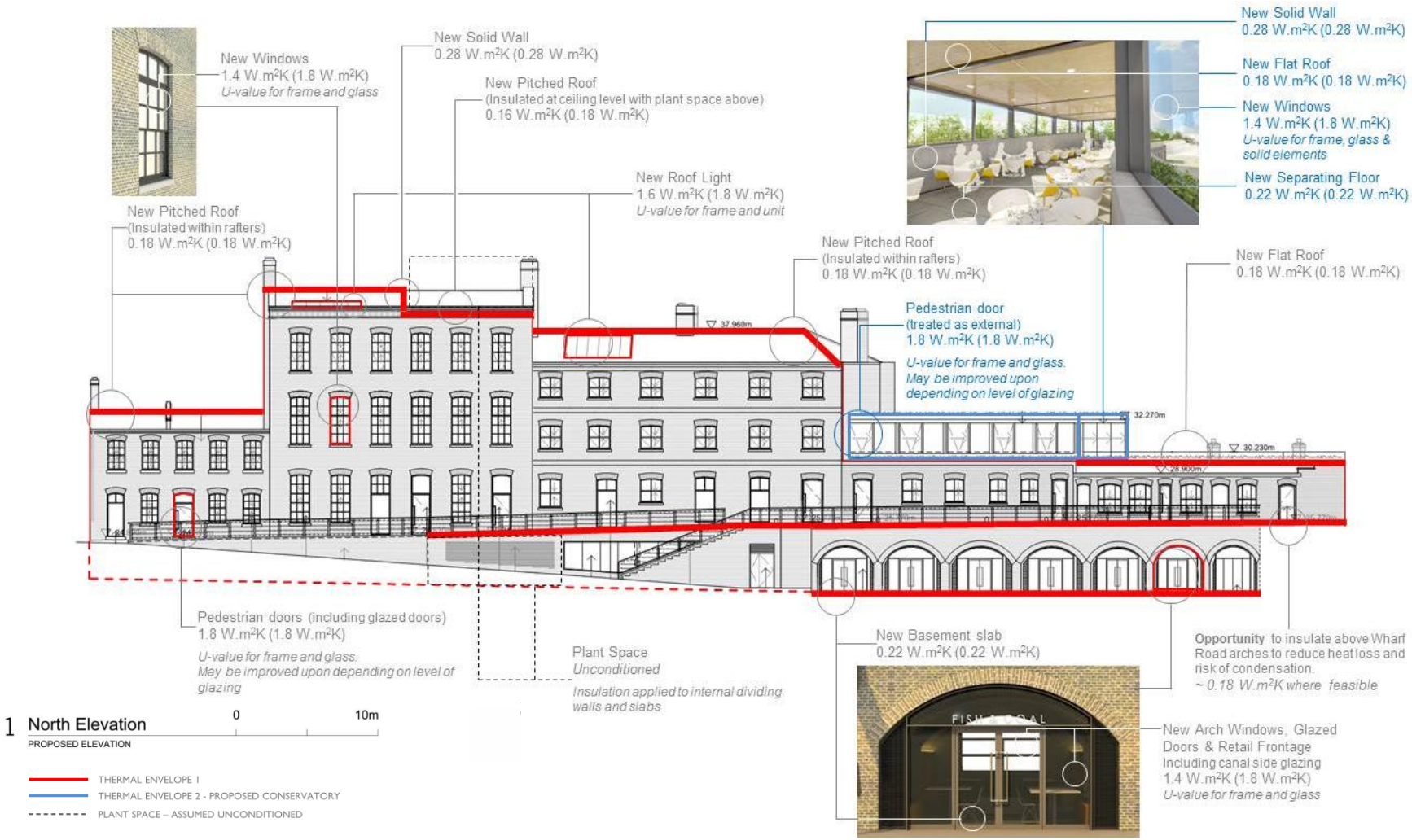

Figure 3.3: Opportunities for improvement in energy efficiency through the provision of insulation to the existing and proposed building fabric. (Part L2B Limiting values given in brackets). N.B. This does not consider the element U-values required to mitigate the risk of internal/interstitial condensation (Part C).

Passive solar design

Passive solar design involves adapting the building massing, and honing the layout and glazing to respond to the local climate, location and corresponding sunpath with the aim of reducing energy demands and improving occupant comfort through the use of heat and light from the sun. Since the FCO and EWRA are existing buildings, the massing and orientation are fixed. Nevertheless, the design seeks ways to reduce energy demands in line with passive solar design principles.

The existing arrangement of the buildings gives most spaces within the FCO a good amount of daylight due to the large windows on the north and south facades and dual aspect, shallow plan to many of the internal spaces.

At canal level, it is proposed to reintroduce and enlarge the former openings in the southern elevation of the EWRA whilst maintaining the existing openings to the north, increasing natural light access to these areas (see Figures 3.4 and 3.5 below).

As noted previously, there are no surviving windows in the existing buildings and as such new units will be installed throughout. These have been designed as a modern interpretation of a timber sash window with the intention that it will not only improve the thermal performance of the building but will also preserve the good levels of daylight, in turn reducing the requirement for artificial lighting and thus energy consumption. The proposed window layout is shown in Figure 3.4.

Figure 3.4: Proposed North and South elevation of the FCO and EWRA, showing the window arrangement.

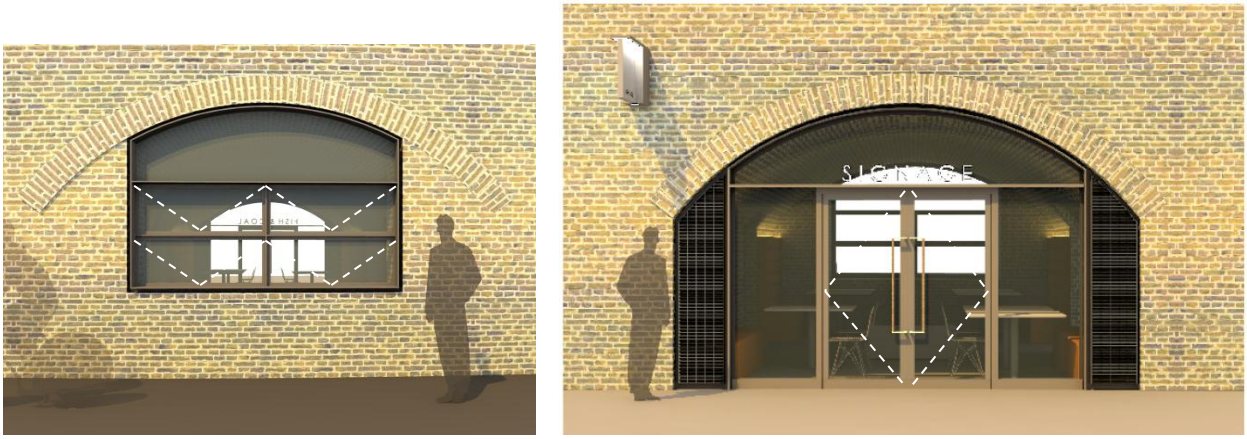

Figure 3.5: Left; Proposed reopening of the archways to the EWRA on the south (canal) facade. Right; proposed reopening of the northern elevation retail frontages of the EWRA.

The buildings' orientation and exposed south facade mean that the large windows which bring benefits in terms of daylight also have the potential to contribute to solar gain and overheating in the summer months.

To limit solar heat gain, all new glazing will be high performance with a low g-value of 0.4. Further, occupant controlled internal blinds will be provided. This is considered to be the most sympathetic approach to providing glare control whilst enabling occupants to manage their own environment and also help provide a consistent aesthetic across the buildings fronting Granary Square.

The depth of the existing window reveals allow the windows to open in a restricted position with the blinds down, should the occupant want to open the windows to provide cooling and natural ventilation when the mechanical ventilation is not being used.

The use of Brise Soleil was investigated as a potential solution to mitigate overheating. However, it was discounted on the basis the internal air temperature was found to be heavily influenced by internal heat gains and therefore it would have only minimal beneficial impact. It was also considered that the use of Brise Soleil would have a negative impact of the heritage character of the FCO and EWRA.

In winter, the building can benefit from the sun, particularly on the south façade by allowing the sunlight to penetrate and provide passive solar heating to the internal spaces. The use of internal blinds offers good flexibility as they can be left open in winter to allow this. The glazing has also been designed with improved U-value performance (on Part L guidance) to reduce the heat loss in winter.

The proposed new conservatory on Block 4 of the FCO, shown illustratively in Figure 3.6, will be enclosed by glazing on three sides (south, west and north) set within a lightweight steel frame. On the north and west façades, full height glazing will provide excellent levels of daylight and panoramic views across the KXC site and the city beyond. In contrast, the south elevation, which would be most exposed to solar gain, has a narrower band of glazing reflecting the height and curvature of the existing parapet and helping to reduce the potential for overheating. Openable panels to the north and south and doors onto the terrace to the west will provide natural ventilation to the space. The strategy for openable windows along the north and south elevation of the conservatory is shown illustratively in Figure 3.7.

The conservatory structure will support a green roof, which will help to further reduce solar heat gains in summer and protect from heat loss throughout winter. The advantages of a green roof are further discussed in Section 3.3.

As for the refurbished elements of the building, low glazing g-values will help to minimise solar heat gains in summer and low U-values will help to help mitigate heat losses in winter.

Figure 3.6 Internal view of the proposed conservatory above Block 4 of the Fish & Coal Offices.

