DISTRICT HEATING OPTIONS APPRAISAL

- RENEWAL STRATEGY FOR HEATING AND HOT WATER

In respect of

MAIDEN LANE, PHASE 2

On behalf of

London Borough of Camden

Prepared by:

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DISTRIBUTION

This document has been distributed to:

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Michael Layhe	London Borough of Camden – Interim Mechanical and Electrical Capital Programme Manager
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APPROVALS

This document requires the following approvals.

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Rolfe Jackson	Director – McBains Cooper

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1.0 EXECUTIVE SUMMARY

McBains Cooper (MBC) were instructed by London Borough of Camden to carry out an Options Appraisal for renewing the heating and hot water system for the existing council housing stock (Phase 2) at Maiden Lane.

The first step was to undertake a Condition Survey of the system, and based up on the results of this, to complete the second step of a full Options Appraisal.

It is clear that the infrastructure within the dwellings (i.e. pipework, hot water storage, radiators) will need to be replaced.

Regarding the distribution network, due to the condition and age of the pipework it is recommended that this be replaced in its entirety. Furthermore, the junction boxes (connections of the distribution network at each dwelling) should be reconfigured given their current lack of insulation and in many cases their location in external, poorly sealed junction boxes which suffer significant heat losses.

The report estimates energy demand for the dwellings using UK government benchmarks and RdSAP energy modelling. Various strategies for supplying this demand are review, either from offsite or onsite sources. Opportunities for the reduction of network losses are discussed and are to be investigated in more detail during the Economic Appraisal.

The study also makes reference to the building fabric improvements that have already been commissioned and are in progress, assessing the district heating options alongside side these ‘passive measures’.

The Technical Appraisal recommends the following:

- replacement of existing gas boilers
- possibility of roof mounted PV panels to generate electricity for the estate, thus including the electrical supply required to the mechanical plant, is to examined through structural surveys and roof space/acess evaluations.
- sensitivity analysis of a low temperature network with advanced demand management to be included within the Economic Appraisal

The intention is for LB Camden to review this report and Technical Appraisal undertaken thus far and confirm that the study should progress into the Economic Options Appraisal phase.

2.0 INTRODUCTION

In accordance with instructions received from LB Camden, McBains Cooper have prepared a Condition Survey and Options Appraisal report for the hot water and space heating system for the existing residential buildings under their ownership at the Maiden Lane Estate.

The aim of the survey is to provide a review of the system's condition and Options Appraisal culminating with a recommended Heating and Hot water Renewal Strategy for the estate.

The Renewal Strategy is to be formulated with consideration of the Draft LB Camden Heating Policy (June 2015) which is alluded to at various points throughout the report and included for reference in Appendix I.

It should be noted that LB Camden instructed a section of the Estate to be demolished in 2013 to allow for a new build residential apartment block ("Phase 1") which is due for completion in 2016. LB Camden will allocate a proportion of the dwellings as social housing and the remainder will be sold to the Private market, a proportion of the revenue being allocated to fund the district heating network improvements.

The remaining, existing buildings on the Estate are known collectively as "Phase 2". At the time of writing a building envelope refurbishment programme of the Phase 2 is being undertaken by Pellings to upgrade the properties to 'Better Homes' standards.

Built in the 1970s, Phase 2 consists of 36 blocks of residential dwellings all of similar type of construction, varying from 2 to 4 storeys high, comprising reinforced concrete frames with both precast and insitu floor and wall panels, with reinforced concrete stairs to access the upper levels. The 451 dwellings comprise flats, maisonettes and studios.

3.0 AN OVERVIEW OF DISTRICT HEATING

District heating can be referred to in terms of 'generations', in a similar vein to that of mobile phone networks, indicating a step-change in the technology used and its efficiency. The five generations of heat networks are summarised below:

1st The first generation of district heating systems used steam as the heat carrier. These systems were first introduced in the USA in the 1880s

2nd The second generation of systems used pressurised hot water as the heat carrier, with supply temperatures mostly over 100°c. These systems emerged in the 1930s and dominated all new systems until the 1970s.

3rd The third generation of systems was introduced in the 1970s and took a major share of all extensions in the 1980s and beyond. Pressurised water was still the heat carrier, but the supply temperatures were often below 100°c.

4th The fourth generation systems implement low or zero carbon energy generation systems in the most appropriate way i.e. providing low grade heat to low energy use buildings with low grid losses by integrating low-temperature heat sources. The concept involves the development of an institutional and organisational framework with suitable cost and motivation structures

5th A fifth generation has been cited by cutting edge systems that utilise the latest demand management monitoring. An example is the COHEAT system currently being trailled in the West Midlands by a Cambridge start-up company. COHEAT apply advanced algorithms for thermal storage and load management using a distributed controls system to reduce the cost of heat networks whilst aiming to deliver a best-in-class user experience and performance.

