ENVIRONMENTAL ASSESSMENT

RAMSAY HALL

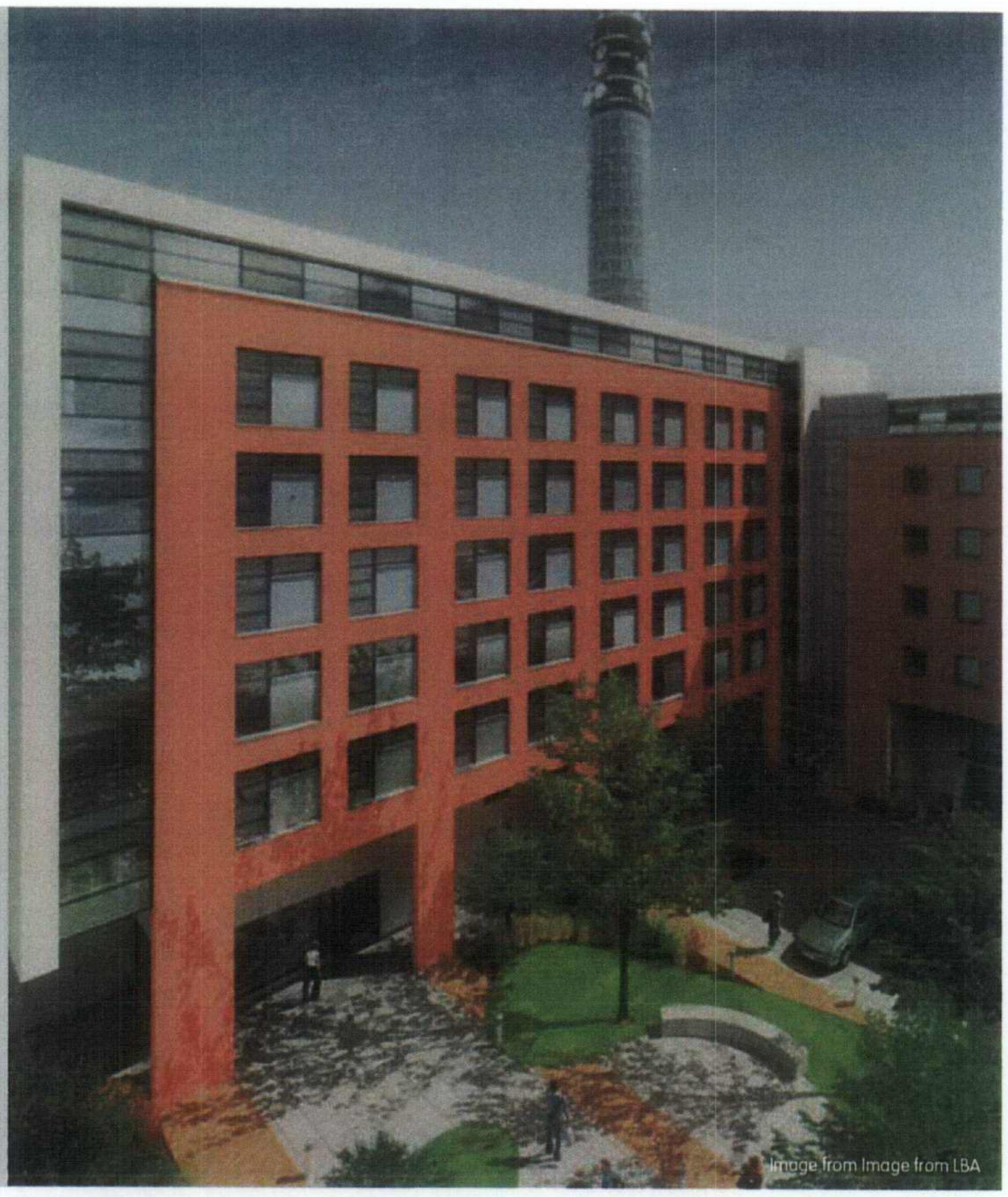
1-2 Hertford Place
London

Proposed Student Accommodation

Carried out for
LEVITT BERNSTEIN ARCHITECTS
on behalf of
UNIVERSITY COLLEGE LONDON
by

XCO2

August 2006



(LB COMMENTS : JAN 08)

ENVIRONMENTAL ASSESSMENT
PROPOSED RAMSAY HALL STUDENT ACCOMMODATION

Remarks	Sustainability Strategy	Environmental Assessment	Environmental Assessment – Ammendment 1
Prepared By	JPM	RM	RM
Checked By			
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Date	08/02/06	09/08/06	15/08/06
XCO2 Job No	256	256	256

1 Executive Summary

This report aims to assess the predicted environmental performance of the Ramsay Hall, University College London (UCL), based on the information provided by the design team. It analyses a range of environmental measures, loosely utilising the Building Research Establishment (BRE)'s EcoHomes methodology.

PLEASE REFER TO BREEAM ASSESSMENT (UB COMMENT JAN 08)

~~If the building were to be formally assessed under EcoHomes, a PASS rate would likely be achieved, based on the widespread application of energy efficiency measures and other environmental features.~~

Of particular interest are the building's energy use and related CO_2 emissions. The new addition will be connected to the existing CHP communal plant which serves other residence hall buildings in the same complex. The new building will benefit the existing system by increasing the utilisation of the CHP unit, therefore generating more "clean" electricity.

Without increasing the existing complex's CO_2 emissions, calculations show that the new building would reduce its own emissions by 12% by connecting to the CHP network. There will also be benefit to existing buildings on site with the increase of CHP hours of operation (as proposed by the client), resulting in some CO_2 emission reductions for the existing part of the complex. Additionally, the communal heating network will be highly beneficial if a future upgrade to biomass heating is implemented.

Other positive environmental features include very good insulation levels (which will reduce heating consumption), efficient appliances and lighting, the provision of cycle storage and recycling facilities, runoff reduction, rainwater recycling for WC flushing and irrigation and efficient water appliances.

Finally, the development of the new residence hall within a highly urbanised location with a range of local amenities and inserted within Central London's comprehensive transport infrastructure and UCL's cycling network will reduce the occupant's use of energy-intensive transport modes and cut CO_2 emissions from the transport sector.