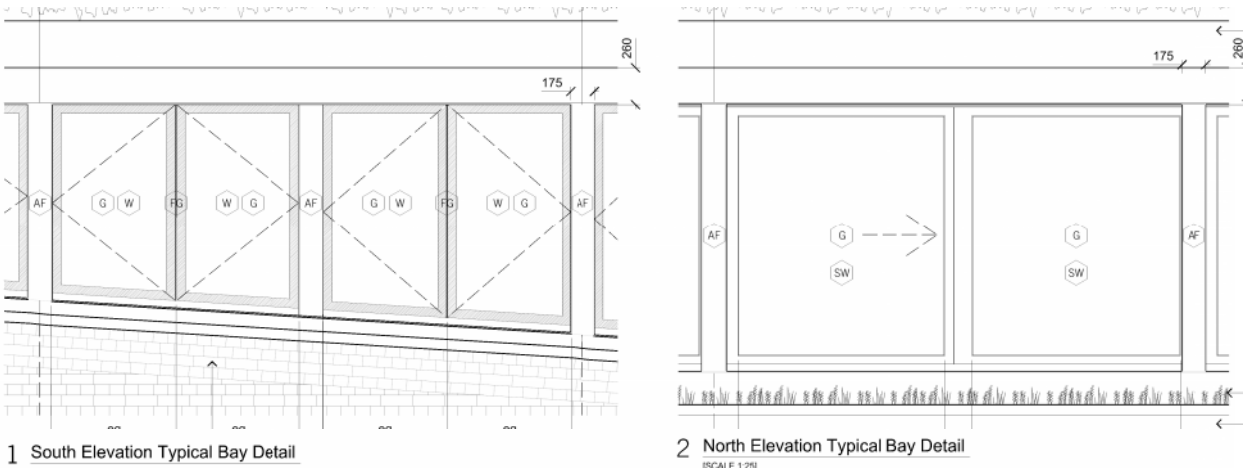

Figure 3.7: Proposed windows opening strategy for the north and south conservatory elevations.

Scope for thermal mass

Thermal mass is a term that describes the ability of a material to store heat. Concrete and masonry products do this very well as they are dense, heavy-weight materials. The ability to absorb and store heat, and release it again slowly when the material's surface is exposed to cooler air, helps to stabilise the internal temperatures.

Utilising thermal mass in a building can thus help to regulate internal temperatures without any mechanical intervention, and temper heating and cooling loads by absorbing and radiating heat naturally to reduce annual energy consumption. To exploit the thermal mass of a building, direct contact is required between the structure and the occupied space via exposed surfaces. The existing masonry walls of the FCO and EWRA act as excellent thermal mass, absorbing excess heat during the day and releasing it during the cooler night-time period, thereby prolonging the period which cooling through natural ventilation will be able to operate.

Scope for natural ventilation

As the development is a refurbishment project, there are certain limitations on what can be achieved in terms of meeting comfortable internal conditions through passive measures due to, for example, the fixed building orientation and large existing windows.

For the purposes of developing the ventilation strategy for the FCO and EWRA, the design team has referred to the Chartered Institute of Building Service Engineer's ('CIBSE') Guide A and the British Council for Offices' ('BCO') current comfort criteria as they are recognised as setting out good practice for office spaces. These criteria suggest that an internal temperature should not exceed 28°C any more than 1% of the occupied hours (CIBSE) and an internal temperature of 25°C should not be exceeded more than 5% of occupied hours (BCO).

Discussions with the prospective tenant suggest that they plan to occupy the office space more densely than the BCO standards. Taking into account the increased density proposed by the tenant, modelling was carried out to look at the ventilation rates required to achieve the criteria set out above, using openable windows or high-level vents in the office space. It concluded that cold draughts are likely to be experienced by the occupants given the air change rate required to offset the predicted occupancy density. This approach would also require the heating systems to be sized to offset the throughput of cold air draughts during peak conditions. Therefore the most appropriate solution would be to provide mechanical ventilation with heat recovery as part of a mixed mode on/off system.

Mixed mode ventilation refers to a hybrid approach that utilises mechanical ventilation systems where necessary as well as natural ventilation via openable windows or high-level vents to maximise comfort. A solution such as this provides a two-tier benefit. Firstly, utilising open-able windows in mid-season conditions can help to avoid significant energy use and higher operating costs of year-round air conditioning. Secondly, mechanical ventilation system with heat recovery can mitigate heat lost in winter months. It achieves this by allowing the exchange of heat energy from the exhaust air leaving the building to the incoming fresh air. This 'pre-heating' can significantly reduce the work done required by the ventilation system to heat incoming air during winter conditions. This system can by bypassed to avoid extra cooling requirements during summer conditions.

The mechanical ventilation plant will be designed to minimise fan energy consumption and operate only when needed.

It is predicted that a system of this description will provide substantial reductions in carbon emissions from the heating system during the winter months as well as the ventilation system during spring and autumn months.

Scope for intelligent lighting systems

As noted previously, the existing windows (once reopened), will give the interior spaces in Blocks 1 to 5 of the FCO excellent levels of daylight. Access to daylight within the EWRA will also be significantly improved by installing windows within the bricked up openings on the south façade and creating new windows to the two eastern-most arches in the retaining wall of the Wharf Road Viaduct, alongside the Coal Drops Ramp. To complement the use of natural light, low energy lighting will be used throughout; mostly high efficiency fluorescent and LED sources to maximise light output. The lighting efficacy in office type spaces will be greater than 55lm/W for luminaires in both office and non-office type spaces, and >22lm/W for display lamps as set out in the Non-domestic Buildings Services Compliance Guide: 2010 Edition.

Lighting within the office areas shall be controlled via a centrally managed lighting control system incorporating combined presence/absence detectors and photocells to allow for daylight dimming, limiting energy wastage when rooms are not in use or when they are sufficiently day-lit. Furthermore, using low energy lighting will limit internal heat gains, thereby reducing the demand for cooling.

The retail units of the FCO and EWRA will be shell and core provision for full fit out by the future tenants. For the purpose of the Part L (2010) assessments it has been assumed that Part L 2010 standards will be met by the future tenants in these areas.

The choice and design of building systems and plant

The building systems and plant have been designed to achieve optimum efficiency matching their installed capacity to anticipated building energy demands. Items of equipment that make up the building's mechanical building services installation will be specified to achieve high levels of operational energy efficiency and will be regularly serviced to maintain their performance.

Reflecting the domestic scale spaces of the buildings, the office space will be densely occupied in comparison to new build BCO standards. As noted above, this has driven the requirement for mechanical ventilation systems in the office spaces as part of a mixed mode solution, with plant located in the roof void above Block 2 and within a separate plant room at canal level. Natural ventilation alone is not anticipated to offer sufficient levels of occupant comfort in peak summer or winter conditions, however openable windows will provide a mixed mode strategy during mid-season external conditions.

The mechanical systems will include mechanical supply and extract ventilation with heat recovery, in addition to the incorporation of fan coil units to provide local temperature control during the peak summer and winter conditions. They will be controlled via local temperature sensors and manual on/off controls. In mid-seasons the occupants will have the ability to open the windows to achieve acceptable comfort conditions.

For the proposed retail units, windows will be openable along the canal elevation, however, it is not expected that natural ventilation will be sufficient on its own. It is therefore proposed that mechanical ventilation with heat recovery is incorporated into the design for year-round use. Fan coil unit terminals will also be provided with local temperature control using temperature sensors and manual on/off controls. These systems will be installed by the tenant as part of the fit-out of these units.

The proposed conservatory will have openable panels to the north and south and doors onto the terrace to the west, providing significant levels of natural ventilation to the space, especially in summer months. However, mechanical supply and extract ventilation with heat recovery will also be provided in this part of the building alongside fan coil units to provide local temperature control throughout the year. As per the rest of the development, the proposed systems will be controlled via local temperature sensors and manual on/off controls.

It is recognised that the FCO and EWRA are likely to be occupied before the wider infrastructure in the area around the Coal Drops and Pavilion H is finalised. The buildings' proximity to these developments presents an opportunity for centralised services and plant systems which could bring greater efficiencies across all three areas compared to individual plant within each building. However, this requires a more detailed technical feasibility study to be undertaken at the detailed design stage of the Coal Drops refurbishment in order to assess the viability of the proposed options.

Until these later schemes come forward, it is proposed that the FCO and EWRA will be served by a high efficiency temporary gas boiler for space heating and domestic hot water, and a highly efficient air cooled chiller for cooling. It is anticipated that the air cooled chiller and boiler house will be located at the lower

ground floor level between the Eastern Coal Drops building and Stable Street as illustrated in Figure 3.8 and shown for information in drawing HL-XX-00-DRU-5909500 forming Appendix C to this document. A separate planning application will be submitted in relation to the temporary siting and design of the air cooled chiller and boiler house.

All of these systems have been designed so that they could provide a highly efficient long term solution if required, albeit the boiler house and chiller are likely to require relocation to facilitate development of the Coal Drops in due course. However, the use of this system on a permanent basis is not considered a primary objective.

High efficiency variable speed drives will be utilised to vary the fan and pump speeds throughout the FCO and EWRA building's services in order to match the energy supply to the actual heating and cooling load profiles, therefore reducing energy consumption. The incorporation of heat metering will also be targeted at each floor level will also satisfy the BREEAM metering credit and Part L of the Building Regulations. This, along with a building management and control systems, will provide an opportunity to monitor and manage the building services effectively. The proposed building management and controls systems are further discussed in section 3.4

Valved and capped domestic hot water connections will be provided in the risers at specified locations for future extension by the tenant for tea points and 'test kitchens' within the proposed office areas. Energy saving measures such as low-flow taps and using highly insulated storage vessels will be deployed to limit heat losses.

