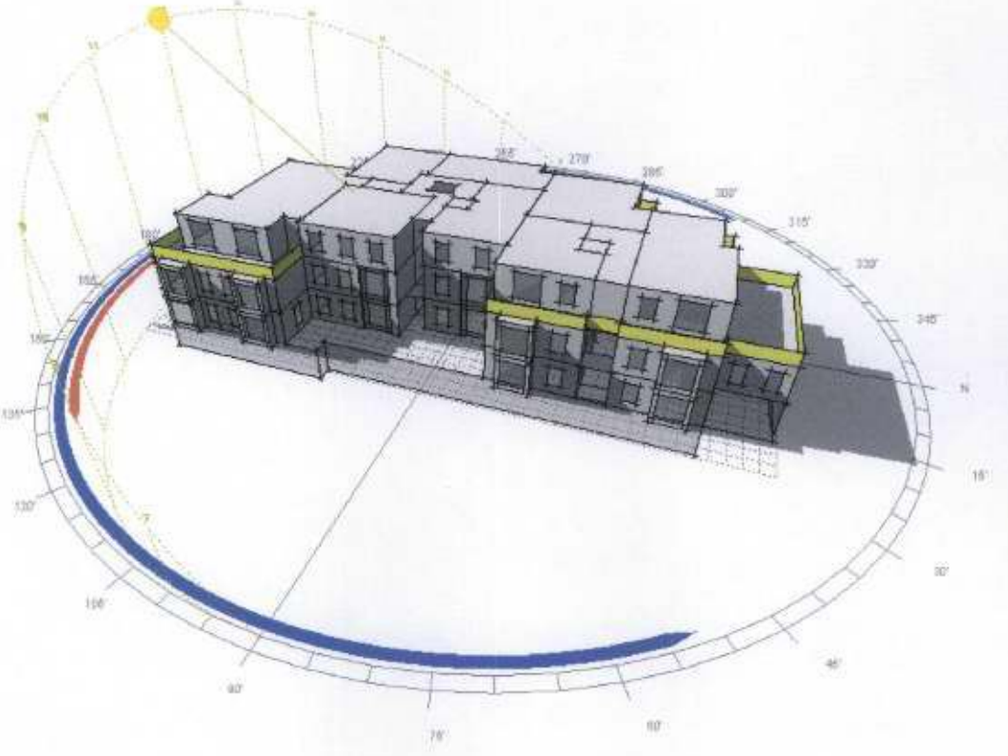
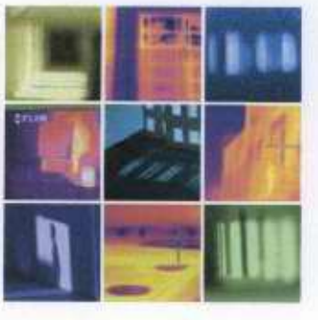
SUSTAINABILITY REPORT

361-367A ST MARGARETS ROAD, TWICKENHAM

19 MARCH 2008



ArchiLab



CLIVE CHAPMAN
ARCHITECTS

Executive Summary

This report describes the detailed study carried out to assess the environmental sustainability of the St Margarets Road residential development for Mizen Homes.

The project is a mixed use development of privately owned dwellings and affordable dwellings managed by a Registered Social Landlord (RSL).

For planning requirements, the building will have to comply with the guidelines set out in the London Borough of Richmond-Upon-Thames' Sustainable Construction Checklist (SCC), which, among many other requirements, specifies the need for at least 10% of the energy of the development to be provided by site renewable energy generation. The building will also be required to comply with the Ecohomes 2006 'excellent' rating.

This report confirms that the proposed development (with further input from the design team) will comply both with the SCC and obtain an EcoHomes 2006 excellent score. The building will minimise energy consumption, harmful emissions and increase the overall quality of life and well being of the local residents.

1.0 Introduction

Clive Chapman Architects, in partnership with environmental consultant, Dr Stephen Pretlove, have been appointed to carry out a sustainability assessment of the St Margarets Road project for the construction of a block of 27 flats, with underground car parking, for Mizen Homes Ltd. The development includes 17 privately owned dwellings and 10 affordable homes which will be developed in conjunction with a local Registered Social Landlord (RSL).

For planning requirements, the local authority, London Borough of Richmond-Upon-Thames, requires that the dwellings comply with Ecohomes 2006 to a level of 'Excellent'.