In conclusion, this building as specified exceeds Part L requirements and the environmental performance of average buildings. It is therefore expected to have lower environmental impacts, including greenhouse gas emissions, which are of particular concern. The proposed infrastructure also paves the way to possible future emission reductions.

2 Introduction

Following the Sustainability Strategy report by XCO2 in February 2006 for the Ramsay Hall development of the University College London (UCL), this document evaluates the predicted environmental performance of the building based on its energy and ecological features. It works as an update to the previous report, but more importantly as an expanded assessment of the development's level of sustainability.

The development involves the demolition of an existing two storey structure and the building of a new eight storey block within the existing courtyard to comprise of 91 student residences and therefore providing much needed student accommodation for UCL. The development is located directly west of UCL's main campus, within walking distance of it, and will feed into the University's existing infrastructure.

This document does not discuss the related background sustainability and climate change issues, as these have been addressed in the previous report.

~~Since BRE's standard EcoHomes and BREEAM assessments are not applicable to university residence halls, **this report is not a formal EcoHomes assessment**, but purely based on the structure and contents of that rating system. Likewise, the achieved rating will be an indicative evaluation, and not a certified result with collected documentation. However, the report should provide clear indication of the development's environmental measures.~~ PLEASE REFER TO BREEAM ASSESSMENT (LB COMMENT JAN 08)

The following areas will be evaluated, based on the standard EcoHomes assessment:

- Energy
- Transport
- Pollution
- Materials
- Water
- Ecology
- Health and Wellbeing
- Management

3 Energy

3.1 CO_2 Emissions

At Ramsay Hall the proposed scheme uses the nearby combined heat and power unit (CHP) and back up gas boilers located in the basement of the near-by New York Building. We have been informed by the client that this plant was specifically designed to accommodate the heating and domestic hot water (DHW) requirements of the Ramsay Hall proposal.

In a typical power station, about 70% of the primary energy is lost up the cooling tower as waste heat (i.e. for every 10 units of fossil fuel burned at the power plant, only 3 units of electricity are available to the end user). CHP involves generation of electricity on site, capturing waste heat from the generation process and using it to heat water. This hot water is then used for space and water heating in dwellings. This improves the efficiency of electricity generation from around 30% to around 80%. The CO_2 emissions from heat and power consumed within the connected buildings are often reduced by 10 – 20%, though greater reductions are possible.

Preliminary calculations were carried out to see the likely CO_2 savings for the Ramsay Hall proposal due to the use of CHP. Firstly, estimates of the new building's energy consumption were carried out:

Energy Consumption Figures		
	Heating Kwh/yr/m²	Power Kwh/yr/m²
Residence Hall (CIBSE Guide F -10% EF)	216	76.5
Total floor area - new building	2357 m²	
	Heating Mwh/yr	Power Mwh/yr
New Building Energy Demand	509	180

These figures were based on 'typical' energy consumption standards for student residences from CIBSE Guide F, readjusted for 10% energy savings due to efficient design. From these figures we can calculate the predicted CO_2 emissions from a notional building being serviced by grid electricity and gas boilers:

Scheme serviced by gas boilers and grid electricty			
Boiler system efficiency	90%		
Demand to be met (MWh)	Primary energy	CO2 t/MWh	tCO2/yr
Heat 509	565.7	0.192	108.6
Electric 180	180.3	0.422	76.1
		Total CO2 t/yr	**185**

Such a system would produce 185 tonnes of CO_2 per annum. This system was used as a baseline for comparison with the proposed system.

The next step was to calculate the CO_2 emissions deriving from the CHP scheme as proposed for the new building. It should be noted that the CHP system is already in operation and generating CO_2 emission reductions for the existing buildings. Those reductions should not be accounted for in benefit of the new building, as this would be in detriment of the existing building's emission reductions.

For this reason, the CHP usage for the new building comes not from an increase in emissions from the existing buildings, but from (1) the higher utilisation of the plant (using the system's spare capacity) during its current hours of operations, and (2) the increased hours of operation.

(1) Currently, the plant runs at about 93% capacity on average, but as a result of the increased peak demand after the addition of the new building, the plant will be able to run at its full capacity during its current hours of operations (3,232 hours/year).

(2) Additionally, we have been informed by the client that it is their intention to expand the CHP plant operation to the whole year. The additional 5,528 hours of operation will address the hot water demand during that period and the space heating demand for an additional 2.5 months a year. The hot water demand was based on the figure of 35 kWh/m^2/year (plus 10% distribution losses), prorated for those 5,528 hours. The additional heating demand was based on the London degree days for the months of April, October, and 50% of March. It is assumed that the period between (and inclusive of) May and September space heating will be turned off, even if degree days are present.

The table below shows the CHP generation before and after the new building addition, and its impact on the new building's total consumption:

CHP plant generation: before and after	
Additional generation due to higher utilisation	
Current CHP hours of operation	3,232
Current CHP utilisation	93%
New CHP winter utilisation	100%
Additional CHP heat generation due to higher utilisation (MWh)	1,131
Additional generation due to expansion of hours of operation	
Additional CHP hours of operation	5,528
Non-winter utilisation (summer HW and mid-season heating)	26%
Additional CHP heat generation due to increased hours (MWh)	499
Balance	
Current annual CHP heat generation (MWh)	1,055
New annual CHP heat generation (MWh)	1,631
Additional annual CHP heat generation (MWh)	575
Percentage of CHP heating for new building	**100%**

The "Additional annual CHP heat generation" (575 MWh/year) exceeds the new building's annual heat demand (509 MWh/year). Therefore, the CHP contribution to the total heating demand of the new building was considered to be 100%. This figure of heating from the CHP plant for the new building allowed us to calculate its resulting annual CO_2 emissions and savings in relation to the baseline scenario, as seen on the next graph.