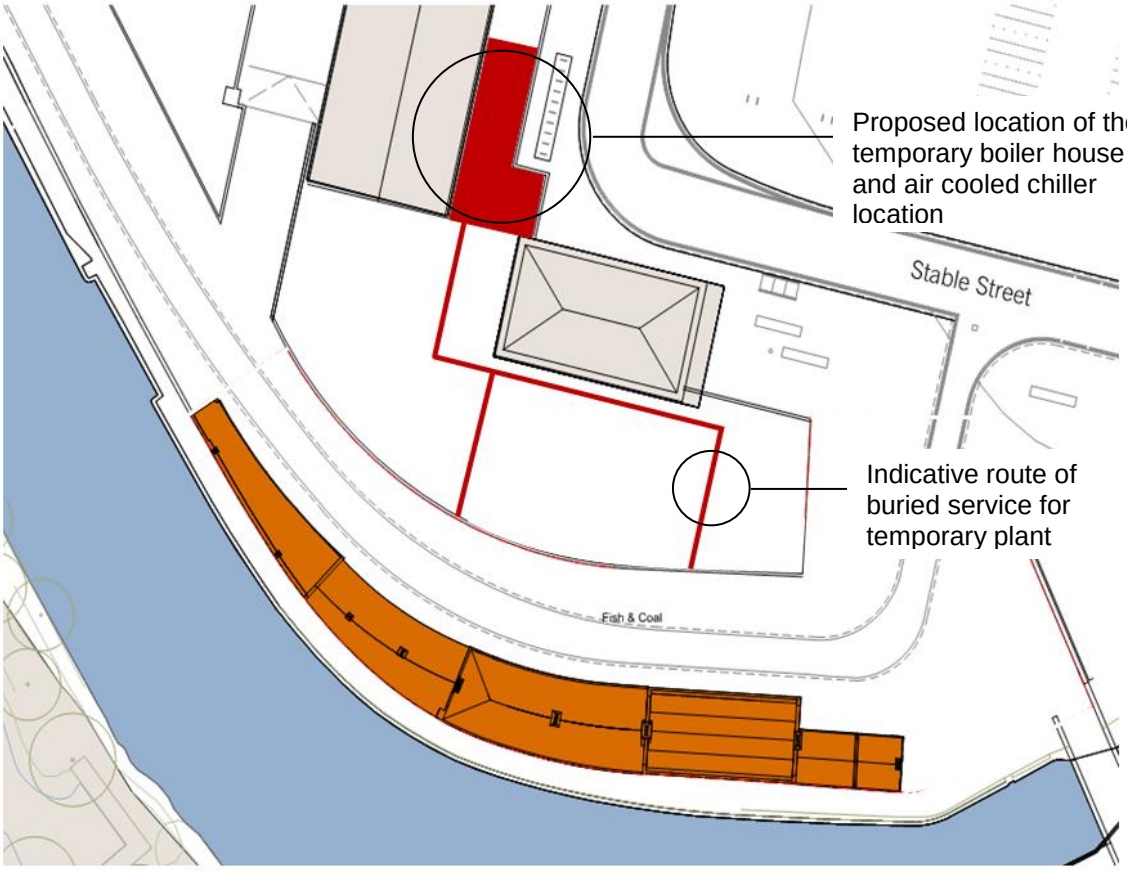

Figure 3.8: Proposed location of the temporary boiler house and air cooled chillers within the surrounding environment.

3.2 Condition 17 (b): Reduction in carbon emission

Explain the reduction in carbon emissions achieved through building design and technology energy efficiency measures, compared with the emissions permitted under the national Building Regulations prevailing at the time the application for approval of reserved matters is submitted.

The project is a refurbishment of an existing building and therefore is subject to Part L2B of the Building Regulations and associated Approved Document concerned with conservation of fuel and power (existing buildings other than dwellings). The requirements of Part L2B for historic buildings are clear; the aim should be to improve energy efficiency where feasible and to the extent that it is practically possible, provided that the work does not prejudice the character of the host building or increase the risk of long-term deterioration to the building fabric or fittings.

The energy efficient design measures for the FCO and EWRA, as previously described in Section 3.1, seek to maximise efficiency as far as possible whilst being sensitive to the historic fabric of the building, and are thus consistent with Part L2B. The KXC Section 106 Agreement requires a 5% improvement on the TER for *new* buildings, using good passive design and energy efficient measures. As an existing building, this obligation does not apply to the refurbishment of the FCO and EWRA. However, for completeness, an assessment against Part L of the Building Regulations 2010 has been undertaken to illustrate the impact of the proposed measures on carbon emissions.

To demonstrate the proposed building's reduction in carbon emissions, the predicted carbon emissions have been compared to those of a notional building constructed to the refurbishment standards set out in Approved Document L2B (See L2B AD 4.21) and is equivalent to the National Calculation Methodology (NCM) approach used for new buildings assessed under Part L2A of the Building Regulations. To calculate the carbon emissions an established dynamic simulation tool, Virtual Environment IES, was used, which is compliant with the NCM methodology. Where new thermal elements (walls, floors or roofs) are added to the development, Part L2B sets out new thermal element standards that differ slightly from the refurbishment standards. Where new thermal elements are proposed for the FCO and EWRA, i.e. the conservatory, the new thermal element standards have been used.

For the purposes of this assessment it has been assumed that a gas fired boiler will provide the space heating and domestic hot water and an air cooled chiller system will provide the space heating and cooling loads (see Section 3.1). As noted in Section 3.1, it has been assumed that current Part L 2010 standards will be met by the future tenant in the commercial units.

Modelling predicts that the passive design and energy efficiency measures set out in Section 3.1 will result in a reduction in annual carbon emissions from 80.8kgCO_2/m^2/yr for the Part L 2B 2010 Notional Building, to 72.70kgCO_2/m^2/yr for the proposed FCO and EWRA. This represents a 10% reduction in carbon emissions beyond a Part L2B 2010 Notional building.

This is a significant achievement when it is considered that the development predominantly relates to a retained heritage building that is below current levels of insulation and can only be improved relatively modestly through retrospective additions. The expected reduction in carbon emission is shown graphically in Figure 3.9 below:

Further details of both the L2B Notional and the Proposed Building modelling characteristics and methodology are provided in Appendix A.

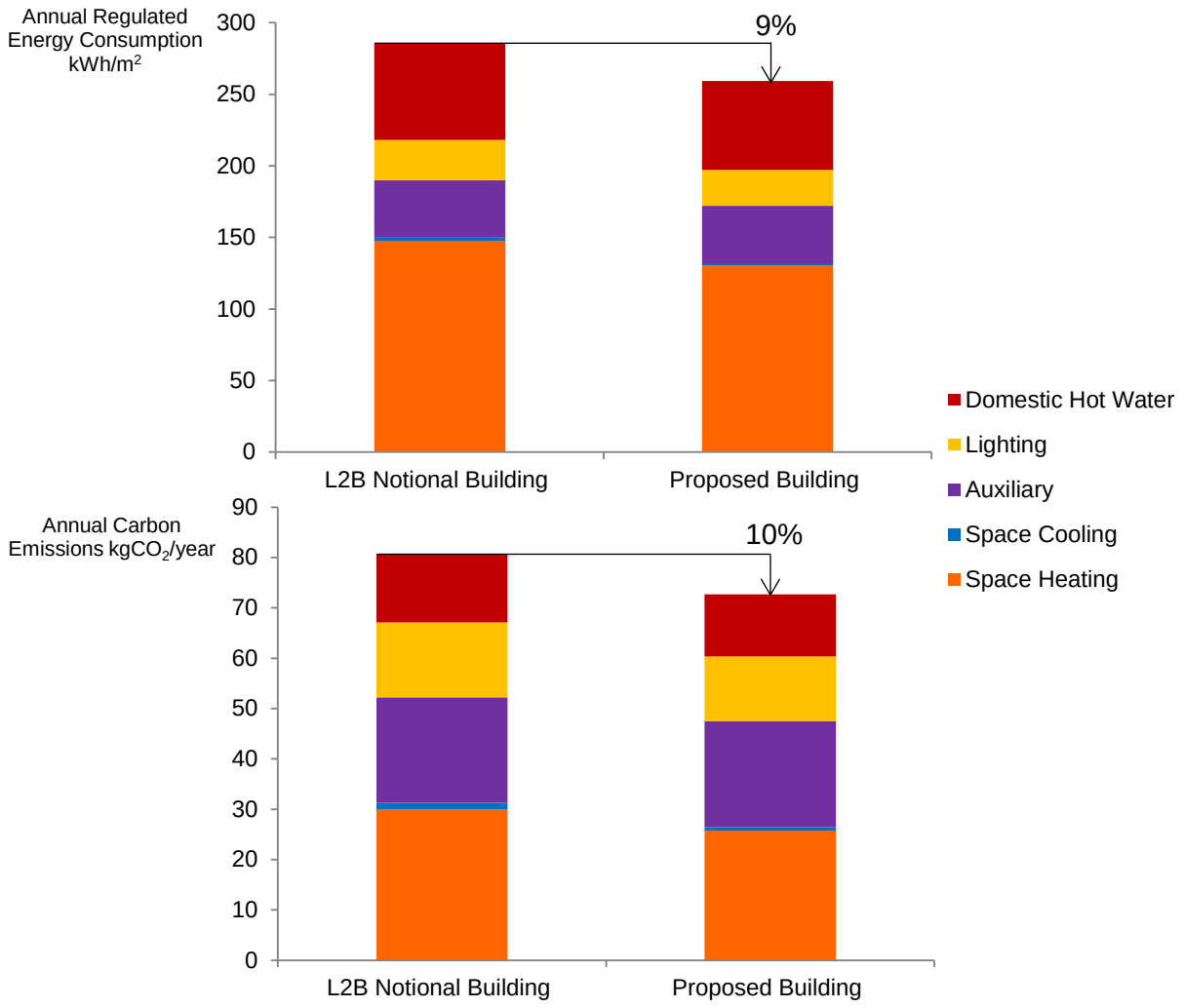

Figure 3.9: Graphic representation of the breakdown by end use of regulated energy and carbon emissions and showing a 10% reduction in carbon emissions (9% Regulated Energy Consumption) for the Proposed Building through passive design and energy efficiency when compared to the Part L 2B 2010 Notional Building.