A district heat network can be broken down into three separate components:

1 **The primary network**

This refers to the pipework connected to the energy centre, which distributes hot water or steam to heat sub-stations or directly to each building. Typically, the primary network comprises buried insulated external pipework and heat substations in each building (or group of buildings) which connect the buildings to the network. In the case of the existing system at Maiden Lane Phase 2, there are no substations and the mains network passess directly in to the risers in each block. Furthermore, a proportion of the primary network piping is routed through basement storage areas at high level rather than being buried underground.

2 **The secondary network**

This refers to the riser and lateral (or vertical) pipework which distributes heat *within* a building (e.g. a block of flats), often from a block's sub-station to individual dwellings. In newer systems, individual properties are frequently connected to the district network by Heat Interface Units (HIUs) which act as the interface between the primary circuit and the dwelling's internal heating circuits. Any dwelling level heat metering is typically housed in the HIU which in its entirety is of a similar size to domestic boiler.

3 **The tertiary network**

This describes the pipework after the HIU (internal heating circuits) within the property, providing the internal space heating and hot water circuits. This network is generally the responsibility of the occupier (or Leaseholder in the case of Maiden Lane) or landlord.

3.1 Centralised and local heating plant

There are three options for locating the plant in a scheme such as Maiden Lane Phase 2:

- Individual plant within each dwelling
- Block by block basis
- Centralised plant with site wide network

Individual plant is traditionally favoured by residents as its affords complete autonomy over their heating system, in terms of controls, maintenance and replacement.

Block by block plant can reduce the required system temperature and pressure regimes. "Top up" or standby boilers in at various points around the network can help avoid the need for temporary, centralised boilers in the event of a failure of the network.

A centralised boiler room allows a single point of distribution and maintenance, and the use of larger boilers which have greater efficiencies than smaller versions. The key consideration is minimising heat loss throughout the longer length of heating network.

3.2 Prefabricated pipework

Large, deteriorated parts of a decaying steel pipe network can be quickly replaced with pre-insulated polybutene pipe system and be operational within weeks. This is a particular consideration for Maiden Lane given that the estate will remain occupied during the district heating renewal works and minisming disturbance is of prime importance. The lifetime of the material can also be exceed that of a traditional, steel system thus mitigating against pipework replacement due to corrosion in the future.

Figure 1: Preinsulated pipework

3.3 Heat Interface Units (HIU) - Dwelling interface with the wider district network

Newer district heating schemes include HIUs in each dwellings which take the heat from the main heating network and transfers it to the dwelling's own central heating system and domestic hot water supply via a plate heat exchanger, which is housed within the casing of the HIU.

The dwelling's central heating system can be directly or indirectly connected to the community heating system through the HIU.

- Direct connection – in this case, the water from the community heating flows through the dwelling's circuit.
- Indirect connection – the dwelling's heating system is a separate secondary circuit heated by an additional heat exchanger inside the HIU.

The HIU, which also contains other equipment such as controls and metering equipment (and in the case of indirect connection, a small pump to push the water around the dwelling's internal circuit), is approximately the size of a wall-hung gas boiler.

Crucially, there is no need for domestic hot water storage tanks within the dwellings as hot water can be obtained instantaneously from the heat exchanger 24 hours a day.

Otherwise, there is little difference from a typical central heating arrangement with radiators, timers and controls. Some consideration needs to be given to the sizing of the radiators to ensure an adequate drop between flow and return temperatures; increasing the temperature difference allows a smaller diameter pipe and therefore, lower cost pipework can be installed, as well as pipe heat loss being reduced.

3.4 Typical reasons for heat losses

Whilst LB Camden is undertaking building fabric improvements to the dwellings themselves in order to reduce energy demand for space heating, the design and specification of the heating plant and distribution network also have a substantial effect on further minimising the energy demand.

Key considerations include the following:

Insulation	levels of insulation around the pipework at all stages of the network; primary, secondary and tertiary
Number of Heat Exchangers	a greater number of exchangers between the source of heat generation (boiler in energy centre) and the heat emitters (e.g. radiators) in a dwelling will increase the flow temperature from the energy centre, which will in turn increase losses throughout the network due to a greater temperature differential between the water and ground
Pipe configuration	double pipe instead of a single pipe configuration to supply the heat at two temperature levels i.e. space heating and domestic hot water.
Length of the pipework	the overall length connecting: - Energy centre to substations; - Substations to Blocks; - Laterals (or verticals) to each Heat Interface Unit
Oversized pipe diameters	the heat losses increase proportionally to the diameter of the pipes
Commissioning	poor commissioning can result in high primary flow rates, reducing the heat transfer to to the tertiary circuits, while increasing the return temperature in the primary network and thus the heat losses.
Heat emitters	the efficiency of heat emitters (e.g. radiators) and their location with a dwelling should be optimised

3.5 Pipework sizing and operating temperatures

Pipework

The selection of pipe or duct sizes and operating pressures for district heating is ideally based on economic optimisation.