The increase in CHP utilisation will actually contribute to an even higher CHP use and resulting CO_2 emission reductions for the whole complex. However, as this additional generation would exceed the new building's demand, the emission reductions cannot be counted against the building's emissions baseline. Instead, those emission reductions were attributed to the existing buildings on site. In short, in addition to the emission reductions calculated on the next page for the new building, there will be unaccounted emission reductions for the existing buildings due to the higher utilisation of the CHP plant.

Scheme served with Gas CHP with back up from gas boilers and grid electric			
Proportion of heat supplied by CHP	100%		
Split (CHPe / CHPt)	0.60		
Total CHP efficiency	82%		
Boiler system efficiency	90%		
CHP Systems			
Demand to be met (MWh)	Primary energy	CO2 t/MWh	tCO2/yr
Heat 509	622.8	0.192	119.6
Electric 180	220.6	0.192	42.3
			161.9
Back-up boilers and grid electric			
Demand to be met (MWh)	Primary energy	CO2 t/MWh	tCO2/yr
Heat	0.0	0.192	0.0
Electric 0	0.0	0.422	0.0
			0.0
		Total CO2 t/yr	**162**

The emissions for the proposed scheme were compared to the baseline scheme to determine the percentage of CO_2 emission reductions:

CO2 emission reduction for new building		
With CHP and backup	162	Total CO2 t/yr
Grid and boiler	185	Total CO2 t/yr
Saving	**12%**	

It is important to note that these savings could only be achieved by the extension of the CHP hours of operation to the whole year. However, this is a Maintenance and Operations decision outside the control of XCO2. If the hours of operation are not extended, the CO_2 savings for the new scheme are expected to be around 4%.

The other benefit of connecting the new building to the CHP network is that it provides the infrastructure for future use of biomass with a communal heating distribution system, which would represent even higher emission reductions for the project.

3.2 Building fabric

The development at Ramsay Hall will look to go beyond what is required by regulation with regards to elemental U-values. Below are the best practice U-values as set out by the Energy Efficiency Best Practice Programme[1]

Element	U-Value (W/m²K)
Roof	0.13
Walls	0.25
Floors	0.2
Windows and Doors	1.8

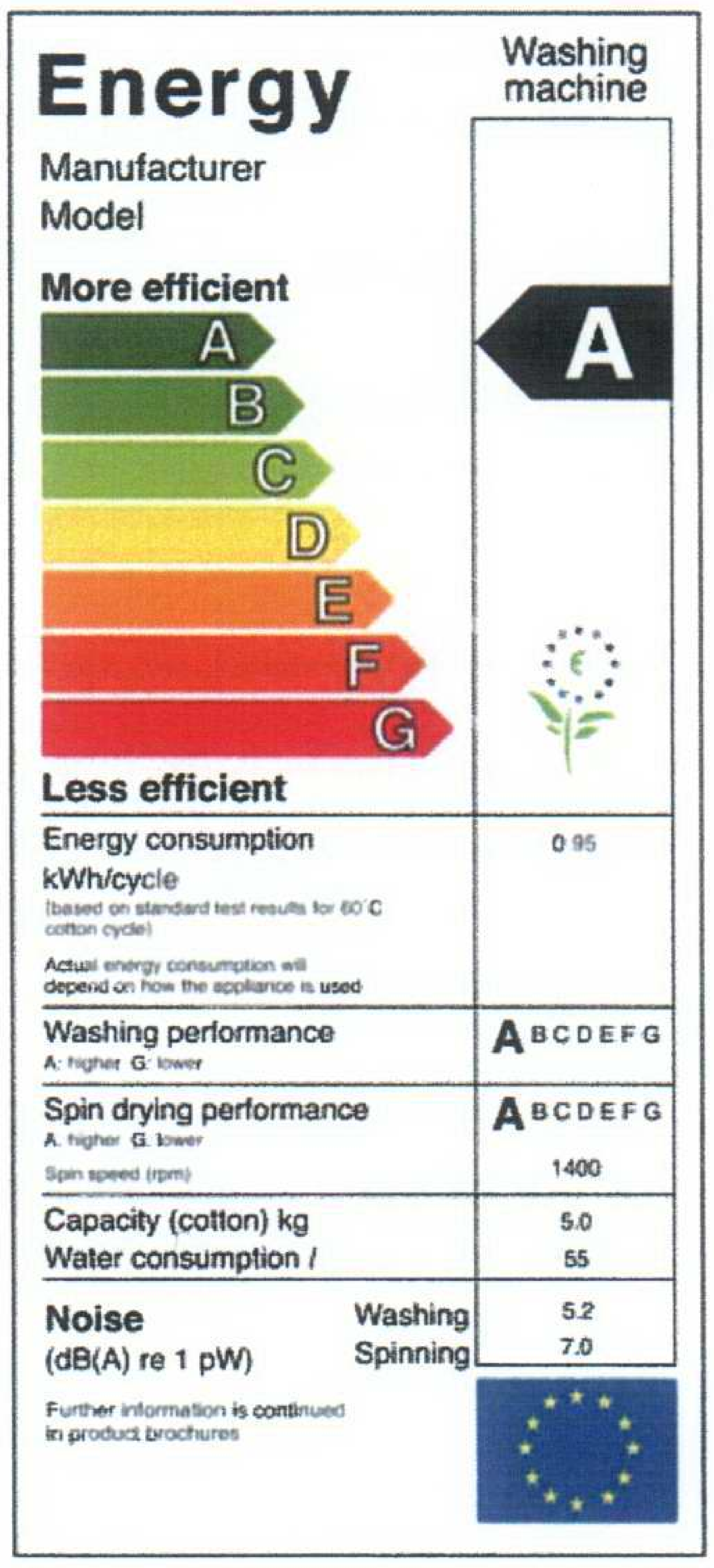
Those Best Practice U-values on the left have been specified for floors, windows and doors, and have been improved upon for the roof (0.125) and walls (ranges from 0.168 to 0.232 depending on the façade). Therefore, the building exceeds building regulations standards and best practice guidance.

3.3 Drying Space

Due to the nature of this development it was deemed un-necessary to provide individual rooms with drying space. A communal laundry is provided on site which will use EU Energy Efficiency 'A' rated appliances.