The major features that contribute to these savings are:

a) Good daylight, resulting in a reduced need for electric lighting

b) The 'light-touch approach' to upgrading the FCO and EWRA walls permitting excessive heat gains to escape the building in summer months.

c) Mid-season natural ventilation in office spaces.

d) High efficiency lighting installation in office spaces

e) Highly efficient heating, cooling and domestic hot water systems

It is evident from Figure 3.9 that a large proportion of the proposed building's energy consumption comes from heating. It should be noted, however, that this is due to decisions to preserve the historic building fabric and thus not insulate the external walls, which places greater demand on the heating system.

3.3 Condition 17 (c) and Condition 46: Green and/or brown roofs

Explain the specification for any green and/or brown roof. At least 15% of the roofs of new buildings constructed pursuant to the planning permission shall be green and/or brown roofs as defined in the Revised Development Specification dated September 2005.

The proposals for the FCO and EWRA relate to the refurbishment of an existing building, and therefore Condition 17(c) does not apply in so far as it relates to the contribution to the site-wide target of 15% of roofs on new buildings being green/brown roofs. Furthermore, the KXC Outline Planning Permission does not within Parameter Plan KXC021, identify the FCO or EWRA as lying within a 'Priority Zone for Green or Brown Roofs'.

It is acknowledged that green/brown roofs can nonetheless provide several benefits for the building as well as the surrounding environment, including:

- Increased biodiversity and ecological value of the roof space

- Improved thermal insulation
  A green roof can help to moderate the heat flow through a building by shading the roof surface, providing an additional layer of insulation, encouraging evapotranspiration (passive cooling and a result of evaporation and plant transpiration) and improving thermal mass. As a result, the roof can help towards reducing the amount of energy needed to moderate the temperature of a building. Green roofs also decrease the exposure of waterproofing membranes on flat roofs to temperature fluctuations, increasing its durability.

- Improved noise insulation for the roof element.

- Storm water Management & Mitigation of the heat island effect in a city location
  Larger green/brown roofs or several localised smaller roofs can help to reduce stress on sewer systems by retaining some storm water and also delaying the time it take to reach sewer systems. They can help to improve water quality by filtering and trapping sediments, leaves and heavy metals and also help to mitigate the heat island effect in a city location by reducing the amount of sunlight that reaches the underlying roof. They can also help to cool the local air through evapotranspiration by using heat from the air to evaporate water in the photosynthesis process.

Due to the potential benefits, opportunities were explored for a green or brown roof on the new conservatory, taking account of the limited accessibility of the roof (and therefore requirement for minimal maintenance), and feedback from LB Camden planning officers at the pre-application stage regarding a preference for a thin, lightweight design.

Consequently, a green roof comprising a wildflower and sedum matting is proposed across the conservatory roof, equating to around 90m^2 (or 17%) of the overall roof scape for the FCO (See Figure 3.10). The nature of this type of roof and the proposed planting is such that it will thrive with a limited build-up and thus maintain the delicate roof profile requested by officers.

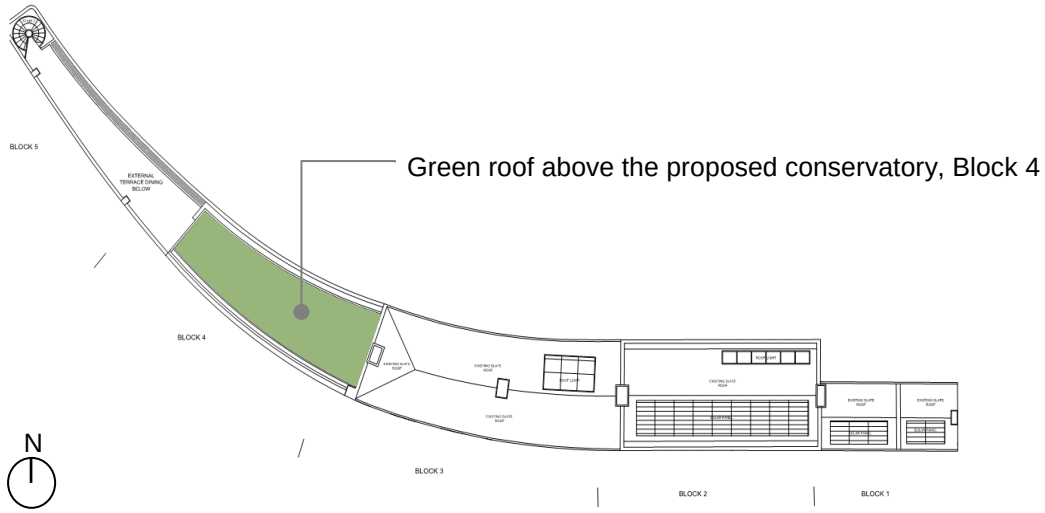

Figure 3.10: Proposed roof plan for the Fish & Coal Offices showing the proposed location of the green roof.

The build-up of the soil substrate and aggregate is expected to be approximately 80mm towards the edge of the roof, but will increase in depth at the centre out of site from the public realm. The varied soil depth, shown in Figure 3.11, allows a greater variety of planting and therefore improved ecological value.

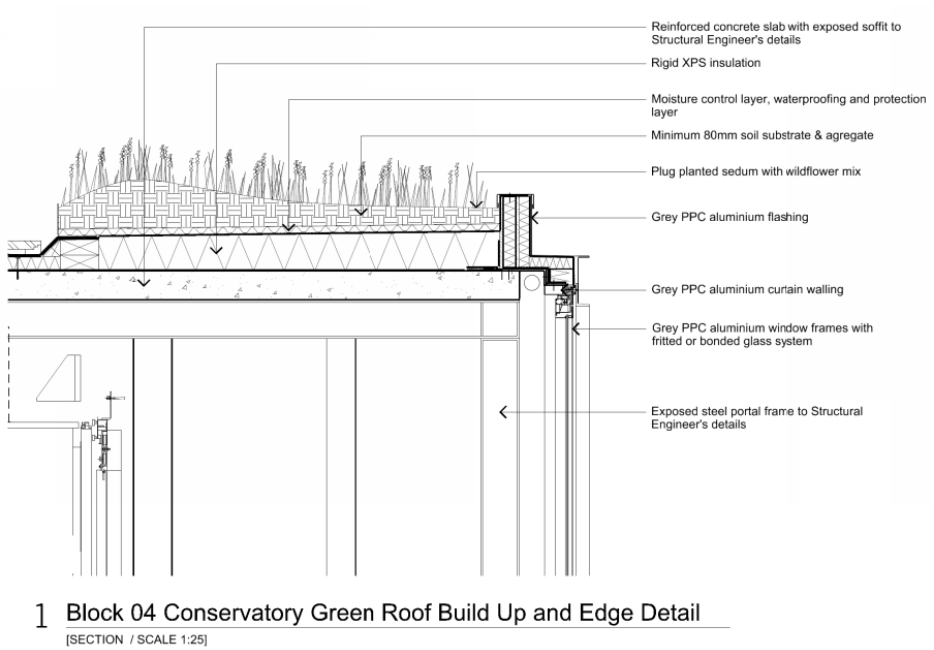

Figure 3.11: Conservatory green roof build up and edge detail

The remaining roofs on Blocks 1, 2 and 3 of the FCO present limited scope for green or brown roofs due to their pitch, and their suitability for photovoltaics/space to accommodate plant.

The roof of Block 5, which is already flat, will be used as an outdoor terrace for external seating, associated with the conservatory restaurant. This terrace will incorporate raised containers for low level planting around its perimeter with a mixture of native and non-native species in order to attract a range of wildlife. These will offer some additional (albeit small) ecological value in addition to the dedicated green roof area. Illustrations of these planters can be seen in Figures 3.1 and 3.6.

3.4 Condition 17 (d): Energy supply

Explain how energy shall be supplied to the building, highlighting:

i. How the building relates to the site-wide strategy for district heating incorporating tri-generation from distributed combined heat and power.

ii. How the building relates to the strategy for using bio-fuel boilers to supplement the energy supplied through the district heating system.

iii. The assessment of the cost-effectiveness and reliability of the supply chain and bio-fuels.

iv. Any other measures to incorporate renewables.

Building energy supply and relationship with the low-carbon district energy system

KXC low-carbon district energy system

The T1 Energy Centre has already been approved, constructed and partially commissioned to meet the heat and hot water demands of the first occupiers at KXC, including the University of the Arts London, commercial tenants in the Western Transit Shed and buildings in Zone B, and residents of Buildings T6, J, R4 and R5 North.

KCCLP and its partners have established the Energy Services Company ('ESCo') to run the district heating, and the necessary heat and power distribution infrastructure has been and is being installed across the KXC site to enable the connection of each new building, and where appropriate retained buildings, to the district energy network. The combined heat and power ('CHP') engines within the T1 Energy Centre will also generate electrical power, which will offset a significant percentage of the demand from this and other buildings.

When fully operational, it is anticipated that the T1 Energy Centre will include the following principal items:

- 3no. 1.8MWth gas fired CHP engines;
- A thermal store, intergral to the CHP operating hours strategy;
- 3no. 9 MWth gas boilers.

These items will be installed on a phased basis as the scheme reaches critical mass, in order to meet peak demands and optimise efficiency.

Biofuel boilers

As outlined in previously submitted (and approved) ESPs, future provision has been made within the KXC low-carbon district energy system for inclusion of biomass boilers. At this time, a robust commercial case to support the inclusion of biomass cannot yet be made, however, this position continues to be actively monitored. The scope for a secondary energy centre within Plot T2 could provide for their inclusion later, subject to procurement of an appropriate fuel source in line with clause 20(a) of Section X of the Section 106 Agreement.

The FCO and EWRA and wider infrastructure

Notwithstanding that neither Section X of the Section 106 Agreement or Condition 48 of the Outline Planning Permission require Development Zone I to utilise the KXC low-carbon district energy system, this option has still been considered. As discussed in Section 3.1, the proximity of the FCO and EWRA to the Coal Drops Yard and Pavilion H does provide an opportunity to centralise services for all three developments to provide energy for space heating and domestic hot water.