If the size of the distribution pipes is decreased to reduce capital cost and heat loss, the pressure drop increases and total pressure rises, requiring more pumping energy and incurring higher running costs.

There is, therefore, an economic optimum when total life cycle costs are minimised.

Economic optimisation involves the evaluation of three factors:
- capital cost of distribution mains and system pumps
- pumping electricity use
- distribution heat loss.

Both capital and annual running costs should be included in the life cycle analysis, together with the most appropriate discount rate and time horizon.

Operating temperatures

Operating temperatures are also a key consideration as lower temperatures will result in the following:

- lower investment cost
- lower operational costs
- improved efficiency of energy generation
- higher potential for renewable energy
- lower risk of overheating
- reduced risk of heat gain into the mains water supply (reducing legionella risks)

The nearby Agar Grove estate re-development (please refer to section 9.1) proposed the following solutions to reduce operating temperatures of the district heating network and thus reduce heat loss:

- reduce the length of the pipework wherever possible
- locate boilers on a block by block basis rather than single, central location
- multiple vertical risers rather than a single vertical riser with long, lateral branches at each level of a building
- Instllation of Heat Interface Units (and corresponding appropriate design of heat emitters)

The above measures allowed the system to adopt a 70° / 40°C temperature regime rather than 100° / 70°C of typical district heating scheme.

A review of the Record drawings provided by LB Camden included isometric schematics, plans and sections of Block RS which showed that vertical risers have been installed and thus the benefits are already inherent within the existing heating network. A series of many vertical risers rather than one riser with long, horiztonal pipework runs, can reduce heat losses and pipework capital costs. In turn, this allows operating temperatures to be lowered, therby lowering the energy costs and CO_2 emissions.

Opportunities for further reducing pipework routes should be investigated, although this would likely require Block by Block sub stations.

Low or ultra low operating temperatures

A lower limit of 55°C is often selected due to the need for providing 50°C domestic hot water (DHW) and to protect against legionella. However, for space heating, the supply temperatures of 35-40°C is sufficient for underfloor heating systems.

To solve the legionella issue with DHW preparation, a micro booster application can be included within the system. This is essentially a small heat pump that uses the district heating mains water as a heat source to boost the temperatures to 55°C for preparation of DHW by instantaneous heat exchanger.

Low supply temperature networks (with a DHW micro booster via a heat pump unit) have been piloted in Denmark but were based on houses rather than apartment blocks. A further study for implementing the scheme in apartments is underway and due to be finished in June 2017.

During the last few years, this concept of low-temperature district heating (LTDH) has been developed, tested and demonstrated to be successful. In these projects, LTDH has been defined as having a supply temperature of 50°C and a return temperature of 25-30°C at the consumer. In minor networks, these temperatures will require a supply temperature at the centralised energy centre of 52-55°C.

The advantage of LTDH is that the network heat losses are lowered, which gives energy savings and lower fuel costs. Furthermore, the lower network temperatures make it possible to use a larger range of heat sources including more renewable energy sources and surplus heat from industrial processes etc. If the LTDH is connected to an existing network, a mixing shunt or a heat exchanger station is required to throttle down the district heating temperature.

LTDH is not considered to be more expensive to build than conventional district heating and full-scale demonstration has proven that LTDH is suitable for low-energy houses.

Pipe in pipe solutions

However, the LTDH concept is not only concerned with the district heating network temperatures. It is also crucial that the whole system has an optimised design, where the network heat losses are minimised by using a twin-pipe system, having small service pipes and a large insulation thickness.

Twin pipe solutions ensure lower heat losses and lower construction costs. A twin pipe consists of two service pipes, a supply and a return pipe, in the same casing.

In small dimensions (Ø14-14 - Ø40-40 mm), flexible pipes are preferable, whereas in larger dimensions (Ø27-27 - Ø219-219 mm), steel pipes will be necessary.

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Flexible pipes are made of materials that result in a more straightforward installation within certain maximum bending angles. The service pipe is typically a plastic pipe and can be supplied with an aluminium layer to ensure diffusion tightness. Flexible twin pipes can also have a service pipe consisting of copper or steel.