2.0 Sustainable Construction Checklist

Throughout this report, reference will be made to the *Supplementary Planning Document – Sustainable Construction Checklist* (SCC), published by the London Borough of Richmond-Upon-Thames. The Council requires architects and developers to follow the guidelines set out in this document when undertaking new development in the Borough. The SCC takes a holistic approach to issues of sustainability and addresses a number of issues, including the following:

a) Environmental ratings
b) Site contamination
c) Site ecology
d) Energy savings
e) Renewable energy
f) Construction materials
g) Water saving/recycling
h) Recycling
i) Surface water run-off
j) Microclimate
k) Public transport
l) Cycling and walking
m) Green and open spaces
n) Secure design
o) Light pollution
p) Flood resistant design
q) Access
r) Construction process.

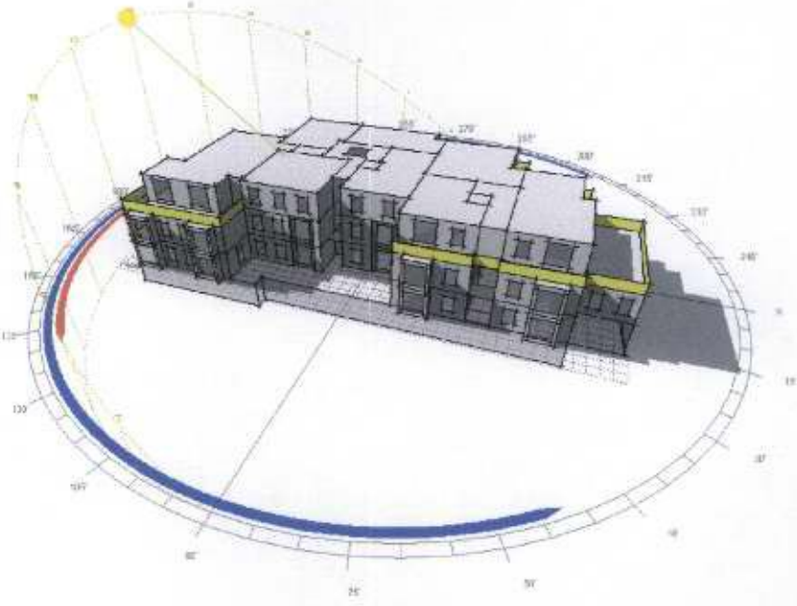
Each of these issues is considered in detail in Section 2.6 of this report.

2.1 Passive and Active design and local climate

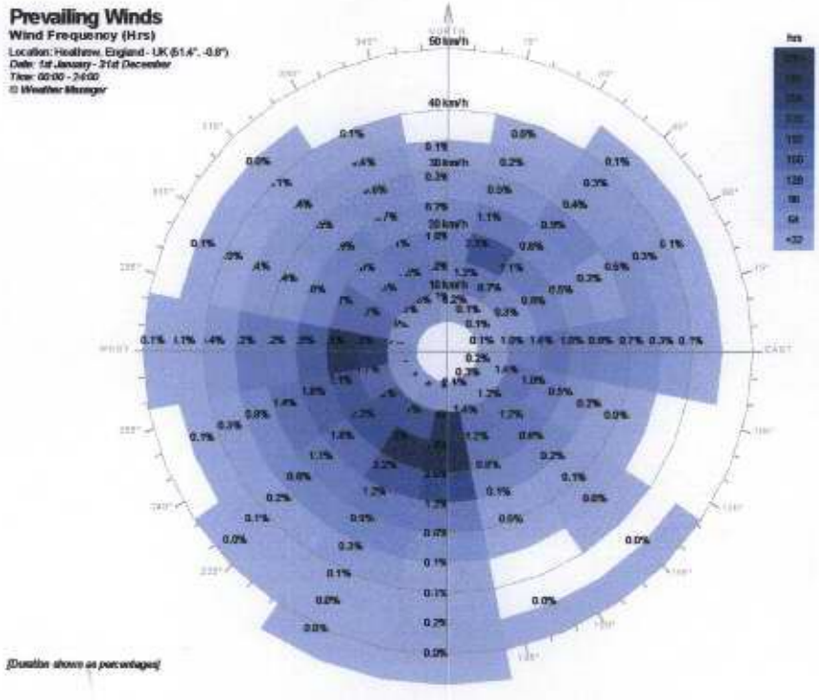
There are a number of fundamental passive and active design issues that have a significant impact on the sustainability of a development.