For such a system to work effectively, it is essential that the infrastructure is developed holistically in the context of these emerging schemes and any heritage considerations in relation to the Grade II listed Eastern Coal Drops. Consequently, as the Coal Drops Yard and Pavilion H are at an early stage of design and are not yet subject to formal pre-application discussions with the Council, it is not possible to provide details of the proposed system at this stage. However, it is expected that connection of all four buildings to the KXC low-carbon district energy system in the future would provide significant reductions in carbon emissions compared to individual high-efficiency boilers and chillers within each building.

The intention is that details of any future centralised system or connection to the KXC low-carbon district energy system for the Coal Drops Yard, Pavilion H and the FCO/ EWRA would be submitted as part of the ESP for the Coal Drops and/or Pavilion H developments.

In the meantime, the FCO and EWRA will be provided with heating and cooling via a highly efficient gas fired boiler and air cooled chiller. Subject to separate approval in the future, it is anticipated that these would be located as per Figure 3.8 adjacent to the currently vacant Eastern Coal Drops building.

Review of renewable energy systems

A review of renewable technologies, including ground source heat pumps ('GSHPs") which are identified in Section X of the Section 106 Agreement for installation within Development Zone I, has been carried out to assess their suitability for the FCO/EWRA in terms of lifecycle costs versus carbon emissions reductions achieved, and the physical and visual impact on the historic fabric of the buildings. A summary of the conclusions for each technology is set out below.

Ground Source Heat Pumps

A Ground Source Heat Pump ('GSHP') system is a heating and cooling system that transfers heat between buildings and the ground. The system relies on a relatively constant ground temperature (below a certain depth) throughout the year and can therefore provide a potential source of heat in winter and cooling in summer. This is in contrast to conventional methods that either burn fuel for heating or reject heat to the external air in order to condition internal air. GSHP systems do require electrical energy to run which can reduce the potential carbon savings.

Generally GSHPs are best suited to new developments as there is an opportunity to install the system beneath the building itself, or incorporate a system into the foundations of the new development. As the FCO and EWRA is an existing building, this option is not available.

Alternatively a GSHP could be installed beneath an area adjacent to a development; however this would require a large amount of undeveloped or open space directly adjacent to the FCO/EWRA. As discussed in section 2.0, the FCO/EWRA is located adjacent to the Regent's Canal, the Coal Drops Yard/Ramp and listed Eastern Coal Drops Building, Granary Square and Pavilion H. As such there is not a large enough open space in the direct vicinity that could accommodate a new GSHP system that would serve the FCO/EWRA alone.

Connection to a GSHP that might be located further away from the FCO/EWRA intended to utilise the system would result in long pipe runs between the system and the development which can often result in significant heat or coolth losses from the system, significantly affecting its operation and effectiveness.

The KXC Energy Assessment (2005) recommends that a GSHP installed in this location be of a capacity of 1100 kW, serving the FCO and EWRA (Development Zone I) alongside Pavilion H and the Coal Drops Yard (Development Zones H and M, respectively).

Preliminary investigations into future options for the Coal Drops, Pavilion H and the FCO and EWRA have been carried out using CIBSE Guide F and TM46 good practise benchmarks for Electricity and Fossil Fuel use for the identified developments. They anticipate that, based on the approved uses for these buildings, there will be insufficient heat load to implement a GSHP system of this capacity.

A GSHP takes time after start up to get to its documented efficiency and therefore the longer that it runs, the longer it will run at this efficiency. If a GSHP is oversized it can cause it to run shorter cycles as it can deliver the required heat or coolth faster. As a result less time is spent running the system at optimal efficiency which will greatly reduce carbon savings that could be made from the system. Beyond the savings lost, running a GSHP on repeated shorter cycles will cause the system to have a short life and require more maintenance meaning the system could be turned off for prolonged periods.

Notwithstanding the space constraints highlighted above, preliminary investigations estimate that a 350kW system could be better suited to serve the areas identified in the KXC Energy Assessment. However the option to connect the Coal Drops, Pavilion H and the FCO/EWRA to the KXC low-carbon district energy system, as discussed above, is expected to provide an even greater carbon saving than a 350kW GSHP system.

Wind Turbines

The growth of wind energy in the UK has been dramatic over the last two decades and it is now seen to be a relatively mature technology. The vast wind resources that the UK possesses have been exploited not only by large commercial wind farms but also within individual developments.

However, the British Wind Energy Association (BWEA) suggests that for a large wind turbine to be viable, a minimum wind speed of 7m/s or above is required. The table below, taken from the BERR wind speed database, indicates that the likely wind speeds found at the KXC site are likely to be insufficient when compared with this minimum value benchmark.

Further to this turbulence created from surrounding buildings (expected to increase as the KX development moves forward) will disrupt constant wind speeds making this an even less reliable source of renewable energy.

Wind speed across King's Cross site at various heights (Source - BERR database)	
10 meters above ground level	4.8 m/s
25 meters above ground level	5.5 m/s
45 meters above ground level	6.0 m/s

Table 3.4: Wind speed data for King's Cross site from BERR wind speed database

Consequently any wind turbine positioned between ground level and 45 metres is unlikely to receive a high enough wind speed to turn the blade and generate power. Some vertical access wind turbines do

have the capability to 'kick-start' at low wind speeds using and electric motor. However these have been known to become net-consumers of electricity when intermittent gusts of wind (common in a city location) mean the turbine is repeatedly 'kick-started' and decelerating as there is not a continuous provision of wind.

In addition, it is considered that wind turbines greater than 45 metres in height would be incongruous in long and short range views of the building, especially given the context of the adjacent Grade II listed Granary Complex and the buildings' location within the Regent's Canal Conservation Area. Large-scale wind turbines are therefore not considered to be a viable renewable energy solution for the FCO and EWRA development.

Solar Thermal

Solar thermal technology uses sunlight to directly heat water, usually for domestic hot water use. To make the best use of a solar thermal system requires a high thermal base load, thus making it more suited to residential projects.

Typically an office space has a small domestic hot water (DHW) demand which makes a solar thermal system unfavourable. Whilst there is a greater opportunity for the retail units to benefit from potential carbon savings from a solar thermal array, the future possibility that the FCO and EWRA may benefit from connection to the KXC low-carbon district energy system to provide DHW and space heating means that any solar thermal installation if installed would compete with the KXC district energy system. This would mean that the solar thermal panels would be providing a source of renewable hot water and limit the savings that might be made by connecting to the KXC district energy system.

For this reason, solar thermal panels have not been pursued further in this project.

Photovoltaics (PVs)

PVs convert energy from sunlight directly into electricity. The main advantage, particularly over solar thermal, is that the generated electricity can be used for a wider range of applications than hot water and can also be exported to the National Grid.

The FCO is well placed to accommodate PVs due to its south facing orientation. While the proposals seek to maximise the potential for using PVs, the visibility of the panels from the public realm and the visual impact on the building as a whole is an important factor in the choice of design and location. For this reason the preferred option is for the removal of the existing roof slates and replacement with in-line solar electric roof slates to Block 1 providing up to 12m^2 of solar tiles. On Block 2, the pitched roof is surrounded by a small parapet that provides the opportunity to install up to 45m^2 of higher efficiency surface mounted PV panels with minimal visibility from the public realm. The proposed locations for surface mounted panels and solar tiles are shown in Figure 3.12.

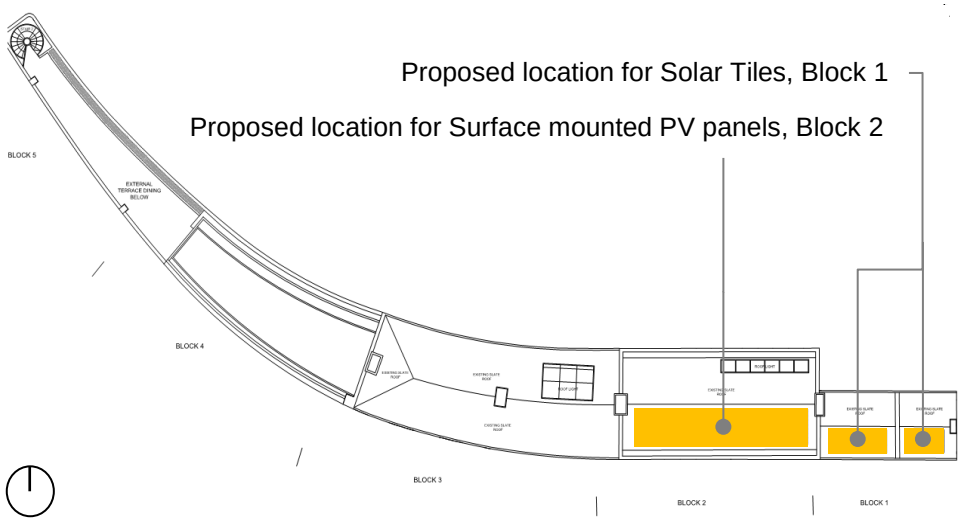

Figure 3.12: Proposed roof plan for the Fish & Coal Offices showing the proposed location for photovoltaic panels

The curvature of Block 3 means that installation of PV panels is not possible on the roof of this part of the FCO. Block 4 is to be occupied by the new conservatory topped by a green roof and Block 5 will be occupied by a roof terrace. Blocks 3, 4 and 5 also reduce in height from east to west and this will cause overshading that would limit the output from PV modules located on these blocks. For these reasons PVs have been discounted for these blocks.

It is anticipated that the combination of the surface mounted PV panels to Block 2 and solar tiles incorporated into Block 1 could provide an additional annual CO_2 saving of up to 1.2% beyond passive design and energy efficiency measures identified in Section 3.1. This would equate to an overall saving for the building of 11.1%.

Figure 3.13 provides a comparison of the building's Part L2B Notional Emission Rate against the predicted emissions rate after passive design and energy efficiency measures as well as after the inclusion of the proposed photovoltaic array.