3.4 Eco-Labelled goods

All white goods that are to be supplied to the kitchenettes and communal Laundry rooms are to EU Energy Efficiency 'A' rated. 'A' rated goods can consume up to a third of standard white goods and can account for considerable emissions reductions.



3.5 Lighting

There is to be full provision of low energy lighting within the proposal. This is to include internal as well as external and landlord lighting. Internal lighting shall have dedicated fittings to hold lamps with an efficacy of no more that 40 lumens per circuit watt, such as compact fluorescent luminaries (CFL's)

External space lighting shall be specifically designed to accommodate only CFL's or strip lights. Any external security lighting should be fitted with PIR sensors and have daylight cut off devices. They should also have a maximum wattage of 150W.

[1] Good Practice Guide 192 'Designing Energy Efficient Multi-residential Dwellings'

4 Transport

UCL's main Bloomsbury campus is located in an area of Central London well-served by public transport (underground, busses and overground trains) and benefits from dedicated cycle lanes along its main streets, integrated with London's cycling network. The proposed development at Ramsay Hall shall adhere to the criteria set out in the UCL Travel Plan. Which key aims are:

- Encourage staff, students and visitors still using private cars to and from UCL to find an alternative
- Ensure that all staff and students have access to public transport information
- Promote the use of environmentally friendly transport by UCL where required for its initiatives
- Establish and co-ordinate various initiatives within a single framework

To adhere to the travel plan the proposed scheme includes a limited amount or car parking spaces, of which 50% are to be allocated to wheelchair users.

4.1 Public Transport

The image to the right shows an aerial photograph on the surrounding area. It is clear to see that the whole development will be within 1,000 metres of at least four London underground stations (Great Portland Street, Warren Street, Euston Square, Goodge St) and less than 500 metres (one block away) from bus stops with regular bus routes on Tottenham Court Road, with combined frequencies of less than 15 minutes at peak and off-peak times assessed.

4.2 Cycle Storage

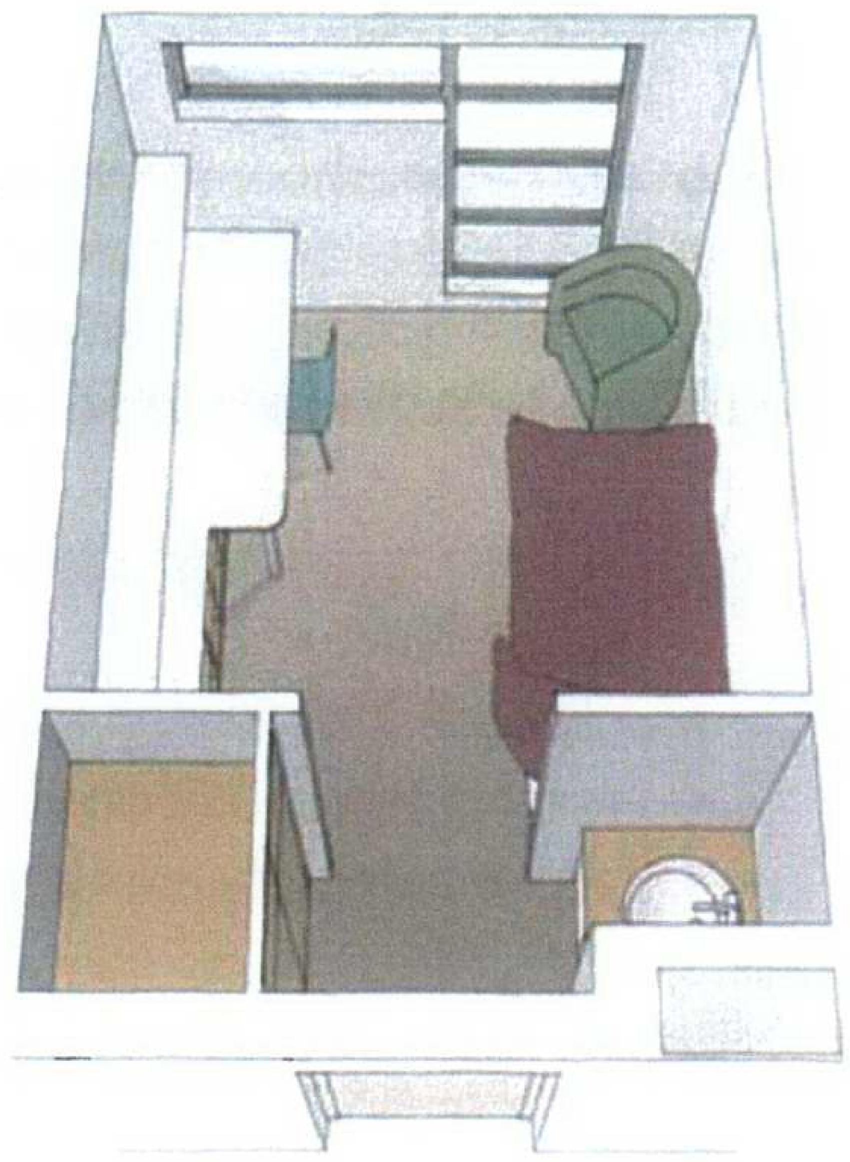
Provision for the storage of 20 cycles has been made. These are located to the rear of the building and will be weather proof and secure. This provision will encourage the use of cycling and reduce the reliance on carbon intensive forms of travel.

4.3 Local Amenities

Due to the Central London location, there is a vast array of local amenities all within walking distance of the development, including post boxes and food shop (within 500 metres) and banks, cash points, pharmacy, outdoor public area, medical centre and public house (all within 1,000 metres). The pedestrian routes to those amenities are safe and well-lit, via wide pavements and zebra crossings or traffic lights. This will encourage walking over transport use.

4.4 Home Office

Due to the use of the building (students' residence hall), it is assumed that few occupants will be working. In any case, provision of a dedicated, quiet, well-lit and ventilated work area with three double electrical outlets and phone and internet sockets is present, which will allow occupants to work (professionally or academically) from their residence, without the need to use transport.