Buildings provide a basic human requirement for shelter against the external environment. At one extreme a building can turn its back on the external environment and as a result will need to incorporate mechanical systems to provide internal comfort to the occupants. This will be expensive in financial and environmental costs both initially and during the life of the building. At the other extreme a building can embrace the local environment (climate) and work with it in a passive way to enable the occupants to be comfortable at the least expense to the occupant and the environment. Sustainable building design adopts the latter of these two strategies.

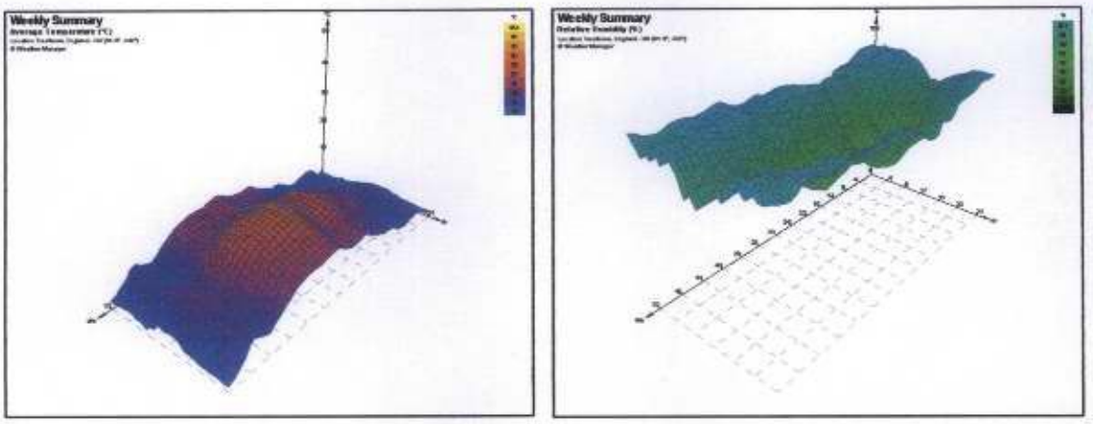
The front of the building is oriented towards the East and the rear towards the West. This means that the front façade will receive sunlight in the morning and the rear façade in the evening and will avoid summertime overheating issues to the South. The following image shows the position of the sun and shading at midday on 21st June.



Winds will predominantly be South Westerly as indicated in the wind rose below. This will assist in the background ventilation of the building, particularly in the summertime when internal heat loads may require ventilation through the use of openable windows and doors.



Temperature, relative humidity and rain levels are those that you would generally expect in the London region of the UK.



2.2 Passive Design

The building is oriented in the North-South direction with the front façade facing East. The building is positioned at the front of the site bordering St Margarets Road as indicated below.

Other dwellings in St Margarets Road are adjacent to the North and South Boundaries and there are some existing trees on the plot, notably the Plane tree at the front of the site, whose roots are protected by the shape of the footprint of the proposed development. The private gardens for the development are to the West of the building and provide a green space for the occupants.

The design of the fabric of the building still requires to be resolved by the design team. The insulation of the structure in general will go above and beyond the requirements of the building regulations. The basement structure will be reinforced concrete to the base, supporting walls and ground floor. The structure of the upper floors and roof of the building will be a highly insulated timber frame and will be finished on the walls with render. The roof finish has yet to be agreed and options are currently being investigated, including the possibility of a green roof Sedum mat.

The glazing will be high performance, low emissivity, argon filled, double glazing. Triple glazing has been investigated, and although it has a very high level of thermal insulation, it significantly reduces the amount of natural light entering the internal spaces. The proportion of glazing in the building is generous, maximising daylight and taking advantage of beneficial solar gains to offset heating loads. Natural light is also introduced into the main core circulation area of the building from openings in the roof, taking advantage of the maximum intensity of daylight from the zenith in the sky.

The table below indicates the levels of thermal insulation assumed for the modelling of the dwellings in this study, compared to the limiting values specified in Part L1A of the building regulations.

Element	*Part L limiting U-values (W/m^2K)*	*U-values assumed for the model (W/m^2K)*
Ground floor	0.25	0.15
Walls	0.35	0.20
Roof	0.25	0.13
Glazing	2.2	2.0

2.3 Active Design

The space and water heating system in any building plays a significant role in the amount of energy consumed in the building and the building CO_2 emissions. This study has examined the impact of four different heating system configurations on energy consumption, CO_2 emissions and compliance with Ecohomes 2006.