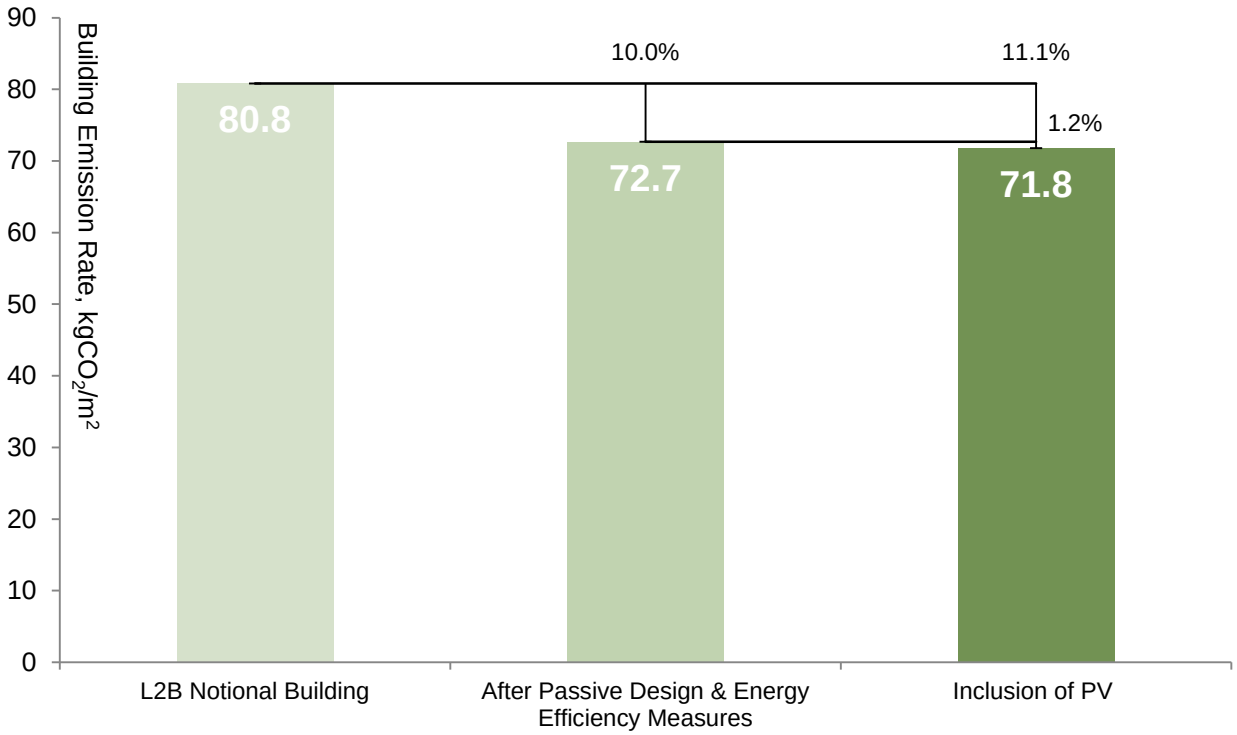

Figure 3.13: CO_2 emissions resulting from passive design and energy efficiency measures, the contribution of The KXC low-carbon district energy system, photovoltaics and the potential contribution of biofuel boilers

3.5 Condition 17 (e): BREEAM Rating

Explain how the proposed building has been designed to achieve a BREEAM and/or Ecohomes rating of 'Very Good' (or an equivalet assessment method and rating) or better.

The Building Research Establishment's (BRE) Environmental Assessment Methodology (BREEAM) is a recognised methodology to drive improvement in the sustainability performance of a development. The standards set by BREEAM are being used to maximise the effectiveness of the issue-specific strategies, including energy, water and waste, addressed in this ESP.

Separate pre-assessments have been carried out by a Licensed BREEAM Accredited Professional based on the BREEAM 2008 "Major Refurbishment" Scheme for the office and retail (i.e. restaurant/bar) spaces to establish the expected scores. It should be noted that the assessment is provisional on the basis that all of the documentary evidence required for a formal assessment (in the form of tender documents and drawings, etc.) is not yet available at this planning stage. Full evidence will be gathered in due course at the detailed design stage, as the project progresses.

BREEAM workshops have been held with the design team to ensure successful integration of BREEAM requirements into the design specification. Workshops have been led by a certified BREEAM Accredited Professional and were initiated at an early stage of design to ensure all of the design team has a robust understanding of minimum standards, voluntary credits and best practice.

The individual BREEAM pre-assessments for the office and restaurant/bar areas of the FCO and EWRA are available in Appendix B of this ESP. A summary of the approach and scores is provided below.

Office

Under the BREEAM 2008 "Major Refurbishment" scheme, the pre-assessment for the offices predicts an overall score of 78.84% which equates to an 'Excellent' rating (minimum score 70%). Additional credits have been identified which could see a further improvement on this score as the project develops during detailed design and construction.

Table 3.6 summarises the performance of the building in each of the BREEAM sections as a result of the credits being targeted at this stage. Appendix B provides a full list of credits targeted for the office element of the development which, if fulfilled, would secure a BREEAM 'Excellent' rating in a full assessment.

Building Performance by Section - Targeted Score	Environmental weighting	Credits available	Credits targeted	% Achieved	Weighted Score
Management	12.0%	10	10	100.%	12.00
Health & Wellbeing	15.0%	13	10	76.9%	11.54
Energy	19.0%	23	13	56.5%	10.74
Transport	8.0%	10	9	90.0%	7.20
Water	6.0%	6	4	66.7%	4.00
Materials	12.5%	13	11	84.6%	10.58
Waste	7.5%	7	4	57.1%	4.29
Land Use & Ecology	10.0%	10	8	80.0%	8.00
Pollution	10.0%	12	9	75.0%	7.50
Innovation	-	10	3	30.0%	3.00
Total BREEAM Targeted Score				**Excellent**	**78.84**

Table 3.5: BREEAM pre-assessment summary table for Office spaces

Retail

Under the BREEAM 2008 "Major Refurbishment" scheme, the pre-assessment for the retail (restaurant/bar) elements predicts an overall score of 82.77% which equates to an 'Excellent' rating (minimum score 70%).

Additional credits have been identified which could potentially be achieved by the design team with additional actions. Some of these credits would also require action from the tenant when fitting-out the retail units. If all of the potential credits were targeted, the development would be able to achieve a score of 89.09%, which equates to an 'Outstanding' rating.

Table 3.7 summarises the performance of the building in each of the BREEAM sections as a result of the credits being targeted at this stage. Appendix B provides a full list of credits targeted for the restaurant and bar parts of the development which would facilitate the achievement of at least a BREEAM 'Excellent' rating in a full assessment.

Building Performance by Section - Targeted Score					
	Environmental weighting	Credits available	Credits targeted	% Achieved	Weighted Score
Management	12.00%	10	10	100.0	12.00
Health & Wellbeing	15.00%	7	6	85.7	12.86
Energy	19.00%	24	17	70.8	13.46
Transport	8.00%	12	8	66.7	6.00
Water	6.00%	8	6	75.0	4.50
Materials	12.50%	13	11	84.6	10.58
Waste	7.50%	8	5	62.5	4.69
Land Use & Ecology	10.00%	10	8	80.0	8.00
Pollution	10.00%	13	10	76.9	7.69
Innovation	-	10	3	30.0	3.00
Total BREEAM Targeted Score				**Excellent**	**82.77**

Table 3.6: BREEAM pre-assessment summary table for the Retail element

3.6 Condition 17 (f): Ecology

Explain the incorporation of bird boxes, bat roosts and other wildlife features on the building.

The building is a refurbishment, and therefore as much of the structure is being retained, the ability to enhance ecology through integrated features is limited. Nonetheless, it is proposed that bird and bat boxes are affixed at high level, away from plant and accessible areas.

The ability to add such boxes must be balanced by the need to preserve the existing heritage fabric and limit their aesthetic impact. The main opportunity areas are therefore at roof level where the boxes would have little visual impact, for example, adjacent to chimneys or integrated into the existing brick façade using fitted boxes such as those proposed on the recently approved German Gymnasium scheme.

Elsewhere, the building will incorporate a mixed wildflower and sedum matting roof on top of the new conservatory on Block 4, shown previously in Figures 3.10 and 3.11. The species will be selected for their ecological value and attraction to a variety of insects and birds.

The roof terrace above Block 5 will also incorporate raised containers for low level planting around its perimeter with a mixture of native and non-native species in order to attract a range of wildlife. These will offer some additional (albeit small) ecological value. An example of these planters can be seen in Figures 3.1 and 3.6.

3.7 Condition 45: Drainage

The new drainage infrastructure within the site shall be designed to achieve a combined (storm and foul) peak discharge to the existing combined sewer of 2,292 l/s or less.

Site Wide Drainage Infrastructure

The figure of 2292 l/s in the wording to Condition 45 describes the maximum peak (storm and foul) discharge which is permissible for the site as a whole to discharge to the existing combined sewers. The peak discharge will be split between the Camden Sewer and York Way Sewer (for the Northern Area) and the Camley Sewer / Fleet Sewer (for the Southern Area).

The cumulative peak discharge from the many building plots and areas of infrastructure will exceed 2292 l/s under certain weather conditions. In these instances, the site wide drainage infrastructure, including online and offline attenuation (see below), will attenuate peak flows discharging from individual plots, adopted highway and public realm, enabling cumulative peak flows to be reduced to 2292 l/s or less.