5 Pollution

It is not just CO_2 emissions that have the potential to harm our atmosphere. By reducing CFC's and HCFC's emissions the potential for long term damage to the Earths stratospheric ozone layer is decreased. Other emissions can also contribute to global warming and be potentially hazardous to human health.

5.1 Insulant ODP and GWP

Many insulation products are manufactured using potentially harmful substances. By specifying insulant materials that avoid the use of these substances, there will be a reduction in the amount of CFC's and HCFC's that are realised into our atmosphere. The development at Ramsay Hall will include a clause in its Employer's Requirements to incorporate only insulant materials that have a zero Ozone Depletion Potential (ODP) and a Global Warming Potential (GWP) of less than 5 (EcoHomes Requirements).

5.2 NO_x Emissions

Nitrous oxides (NO_x) are released during the burning of fossil fuels. An increase in the level of NO_x in our atmosphere can lead to global warming and acid rain. They can also lead to the formation of ozone at lower levels, which is highly pollutant and can cause irritation. Power stations are the main cause of the higher level NO_x emissions whilst domestic boilers and heating systems can cause the lower level emissions.

The use of the existing CHP to provide heat and power to Ramsay Hall will eliminate the need for further NO_x emitting plant. An added benefit is the increased capacity of the existing CHP. CHP engines tend to operate at greater efficiencies the closer they are running to their maximum output and hence NO_x emissions per kWh produced will be reduced for the existing buildings serviced by the CHP network.

5.3 Reduction of Surface Water Runoff

There is an ever increasing risk of flooding in the UK and this is not just confined to localised flood plains. Urban environments, with the vast amounts of impermeable hard surfaces can cause considerable flash floods during times of peak rainfall. The proposal for Ramsay Hall incorporates a rainwater harvesting system, for reutilisation on site. This includes a storage volume of 6,000 litres. The rainwater stored will be used for landscape irrigation and WC flushing (WC consumption estimated at 10,000 litres/day), therefore attenuating most of the peak rainfall on the site. The existing landscaped area will also be replaced with a similar landscaped area to increase permeability of the site and provide rainwater attenuation.

5.4 Renewable and Low Emission Energy Sources

A renewables feasibility study was carried out for the development. As discussed previously, part of the heat demand of the development is to be supplied by CHP, which is one of the low emission energy technologies recognised by EcoHomes.

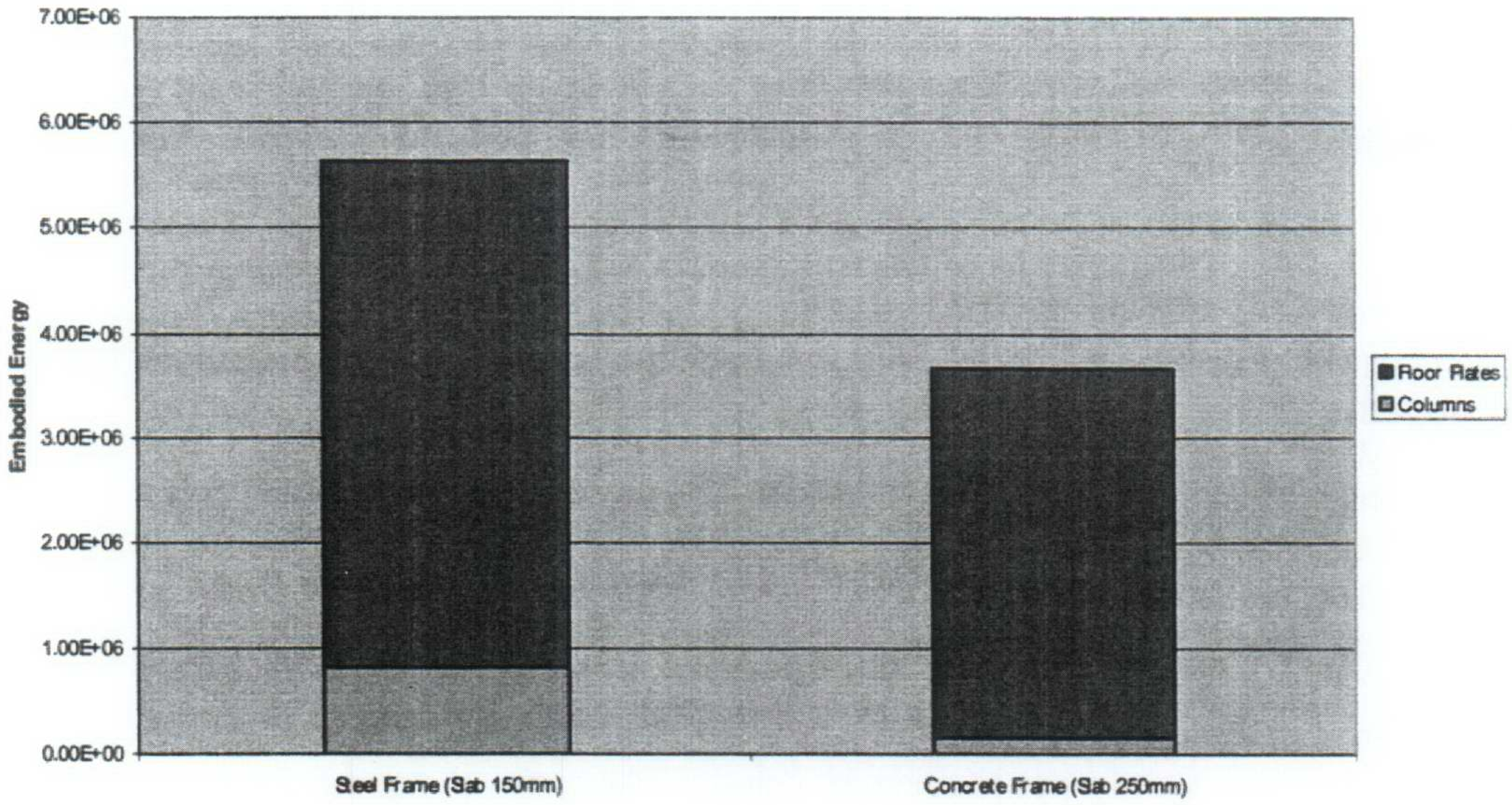
5.5 Flood Risk

According to the UK Environmental Agency flood maps, the development falls outside the extent of the extreme flood, which means it falls within a zone of low annual probability or flooding. This indicates that the development does not contribute to floods, which cause risks to human life, property and the environment.