Where there are a number of dwellings in the same building, as in this development, there are huge potential efficiency advantages from sharing a communal space and water heating system. This study has investigated the impact of four communal and individual space and water heating systems as indicated in the table below:

Option	*Description*
(a)	Communal CHP system with backup boiler(s) to provide space and water heating and electricity to the building. The thermal needs of the building provided by CHP and boilers are assumed to be in the ratio of 40%:60%
(b)	Communal Ground Source Heat Pump (GSHP) system to provide space and water heating
(c)	Individual high efficiency condensing boilers in each dwelling
(d)	Communal high efficiency condensing boiler providing space and water heating to the whole building

The planning requirement for 10% of the energy in the building to be provided by renewable energy systems is described in Section 2.5 of this report. In the table above, only system option (b) is considered to be a renewable form of energy on its own, and so all other options will need to be supplemented with additional renewable energy systems.

Ventilation in the building is provided in each dwelling through the use of high efficiency whole house mechanical ventilation with heat recovery (MVHR) systems. These systems are inherently energy efficient, even though they consume electrical energy, because they provide the required levels of fresh air continuously and recover thermal energy from stale air that is removed from the dwelling. They work on the basis that the dwelling is inherently airtight and they are also controllable so that dwelling occupants can turn them off and open windows on a warm day.

The lighting systems in the building will be high efficiency, low energy lamps and luminaires and will incorporate appropriate controls to ensure that artificial lighting is switched off when daylight levels are sufficient to illuminate the building interior. External lighting will also be specified as energy efficient and due consideration will be given to external light pollution.

2.4 Renewable Energy

The London Plan was published in 2004 and requires the development plans for all London Boroughs to eventually comply with the requirements. The Mayor's Energy Hierarchy, described in the London Plan, comprises three stages of application: use less energy, use renewable energy and supply energy efficiently. This hierarchy has been adopted for this project and various high efficiency communal services systems and renewable energy systems have been investigated.

The Sustainable Construction Checklist (SCC) requires the development to reduce the predicted site CO_2 emissions by at least 10% through the use of site renewable energy. The feasibility of renewable energy systems for this development has been investigated using the broad guidelines published by the Mayor of London in the document *Integrating Renewable Energy into New Developments: A toolkit for planners, Developers and Consultants*. This document is normally referred to as *The Toolkit*. The Toolkit includes a list of renewable energy system options which should be considered for specific building types in London.

Renewable energy options	*Preliminary assessment*	*Decision*
Stand-alone wind turbines	Planning and local community issues associated with noise and visual obstruction. Average wind speed at this location less than 6 m/s.	Rejected.
Photovoltaics	Building has a flat roof which can be free of overshading for most of the day from other buildings or structures. Architectural integration could be an issue. Financial payback period for this technology not deemed to be acceptable.	Rejected.
Solar thermal systems	Building has a year-round hot water demand. Building has a flat roof. Space can be provided for hot water storage.	Likely to be suitable for this site. Carry out more detailed analysis to determine size of panels required.
Domestic biomass heating	A communal heating system is an option. Ability of the London market and infrastructure to support this technology and supply biomass fuel is limited.	Rejected.
Ground Source Heat Pump (GSHP)	Ground may be accessible for horizontal or vertical pipe system. Most appropriate use would be low temperature system such as underfloor heating	Possible option. Carry out more detailed analysis to determine system requirements.

A number of site renewable energy systems have been evaluated for this development. The Toolkit incorporates a route map that helps to consider the feasibility of various renewable technologies and how they might be incorporated into development proposals. The table above indicates the five possible site renewable technologies that were short listed for feasibility analysis for this scheme.

The results indicate that there are two options for providing the 10% renewable energy to this development: a solar thermal system, such as evacuated tubes, and a Ground Source Heat Pump (GSHP) system.

2.5 Carbon Emissions and Energy consumption:

Preliminary investigations have been carried out to investigate energy and CO_2 emissions for compliance with the Building Regulations Part L1A, and with Ecohomes 2006.

Three of the dwellings have been modelled using accredited SAP 2005 software to determine energy consumption, CO_2 emissions and compliance with the sustainability code. The three flats modelled include a ground floor 2B4P private flat, a first floor 2B4P affordable flat and a second floor 1B2P private flat.