The site wide surface and foul water disposal strategy can be summarised as follows:

- To provide separate surface and foul water networks, combining only at the final manhole prior to connection into the existing Thames Water sewerage network
- To provide online attenuation (for example oversized pipe work) and offline attenuation (for example proprietary modular underground storage systems / tanks) to buffer peak flows generated within the site down to the agreed discharge rates into the existing Thames Water sewerage network
- To ensure that no above ground flooding occurs during the worst case 1 in 30 year storm event
- To ensure that no internal building flooding occurs during the worst case 1 in 100 year (+20%) storm event
- To accord with PPS 25 and Sewers For Adoption 6th Edition
- To discharge at various locations into the sewerage network, and
- To design the above infrastructure such that combined surface and foul water flows do not exceed 2292 l/s during a 1 in 30 storm event.

The site wide drainage infrastructure at the KXC development can be described in terms of three drainage infrastructure areas, incorporating both building plots and infrastructure/public realm. These are described under Table 3.8 below:

Drainage Infrastructure Area	Plot developments	Infrastructure / Public Realm
Eastern Goods Yard	The Granary Complex, Q1, Q2, R1, R2, R3, R4, R5, S1, S2, T1, T2, J1, H1, K1, K2, K3, K4 and 50% of I1	Transit Street, Wharf Road, Goods Street, Granary Square, Cubitt Park and Handyside Park
Southern Area Infrastructure	A1, A2, A3, A4, A5, B1, B2, B3, B4, B5, B6, D1, D2, F1 and V1	The Boulevard, Goods Way, Station Square and Pancras Square
Remainder of the Northern Area including the Triangle Site	I1, M1, M2, N1, P1, P2, S3, S4, S5, T3, T4, T5, T6 and W1	Canal Street and Cubitt Square

Table 3.7: Drainage Infrastructure Areas

Table 3.8 identifies the assumed peak foul and surface water flows from each of the building plots which underpin the design of the site-wide infrastructure. The foul water figures are based on CIRIA 177 Variable Peaking Factor and the assumed foul water discharges from various land uses identified in Table 3.9. The surface water peak flows are based on a 1 in 30 year storm. It should be noted that it is most unlikely that the foul and surface water peak discharges from each individual plot will coincide with each other.

Generally, foul water discharges represent small but consistent flows subject to diurnal patterns. For example, residential properties will exhibit two peaks within their diurnal flow pattern, one in the morning and one in the early evening.

Surface water discharges, on the other hand exhibit extreme variations in flow, directly related to rainfall intensity.

The surface water discharge from each plot development will have its own unique hydrograph (identifying the variation between flow and time – the peak of which only lasting for a few minutes in most cases). Each one of these peaks (within the hydrographs) combine within the main drainage infrastructure at different points in time during the storm event creating an averaged flow within the pipe network.

These flows will discharge into the Thames Water network via flow hydraulic controls at the downstream end of each network. These hydraulic controls limit the discharges to a combined maximum of 2292l/s. Where the plot development discharges combine to produce flows in excess of the maximum allowable discharge, water will be held within the drainage infrastructure which has been specifically sized to accommodate these flows.

	Assumed Peak Flows (l/s)	
Plot reference	**Surface Water (1 in 30 year event)**	**Foul Water**
North West		
I	**10**	**1.2**
M1	107	4.6
M2	142	7.1
N1	252	7.5
P1	255	8
P2	210	19.4
S3	156	4.2
S4	175	12
S5	149	5.1
T3	138	9
T4	101	7.2
T5	78	6.5
T6	133	10.6
W1	308	11.8
Total	**2214**	**114.2**

Table 3.8: Peak Surface and Foul Water Flows for the North West Area

Land Use	Demand Options	Discharge to Sewer (l/day/hd)	l/s/head	Operational Hours	Population Density (m2 per person)
Residential	-	152	0.0023457	18	36.2
Student Accommodation	-	152	0.0023457	18	19.5
Retail	Large Retail	26.6	0.0009236	8	40
Food/Drink	Customer/day 2hr sittings	28.5	0.0009896	8	1.4
Education	General	19	0.0006597	8	10
Business	Without Canteen	41	0.0014236	8	12
Hotel		133	0.0046181	8	20
Leisure	Sports club	142.5	0.0049479	8	40

Table 3.9: Foul water discharges from various land uses

Drainage Infrastructure relating to Development Zone I

Development Zone I (i.e. the FCO and EWRA) is serviced by the Northern Area drainage systems (Table 3.7), and discharges via restricted discharges in to the combined Thames Water Camden Sewer. The drainage networks have been designed on SUDS principles providing an overall peak flow reduction of 10% (based on a 1 in 30 year storm).

Thames Water has approved the surface and foul water discharges into the Camden Sewer for the network serving Development Zone I. The approved discharges reflect the assumptions described in Table 3.8 and Table 3.9 (above). The peak flows for Building I1 are 10 l/s and 1.2 l/s for surface water and foul water, respectively. It should be noted that the figures in Table 3.9 do not specifically include public realm areas. However, the Northern Area public realm was included in the hydraulic model used during the design of the infrastructure to ensure that each of the drainage sub catchments (buildings and public realm) are attenuated and the flows into the combined Thames Sewer restricted so that the permissible discharges set out in the Outline Planning Permission are not exceeded.

4.0 Response to Section 106 Agreements

4.1 S106- Section AA: Water

Section AA of the Section 106 agreement places an obligation to use reasonable endeavours:

- *To incorporate within the detailed design water efficiency measures such that the design secures at least 40% of the potable water consumption credits available under the BREEAM methodology which represents a reduction of approximately 20-30% against typical water consumption,*

- *To incorporate one or more of groundwater abstraction, grey-water and black-water recycling and rainwater harvesting as alternative water supplies to meet 5% or more of the non-potable water needs and*

- *To ensure that the design for the treatment of storm water run-off incorporates, where practicable, filtration, attenuation and other techniques that is consistent with current best practice on SUDS, to control the timing and volume of flows.*

BREEAM

It is currently anticipated that with the inclusion of a combination of rainwater harvesting and water efficient sanitary ware, the proposed development could secure 5 out of 6 (83.3%) and all 8 of the potable water credits (100.0%) in the BREEAM Office and Retail Assessments respectively, with the potential to achieve 100% of the credits in both assessments.

The water efficient sanitary ware will include the following:

- Dual-flush WCs
- Low flow rates/aerators on hand basin taps and kitchen sink taps;
- Low flow rates for showers

Water use and reuse

In the southeast, climate change is predicted to reduce summer rainfall by up to 30% by 2080. Furthermore, the transport, treatment and delivery of potable water involve the consumption of energy and resources. All these issues highlight the need to include design that reduces water demand in new developments.

As a result it is proposed that the FCO will utilise a rainwater harvesting system to meet some of the non-potable water needs for the office spaces. Collection will be made from the pitched roofs above Blocks 1 and 2 to plant located in the new canal level plantroom. Using the BREEAM Wat 1 Calculator, it is estimated that rainwater harvesting could yield approximately 0.85m^3/person/year. This would equate to approximately 13 – 14% of the estimated non-potable water needs from sanitary fittings within the office part of the development (the rainwater harvesting would not serve the commercial units).

All parts of the building will be supplied with a water meter, with a pulsed output, which allows effective water management and monitoring to take place and sanitary supply shut off systems will be installed to avoid wastage when rooms are unoccupied. Major leak detection will also be provided to all mains water supply between and within the building.

Sustainable Drainage

Surface water drainage methods that take account of quantity, quality and amenity issues are collectively referred to as Sustainable Urban Drainage Systems (SUDs) and are more sustainable than conventional drainage methods. The FCO/EWRA site discharge has been incorporated in a hydraulic model for the site as a whole (see Section 3.7) and therefore attenuation is not required on an individual plot basis.

As a retained building, opportunities to integrate SUDs into the scheme are limited. Nonetheless, as described in Section 3.3 of this ESP, a green roof is proposed on top of the new conservatory on Block 4. This will help reduce the peak flow and the total volume discharged from the roof by attenuating or retaining rainfall and, on warmer days, by encouraging evapotranspiration.

For further details on the drainage strategy to reduce surface water run-off, please refer to Section 3.7 of this report.

4.2 S106- Section Y: Construction materials and waste

Section Y of the Section 106 Agreement imposes obligations to:

- *Implement the Construction Materials and Purchasing Strategy.*
- *Apply the Construction Materials and Purchasing Strategy to agreeing specifications and targets in contracts with contractors, designers and suppliers of services in relation to construction.*
- *Use reasonable endeavours:*

    1 *To minimise packaging waste associated with the delivery of construction materials.*
    2 *To produce topsoil and subsoil that uses subsoil and crushed rubble from the site combined with organic material for use in areas of landscaping.*
    3 *To achieve the Construction Targets.*

Construction materials and purchasing strategy

The project team intends that best practice will be followed on the FCO/EWRA development and surpassed wherever practicable, in order to maximise resource efficiency. The Construction Materials and Purchasing Strategy will be adopted while careful planning and effective control will ensure that waste during the construction phase is minimised.

Packaging Waste

Packaging used to protect construction materials and assemblies in transportation will be kept to a minimum and wherever possible, will be returned to the supplier to be reused.

Careful handling of materials and planning of their storage and delivery times will reduce unnecessary packaging to protect against damage.

Soil

As the development is a refurbishment of an existing building, little new sub-soil will be needed for or generated by the proposed works. However the creation of the new canal level plant room will create some waste sub-soil.

Trial pit investigations have identified high levels of contamination in certain areas of the KXC site and for this reason suitable allowance will be made for the appropriate excavation and disposal of the contaminated material off site. Please refer to the submitted Earthworks and Remediation Plan for further details on the strategy for removal of spoil.

Construction Targets

An aspirational BREEAM rating of 'Excellent' will be the principle driver for the team's endeavours to achieve the best possible performance against the construction targets. BREEAM credits cover the Green Guide rating of the major building elements, the provision of floor coverings, the environmental impacts of paints and varnishes, the responsible sourcing of materials and the global warming potential of insulants; all matters addressed by the Construction Targets set out in the Section 106 Agreement.

At this early stage, the exact degree to which all the Construction Targets will be achieved cannot yet be determined, because the precise specifications and quantities of many of the materials have not yet been

finalised. However, the Construction Materials and Purchasing Strategy set out above demonstrate a commitment to meeting the Construction Targets.