6 Materials

6.1 Environmental impact of Materials

Embodied energy is the energy that has gone into the manufacture, processing and the transportation of the materials to site. It would be recommended that the architects look to specify materials with as low embodied energy as possible and where high embodied energy materials are specified, their volume is minimised. It is also recommended that materials be sourced as close to the site as possible limiting the energy involved with their transport



The proposed structure at Ramsay Hall is reinforced concrete. Concrete has a lowered embodied energy than steel as shown in the graph above. The use of concrete (including exposed slabs in the bedroom) also provides thermal mass which can assist in cooling during the summer months. The use of toxic or hazardous materials should be avoided. Insulation should be specified that has zero ozone depletion potential and where possible the use of recycled/reclaimed materials should be specified, such as the use of hardcore from the proposed demolition of No. 1 and 2 Hertford Place.

Additionally, most of the building's external walls have an A-rating according to the Green Guide to Specification, which would correspond to a low embodied energy level.

It must be noted however that embodied energy only accounts for approximately 10% of the total energy used by a building over its lifetime and therefore, if one area needs to be prioritised, it should be the energy in use.

6.2 Sustainable Timber

Although there is very little timber being specified on the proposal, the Employer's Regulations will require all timber to be sourced from sustainable sources and be Forest Stewardship Council (FSC)- or PEFC-certified. Items such as skirting boards, door frames and other finishing elements should be from sustainable sources.

6.3 Waste and Recycling Facilities

Each of the Kitchenettes within the proposal will be provided with an 'Eco' bin in addition to a standard waste bin. This bin is compartmented to allow for ease of segregation of waste for recycling. External recycling facilities are provided on site, which is maintained and operating by the London Borough of Camden and are emptied weekly.

7 Water

7.1 Internal Potable Water Use

Several efficiency measures will be taken to reduce consumption in order to address issues of water shortage in the UK. The following will be implemented at Ramsay Hall:

- Minimise consumption
  the following appliances should be specified throughout the scheme:
  - dual flush WCs
  - Low flow showers
  - Spray taps and flow regulators
  - 'A' rated washing machines
- Ease of maintenance
  - Appliances and pipes should be located to allow ease of maintenance.
- Full rainwater recycling facility for external use and WC flushing.

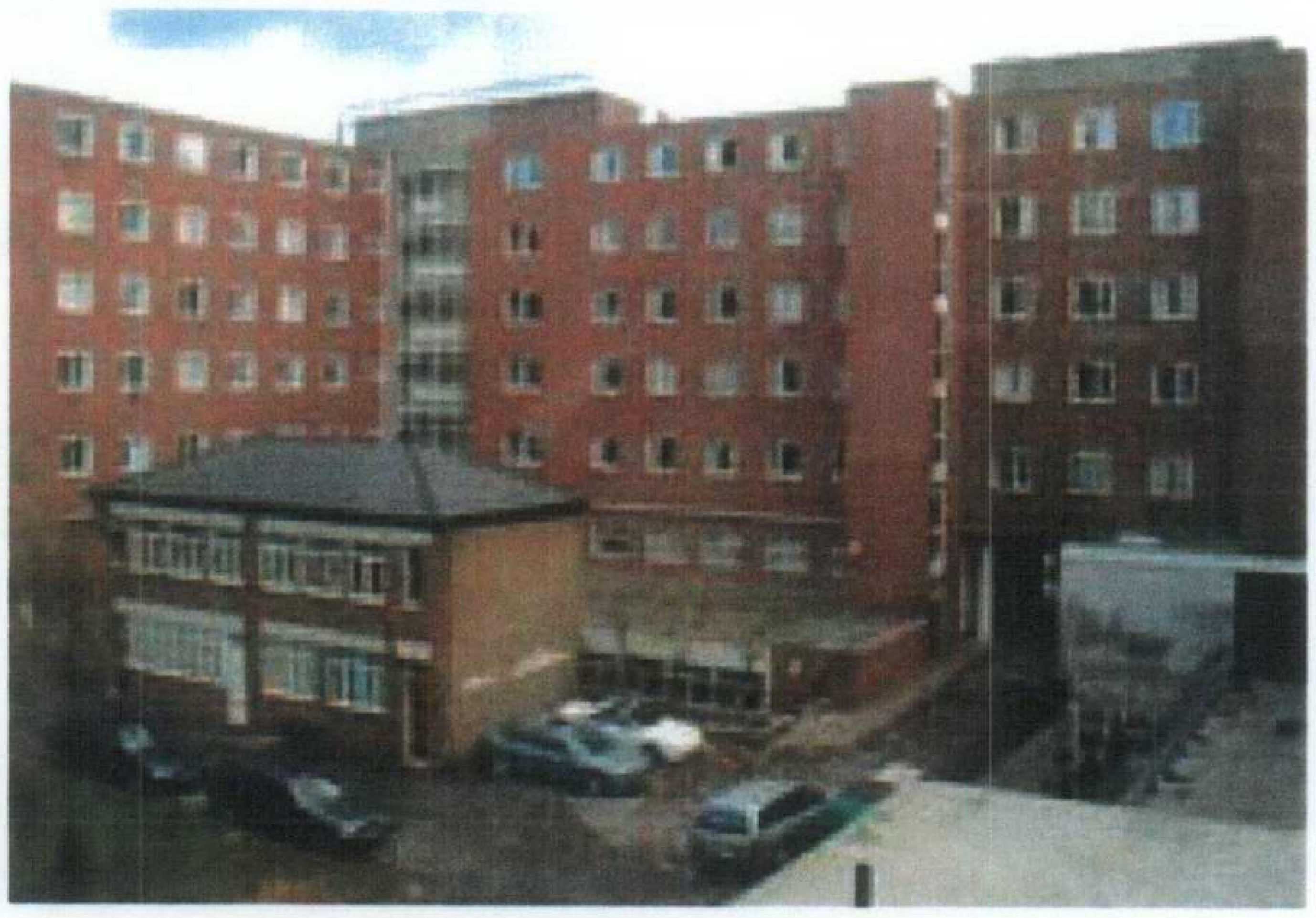
7.2 External Potable Water Use

Rainwater will be collected for use in landscape irrigation. This will decrease the amount of potable water consumed in the development.