The fabric of the building is currently being investigated and has yet to be fully resolved. At this stage the thermal transmittance values are assumed to be those indicated in the table in Section 2.2. These figures represent published values and will be confirmed once the fabric strategy of the building has been fully resolved. The figures represent levels of thermal insulation that can be easily and practically achieved. They could be exceeded if it was deemed necessary to do so.

For each of the three dwellings the four heating system options indicated in Section 2.3 of this report have been modelled. However, the renewable energy options identified earlier as requiring further investigation are included in this analysis. Each dwelling has been modelled with varying areas of evacuated tube solar water heating, including no solar water heating, $2m^2$ and $4m^2$ as follows:

Option	*Description*
(a)	Communal CHP system with backup boiler(s) + evacuated tube solar water heating system
(b)	Communal Ground Source Heat Pump (GSHP) system to provide space and water heating (considered a renewable energy source)
(c)	Individual high efficiency condensing boilers in each dwelling + evacuated tube solar water heating system
(d)	Communal high efficiency condensing boiler providing space and water heating to the whole building + evacuated tube solar water heating system

Full details of the results of this analysis are presented in Appendix A of this report

The results of the preliminary analysis must be treated at this stage as indicative because, firstly, only three representative dwellings have been modelled at this level of detail, and secondly, because a number of assumptions have been made about various critical aspects of the development including the levels of fabric insulation, the ventilation strategy and the mechanical systems being proposed. The next stage of design development will require further clarification and resolution of all of these proposals and will require the input of M&E expertise to look closely at the detailed services strategy and the financial implications of the options being proposed.

2.6 Compliance with the Sustainable Construction Checklist (SCC)

This section describes how the SCC has been addressed and how the guidelines will be complied with. It should be read in conjunction with Section 3.0 of this report which outlines how the Ecohomes 2006 standard has been considered under broadly the same headings.

a) Environmental ratings

This study has identified the requirement to comply with the Ecohomes 2006 'excellent' standard. The detailed preliminary assessment of how this code is being achieved is shown in Section 3.0 of this report.

An accredited Ecohomes assessor will be appointed to carry out the formal assessments and on completion of the project a Post Construction Review will be carried out for the Richmond Planning Authority to confirm compliance of the as-built scheme.

b) Site contamination

There is no evidence that the existing site is subject to ground contamination. However, the client has agreed to carry out a desktop study of the site, post planning.

c) Site ecology

The ecological value of the site has been assessed by Middlemarch Environmental Ltd, a survey carried out and a report commissioned by the client. They have confirmed that the existing site is not of high ecological value.

The only items that have been highlighted in the report were that the trees along the western boundary (which will be protected) may provide a bird nesting habitat and that there is also the possibility that bats may be present in the roof structure of the existing building and it has been recommended that a Bat Survey is undertaken to determine this.

The proposed development will enhance the ecological value of the site in consultation with an accredited ecological expert.

d) Energy savings

The design of the building and its services will minimise energy consumption. The development will be insulated to levels over and above the current Building Regulation requirements, will incorporate high efficiency mechanical ventilation with heat recovery and will utilise high efficiency communal heating systems. The energy requirements in the building will be reduced through the use of various passive design techniques involving the introduction of solar heat gains and natural lighting. On site renewable energy generation will also reduce the building demand for energy.

e) Renewable energy

The planning requirement, for 10% of the energy in the building to be provided by renewable energy systems, will be achieved using evacuated tube solar water heating systems positioned on the roof. Preliminary analysis of the renewable energy requirements have been estimated using the algorithms built into the SAP 2005 for evacuated tube systems and are based upon an extrapolation of the results of the detailed simulation of the three flats described in Section 2.5:

- Estimated total annual energy consumption for the whole development of 27 flats **176,200 kWh/year** (average 6,525 kWh/year per flat)
- Estimated annual renewable energy requirement for the whole development **17,620 kWh/year** (average 653 kWh/year per flat)
- Estimated area of evacuated tube solar panels required to provide 10% of the energy for the whole development **85 m^2** (average 3m^2 per flat)

Alternatively, if the Ground Source Heat Pump system were selected then this would provide far in excess of the 10% requirement.

f) Construction materials

The specified construction materials will be environmentally friendly wherever possible. As far as possible, the materials used in this development obtain an A rating from the *Green Guide to Housing*.