In addition to the Section 106 requirements, the project contractor will have its own corporate construction targets which will be applied to the proposed development.

4.3 S106- Section Z: Waste

Section Z of the Section 106 Agreement imposes obligations to:

- *Provide occupiers with Waste Information Packs and use reasonable endeavours to obtain feedback on the success or popularity of the initiatives contained within the Packs.*
- *Use reasonable endeavours to incorporate within the detailed design best practice design solutions that provide for waste segregation and storage areas and to maintain the solutions that are implemented.*
- *Provide and maintain segregated waste containers within the Public Realm areas at suitable locations and in appropriate numbers.*

Waste information packs

To encourage the minimisation of waste generated during the operational life of the building, Waste Information Packs will be provided to occupiers of the building and will include information on recycling, re-use of materials and sustainable purchasing. Arrangements will be made to monitor their effectiveness in encouraging waste minimisation.

Waste segregation area

Waste will be taken in bags to a dedicated refuse storage area at canal level. The bin store has been designed and sized to be shared by both the office and retail demises. Refuse will be stored in the bin store until it is collected via the service doors that open out onto the Coal Drops Ramp. The bin store within FCO and EWRA will be clearly labelled to allow for waste separation and recycling and provides an enclosed hygienic environment for storage until pick-up.

The refuse will be collected on a daily basis by the KXC Estate Management Team and taken to a central waste room for collection by the refuse contractor.

Further details of the Waste and Refuse Strategy for the building are provided in the submitted Urban Design Report.

5.0 Appendix A – Modelling Parameters

5.1 Further Details of Carbon Emissions Modelling

The following section provides details of the key features of the L2B Notional Building approach and the parameters used in modelling the proposed design.

Figure 5.1 below shows the geometry that was used in the modelling software to perform the dynamic simulation modelling.

5.2 Key Model Characteristics

The key characteristics are shown in Table 5.1 below. Further modelling parameters are given in the subsequent text beneath.

	L2B Notional Model	Proposed Building Model
Geometry	Same size and shape as proposed building. See Table 5.2 below.	See Figure 5.1
Openings	Same size and shape of windows, doors and roof lights as proposed.	As per design
U-values	To standards set out in Tables 3, 4 and 5 of AD L2B.	As per the parameters described in 3.1 Condition 17 (a): Energy efficiency
Climate	CIBSE Test Reference Year London	
Loads, Occupancy Schedules, Internal Heat Gains, Set Points	Using L2A model templates	
Heating System	To minimum standard set out in Table 1 of the 2010 Edition of the Non-Domestic Building Services Compliance Guide	Mains Gas Boiler 91% Efficient
Cooling System		Air Source Heat Pump EER = 3.20
Ventilation		Mechanical Ventilation with Heat Recovery Efficiency = 50 – 70%
Lighting Load Offices (W/m^2/100 Lux)		2.0
Lighting Load Retail (W/m^2/100 Lux)		5.2
Lighting Controls	Lights on NCM Schedule.	Daylight linked dimming. Lights dim and turn off in rooms with good daylight when external brightness > 25000 Lux.
* Heating, cooling, ventilation and lighting plant efficiency standards as set out in section 4.30 of AD L2B which in turn refers to the Non-Domestic Building Services Compliance Guide.		

Table 5.1: Pertinent model features

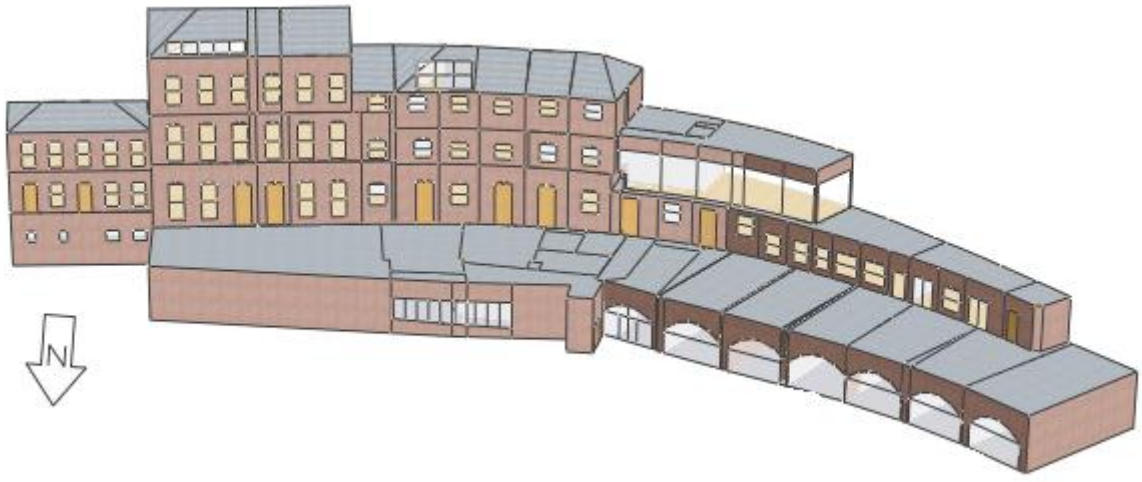

Figure 5.1: IES Model Geometry

5.3 L2B Notional Model Characteristic

Geometry and Materials

Same size and shape as proposed design. See Figure 5.1 above.

Same size and shape windows, doors and roof lights as per proposed design

U values to standards set out in Tables 3, 4 and 5 of AD L2B.

Window and glazed doors, U-value = 1.8 W/m^2/K (including frame)
New Roof, U-value = 0.16 W/m^2/K
Retained or Renovated External Wall, U-value = 0.3 W/m^2/K
Retained or Renovated Floor, U-value = 0.25 W/m^2/K

Assumed Glazing g value = 0.6

Assumed Air Permeability = 15 m^3/hr/m^2 @ 50Pa.

Building Services

Heating, Cooling, Ventilation and Lighting plant efficiency standards as set out in section 4.30 of AD L2B which in turn refers to the 2010 Edition of the Non-Domestic Building Services Compliance Guide.

Space Heating & Hot Water

Load	Demand, time schedules and set points taken from L2A modelling method.
System	Same as proposed building. Mains gas boiler
Seasonal Efficiency	From N-DBSCG = 84%
Fuel	Mains Gas

Cooling	
Load	Demand, time schedules and set points taken from L2A modelling method.
System	Same as proposed building.
Seasonal Efficiency	From N-DBSCG SEER = 2.5
Fuel	Same as proposed building. Mains Electricity.
Ventilation	
Load	Demand, time schedules and set points taken from L2A modelling method.
System	Mechanical Ventilation with Heat Recovery
Heat Recovery Seasonal Efficiency	50 – 70%
Fuel	Mains Electricity

Table 5.2 L2B Notional Model Characteristics

Lighting

The design illumination (Lux) levels used are taken from the L2A modelling method. E.g. Office spaces illuminated to 400 Lux. The lighting efficiency standards from the N-DBSCG are used in conjunction with some reasonable assumptions relating to the effect of losses from the fittings and the distribution of light within the spaces.

There is no daylight control assumed in the Notional building.

The lighting loads for the L2B notional building are as follows:

	L2B Min Standard for Office Like Spaces	L2B Min Standard for Other Spaces	L2B Min Standard for Display Lighting
Lighting Load (W/m^2/100 Lux)	3.0	3.8	9.5

Table 5.3: lighting loads for the L2B notional building

5.4 Proposed Building Model Characteristics

Geometry and Materials (U-values are area weighted averages)

Windows, roof windows, roof lights and glazed doors, U-value = 1.42 W/m^2/K (including frame)
Personnel doors, U-value = 1.82 W/m^2/K (including frame)
New Roof, U-value = 0.17 W/m^2/K
Retained External Wall U-value = 1.79 W/m^2/K
Renovated Floor U-value = 0.22 W/m^2/K

Glazing, g value = 0.4
Air Permeability = 15 m^3/hr/m^2 @ 50Pa.

Building Services

Space Heating & Hot Water

Load	Demand, time schedules and set points taken from L2A modelling method.
System	Mains Gas Boiler
Seasonal Efficiency	91%
Fuel	Mains Gas

Cooling

Load	Demand, time schedules and set points taken from L2A modelling method.
System	Air cooled chiller.
Seasonal Efficiency	SEER = 2.35
Fuel	Mains Electricity

Ventilation

Load	Demand, time schedules and set points taken from L2A modelling method.
System	Mechanical ventilation with heat recovery
Heat Recovery Seasonal Efficiency	50 – 70%
Fuel	Mains Electricity

Table 5.4 Proposed Building Model Characteristics

Lighting

The design illumination (Lux) levels used are taken from the L2A modelling method.

	Lobby / circulation / office spaces, meeting rooms and library	Proposed for Retail Spaces	Stairs	Plant / store / comms rooms	Kitchenette, Staff WC, show kitchens	WCs
Lighting Load (W/m^2/100 Lux)	2.0	5.2 *	3.0	3.75	4.5	4.7
* 80 lumens/circuit watt inference display lighting in retail spaces						

Table 5.5: Lighting Loads

Daylight dimming lighting controls are simulated in the rooms with good daylight. Lights begin to dim when the external diffuse illuminance > 150 W/m^2 (15000 Lux). The lights are fully off when the external diffuse illuminance > 250 W/m^2 (25000 Lux).

6.0 Appendix B – BREEAM 2008 Pre-Assessments

6.1 BREEAM 2008 Office Pre-Assessment Report - Fish & Coal Offices and Eastern Wharf Road Arches

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6.2 BREEAM 2008 Retail Pre-Assessment Report - Fish & Coal Offices and Eastern Wharf Road Arches

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7.0 Appendix C – Air Cooled Chiller and Boiler House Plan and Section (Drawing ref: HL-XX-00-DRU-590-9500)

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