8 Ecology

8.1 Ecological Value of Site

The development benefits from being on a site of inherently low ecological value (an under-utilised building of mediocre architecture, surrounded by a car park and hardscape). If there is a demand for student housing it is better to be developed on a site of such nature rather than on land that has a greater ecological value.



The project will replace the existing building and car park with a carefully designed scheme which includes a visually attractive interior garden

8.2 Ecological Enhancement

The existing courtyard currently incorporates a small informal soft landscaped area. The proposal includes improving the existing landscaped area to make it more accessible to the students and also to encourage an increase in the number of species present.

8.3 Protection of Ecological Features

Wherever possible the existing trees will be retained and protected during construction.

8.4 Change of Ecological Value of Site

It is expected and accepted that most developments will decrease the number of species on the site, up to a certain extent. The fact that the Ramsay Hall development will not decrease the number of species on site is highly beneficial.

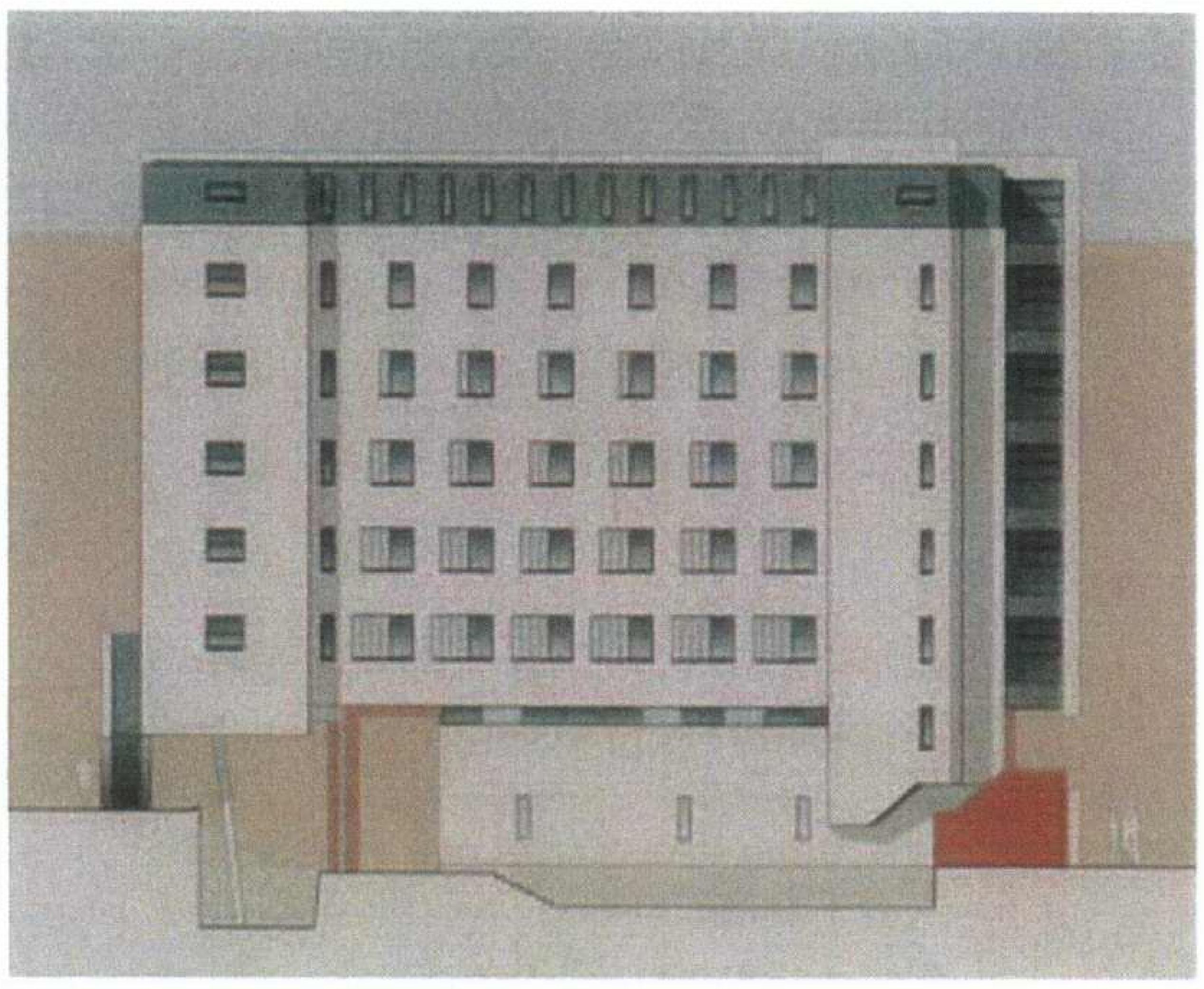
8.5 Building Footprint

The development has a high floor area to foot print ratio due to the number of stories and the reduced foot print of the ground floor compared to the upper floors. This allows for a greater level of amenity space for the occupants while optimising land use and reducing the development's environmental impact.