Apart from the basement structure, the building will be primarily timber framed, internally and externally and all timber will be obtained from a certified sustainable source.

All materials used for insulation in the development will have an Ozone Depletion Potential (ODP) of zero and a Global Warming Potential (GWP) of less than five.

PVC windows will not be used, low emission finishes will be specified wherever possible, recycled aggregates will be used wherever possible and materials will be sourced locally wherever practical.

g) Water saving/recycling

Water saving devices will be installed in the development to reduce the water consumption to 38 m3 water per bed space per year. The scheme will include for very low water usage appliances, low flow taps and showers and 4 litre flushing toilets. Rainwater will be collected on site for watering gardens and landscaped areas.

h) Recycling

The development has significant space allocated to recycling facilities, both internally and externally.

i) Surface water run-off

A green roof is currently being considered which will slow the flow of water to the main water courses. This option may be however be affected by the necessary use of roof area for the solar water system option being proposed.

On the existing site, and for the proposed development, a substantial area of the site footprint is soft landscaping, and this does, and will, provide significant rainwater attenuation.

The storm water will discharge to an adequate soakaway or some other adequate infiltration system to be calculated at detail design stage.

The impermeable area of the proposed building will be marginally higher that the existing and therefore the storm water discharge would be of similar magnitude.

j) Microclimate

The climatic analysis carried out for this location indicates no negative effect of the microclimate for the existing public realm and buildings. The climatic impact of the proposed building is minimal.

k) Public transport

The development provides short direct safe links to public transport.

l) Cycling and walking

Secure cycle storage will be provided for 29 cycles, 1 for each 1 or 2 bedroom flat and 2 for each 3 bedroom flat.

m) Green and open spaces

The development provides easy access to green and open spaces through the provision of green space at the front and (private) rear of the development, the

ecological enhancement of these spaces as areas of wildlife habitat and through the possible provision of a green roof to the building.

n) Secure design

The developers and designers of the scheme will work with the local Architectural Liaison Officer and achieve the 'secure by design certification for this scheme.

o) Light pollution

The design of the scheme encourages the use of natural lighting to most internal areas of the dwellings. The internal and external lighting systems will be energy efficient in terms of both the installed load and hours of use through the use of low energy lamps and controls.

p) Flood resistant design

A flood risk assessment has been carried out by Fenland Hydrotech Consulting Engineers who have identified that the site is located within a high flood risk area. However, the site is protected against a 1 in 1000 year flood event by the flood defences along the River Thames.

The building finished floor levels for the residential ground floor will be set at 6.31m AOD which is 0.748m above the 100 year flood level, and 0.58m above the 1000 year flood level of 5.73m.

q) Access

The development will be accessible to all and will fully comply with Disabled Discrimination Act (DDA) and Building Regulations Approved Document M requirements for disabled access to all areas. A design and access statement will be produced to show how the building is accessible to all.

r) Construction process

The adverse impact of the construction process will be reduced as far as possible.

The Considerate Constructors Scheme will be a requirement for the construction management contractor and the construction site impacts, such as waste, air quality and energy consumption will be monitored as required by the relevant sustainability codes.

Equipment used on site will be efficient, quiet and well maintained and due care and consideration will be given to the existing soft landscaping, and planting to protect the local biodiversity as far as possible.

3.0 EcoHomes 2006

The Ecohomes 2006 standard for sustainability has been superseded by the newer Code for Sustainable Homes 2007 standard for most new housing developments. However, in this case, the local authority is still working to the older standard and requires this project to achieve a rating of 'Excellent'.

For an Ecohomes rating of 'Excellent', credit scoring must demonstrate a score of at least 70 out of a possible 100 under eight main categories: Energy, Transport, Pollution, Materials, Water, Land Use & Ecology, Health and Well being and Management.

3.1 Compliance with Ecohomes 2006

The Ecohomes standard deals with energy and emissions by allocating credits for the rate of CO_2 emissions per square meter of the dwelling floor area per year. Between 1 and 15 credits are available in the code and the preliminary analysis of the code indicates that we need to achieve between 9 and 11 credits, which equates to less than 20 $kgCO_2/m^2/year$ and less than 15 $kgCO_2/m^2/year$ respectively.

The results of the preliminary analysis are shown in Appendix A and indicate the predicted CO_2 emissions in column five and the Ecohomes credits in column six.

The most credits are obtained where the CHP system is specified, increasing from 10 for the dwelling without renewable systems to 11 where evacuated tube solar water heating systems are incorporated.

The GSHP system also scores highly, between 9 and 10 for the dwellings modelled.

The dwellings modelled with individual and communal boiler systems do not score well on the Ecohomes standard, indicating scores between 6 and 9. However, where credits of 9 are achieved, basic compliance with the building regulations is not demonstrated.

Compliance with the Ecohomes 2006 standard will have to be confirmed with an accredited assessor once the design of the building fabric and systems have been more fully resolved.

3.2 EcoHomes 2006: preliminary analysis

The EcoHomes Pre-Assessment Estimator for the development is shown in Appendix B.

The preliminary analysis indicates a score of 71.29% for the scheme which is an EcoHomes 'Excellent' score. This section describes the strategy that will be adopted under each category to achieve this rating.

a) Energy

The emission rates from a selection of the dwellings in the scheme have been determined and indicate, given the two main options for providing heating to this development, a credit value of between 9 and 11.

The building envelope performance has been determined using the Heat Loss Parameter (HLP) and the results show that maximum credits can be achieved for this for most dwellings as currently specified. Data from the modelling of the Ground Floor flat shows the HLP to be marginal in this case, due primarily to the assumed U-value of the ground floor soffit to the basement car park which will need to be marginally reduced (improved).

Tidy driers will be provided in dedicated drying spaces.

White goods will not be supplied to the affordable homes, but information will be provided on Eco labelling.

Internal lighting will be at least 75% dedicated low energy systems, external lighting will accommodate only CFL and security lighting will not exceed 150W and fitted with PIR sensors.

b) Transport

The location of the building in relation to public transport allows us to maximise the credits under this category. The proximity of the building to local amenities also allows credit under the code.

Cycle spaces will be provided for 29 cycles, 1 for each 1 or 2 bedroom flat and 2 for each 3 bedroom flat.

Home office areas will be provided in each dwelling with additional power points.

c) Pollution

All insulating materials in the development will have a Global Warming Potential (GWP) of less than 5 and an Ozone Depletion Potential (ODP) of zero.

The heating and hot water systems will have an average NO_x emission rate of less than or equal to 40 mg/kWh.

A flood risk assessment has been carried out and there is a high flood risk in this area so attenuation will be required to deal with run-off.

A feasibility study considering renewable and low emission energy has been carried out as part of this study and the results indicate that the options currently being considered will achieve at least 10% of the energy consumed in the dwellings to have come from site renewable sources of energy.

d) Materials

As far as possible, the materials used in this development obtain an A rating from the *Green Guide to Housing*. The fabric of the building has yet to be fully resolved but the current strategy is as follows. The roof structure will be timber frame with either asphalt or a lightweight Sedum mat finish. The external walls will also be insulated timber frame with a render external finish. The internal walls will be timber framed. The ground floor and basement construction will be reinforced structural concrete. The windows will be low E, argon filled, double glazing in timber frames. The external surfacing will be concrete paving to driveways and paths and the boundary protection will be timber fencing.

All materials will be responsibly sourced and full credits will be sought.

Recycling facilities will be provided in the basement area of the building.

e) Water

Preliminary calculations indicate that the internal potable water use will be 38 m^3 per bed space per year. This calculation is based upon the use of very low water usage appliances, low flow showers and flow regulated taps. The toilets will be specified as 4 litre flushing systems.

External potable water use will be limited through the provision of four 200 litre water butts for rainwater collection for watering gardens and landscaped areas.

f) Land use and ecology

The development is on land which is inherently of low ecological value, and so it will be enhanced in consultation with an accredited ecological expert, ensuring the protection of any existing ecological features on the site. The change of ecological value will, as a result, be maximised in this case.

g) Health & Wellbeing

The design of the scheme encourages the use of natural lighting to most internal areas of the dwellings, although the kitchen areas to most dwellings have no direct access to daylight. Private outdoor spaces are also provided in the scheme.

h) Management

Home user guides will be provided to all home owners in the scheme covering non-technical information regarding the operational and environmental performance of the dwelling. The Considerate Constructors Scheme will be a requirement for the construction management contractor and the construction site impacts will be monitored as required by the code.

The developers will work with the local Architectural Liaison Officer and achieve Secured by Design award