9 Health and Well Being

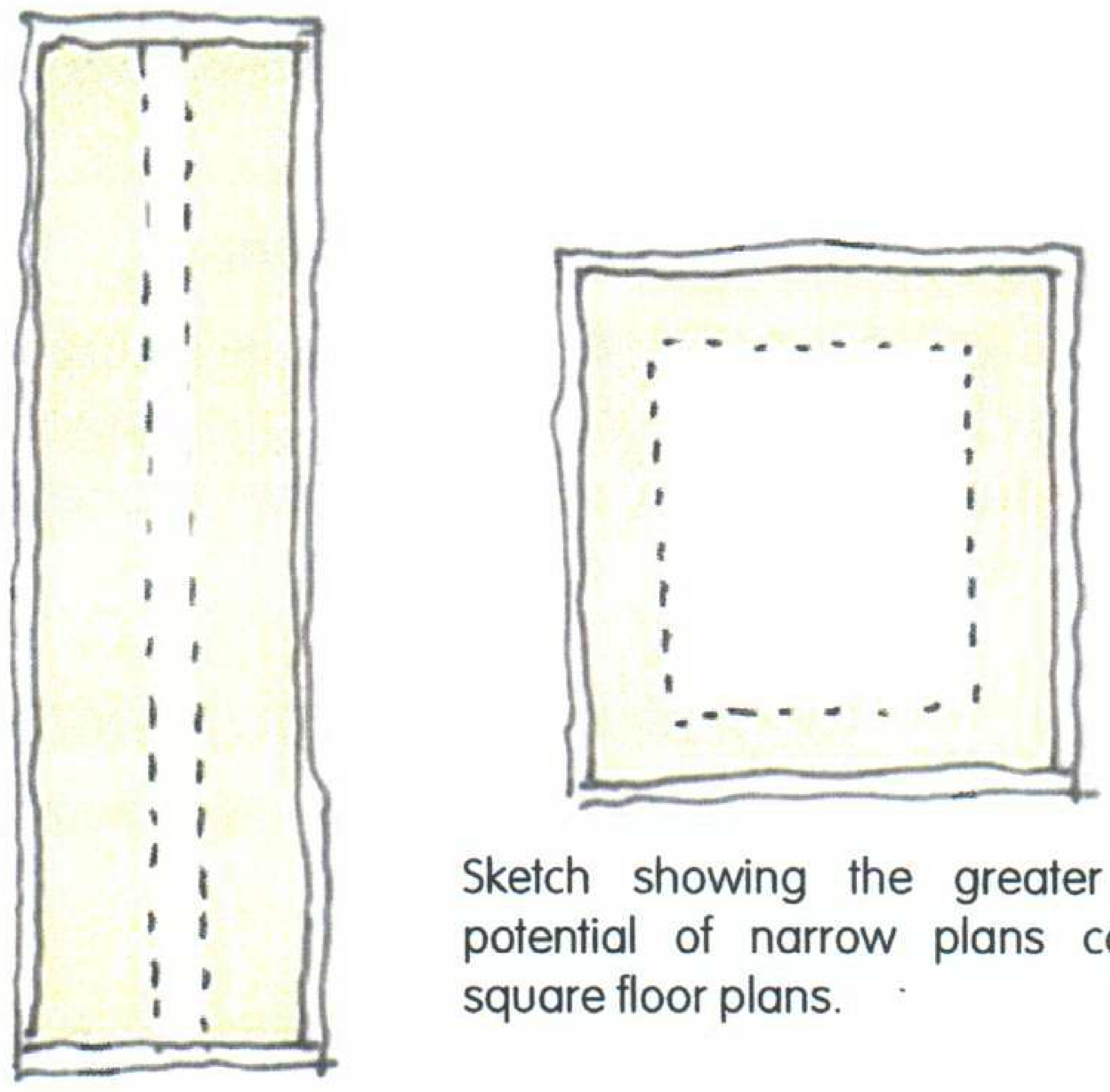
9.1 Daylighting

By increasing natural daylight levels within the proposal, there will be a reduced requirement for carbon intensive, electric lighting. Natural light has also been proven to have additional health benefits to the occupants and create a better working environment. The close proximity of the adjacent buildings also mean that detailed attention should be paid to achieving good natural light levels.



The form of the building, dictated by the spatial arrangement of the courtyard allows for a greater level of daylight penetration compared to squarer floor plan, as shown in the sketches above.

The rear façade of the proposal also attempts to increase natural light levels. The lower down the façade the lower the vertical sky component (the % of the sky visible) and therefore the lower the potential to achieve good natural daylight levels. The architects have responded to this by increasing the apertures on the lower floors by using translucent panels, as shown on the image to the right. This will not however affect privacy levels that can sometimes cause problems on lower floors of residential developments.



Sketch showing the greater daylighting potential of narrow plans compared to square floor plans.

Rear elevation

9.2 Private Space

The provision of a private or shared outdoor space in the development is crucial for the quality of life of the occupants. The development includes an internal garden of around 900 m^2, which, for the about 534 students in Ramsay Hall and surrounding blocks would correspond to close to 2m^2 per bedspace, therefore exceeding EcoHomes recommendations by almost 2 times.

9.3 Use of non-toxic finishes

Some finishes and paints not only use dangerous chemicals and have a high embodied energy in their production but also 'off gas' for many months, sometimes years after their installation. This off gassing' of volatile organic compounds (VOC's) has been linked to many health problems. The specifications for Ramsay Hall are to include a clause to ban the use of formaldehyde and other VOCs in the development.

10 Management

10.1 Considerate Constructors

The specifications will require the compliance with the Considerate Constructors Scheme and achieve formal certification under it. Alternatively, a similar, independently assessed scheme monitoring site impacts and requiring specific performance levels will also be accepted.

10.2 Construction Site Impacts

Demolition and construction waste will be minimised. According to EcoHomes, the contractor must be committed to monitor, sort and recycle construction waste on site. Targets for waste minimisation can be based on DTI's or BRE's Environmental KPI benchmarks. Waste must be recycled on site or sorted on site and collected for local recycling. Also, site timber can be reclaimed, reused or responsibly sourced, while water and energy consumption on site should be monitored.

The construction process of the proposal should adopt a simple strategy that will help minimise waste production during construction:

REDUCE > RE-USE > RECYCLE

Areas where waste should be minimised:

- Pre-design
  - re-use of any of the existing building materials
  - re-cycling opportunities
  - development of a waste strategy
- Design
  - construction techniques
  - building design
- Specification
  - avoid over design
  - avoid over ordering
  - opportunity for re-claimed or recycled materials
- Site Management
  - handling of materials
  - delivery and storage of materials
  - prevention of contamination
  - recording and segregating of waste