Both flexible pipes and straight pipes are recommended with a diffusion barrier between the insulation and the outer polyethylene (PE) casing in order to keep thermal conductivity low and unchanged over time.An example of a steel twin pipe and a flexible twin pipe is shown in the figure below.

Figure 2: Example of district heating twin pipes. A steel pipe twin pipe (left) and a flexible PE pipe (right)

3.6 Leak detection

District heating pipes can incorporate a leak detection system that is able to pintpoint the presence and position of moisture as soon as it arises. Wires embedded in to the insulation layer, run the entire length of the pipe network back to the energy centre. Moisture alters the resistance of the wire, raising an alarm so that scheme operators can rectify the matter before a leak occurs and endu users experience a loss of service.

Figure 3: Cross section of district heating pipes with leak detection

3.7 Metering energy usage

Metering energy consumption is a key commitment within the draft LB Camden Heating Policy (June 2015). Without detailed and accurate consumption data, it is not possible to monitor the performance of the district energy network, optimise its operation or evaluate the behaviour of the occupants' consumption patterns. Furthermore, metering allows consumption based billing of users, which will inherently reduce consumption as residents will closely manage their usage as a result.

However, the design of a metering strategy should be carefully considered and it is crucial that the process is started at the end point i.e. the desired outputs must be firmly established and agreed by engineering, maintenance and billing stakeholders first, before designing a strategy that will deliver coherent and accurate data, in a common format whose collection of readings is both automated and of sufficient regularity.

It is unfortunately common practice for metering to be installed even in new buildings that will never provide the correct data to enable the client to undertake the analysis that would be most beneficial. Furthermore, meters are often poorly commissioned, installed incorrectly and thus yield meaningless readings, or inadequate training of staff means should a particular individual leave the organisation, all knowledge is lost.

The most efficient and well designed district heating network will rapidly be rendered uneconomic or give rise to disputes between consumers and operators if the metering strategy is poorly specified, installed or maintained.

Figure 4: Wireless or automated meter reading can significantly enhance a district heating sytem in terms of efficiency and customer satisfaction

3.8 Energy budget incentives

ABG Frankfurt Holding – a property company/housing association responsible for about a quarter of homes in Frankfurt, Germany – has delivered thousands of new Passivhaus dwellings in the city. One such development, Aktiv Stadthaus, includes an energy budget as part of the rental cost and residents are encouraged to control their energy use via a mobile phone app. This convenient, real time view of their costs greatly incentivises residents to manage their energy consumption carefully.

Opportunities for rewarding low energy consumers who undercut the stated 'energy budget' can be explored(such as cashback on monthly rent), or penalising users for excessive consumption.

3.9 Advanced demand management (5th generation district heating)

COHEAT, a Cambridge-based energy technology company specialising in community scale heat networks

Affordable Warmth Solutions (AWS) is a company set up by the National Grid to help those living in some of the most deprived areas of National Grid's gas distribution network areas.

In July 2015, COHEAT began installing a pilot project at Trident Housing Association's Meeting Street flats in Birmingham. This was made possible thanks to the financial and technical support of AWS who provided match funding for the heat network and a new gas supply.

Advances in controls and monitoring techniques (so called "distributed controls technology") developed by COHEAT are making heat networks even more efficient and also unlocking vast quantities of in-home data that can help social housing providers reduce costs and improve their service offerings.

Heating control, heat metering, billing, and (pre) payment collection built into the control system aims to provide a seamless user experience for the resident and minimises management issues and debt risks for the landlord and / or heat network operator.

The technology aims to provide affordable space heating with individual temperature control in every room, along with a reliable and constant supply of hot water.

The systems provide each resident with real-time feedback on how the way they use their heating affects energy consumption and their bills. To help further alleviate fuel poverty, the system allows the operator to customise the look, function, and language of heating controls to suit each resident.

The same data also allows support workers to monitor the comfort and wellbeing of their residents and to intervene before fuel poverty becomes an issue. The control systems have not only delivered significant efficiency improvements, but are also providing unrivalled insight into the welfare of low income tenants.

On a very practical level, the heating generation equipment is located centrally so that it can be maintained without disturbing residents. In addition, should internal maintenance problems arise, such as water leaks or damp, the system immediately alerts maintenance staff to expediate the repair time.

A full independent evaluation of this 5th generation (5G) technology is proposed for the end of the heating season in Spring 2016.

It is recommended that the findings from the evaluation are reviewed to assess whether certain features can be incorporated into the Maiden Lane Phase 2 design.

4.0 EXISTING HEATING AND HOT WATER INSTALLATION

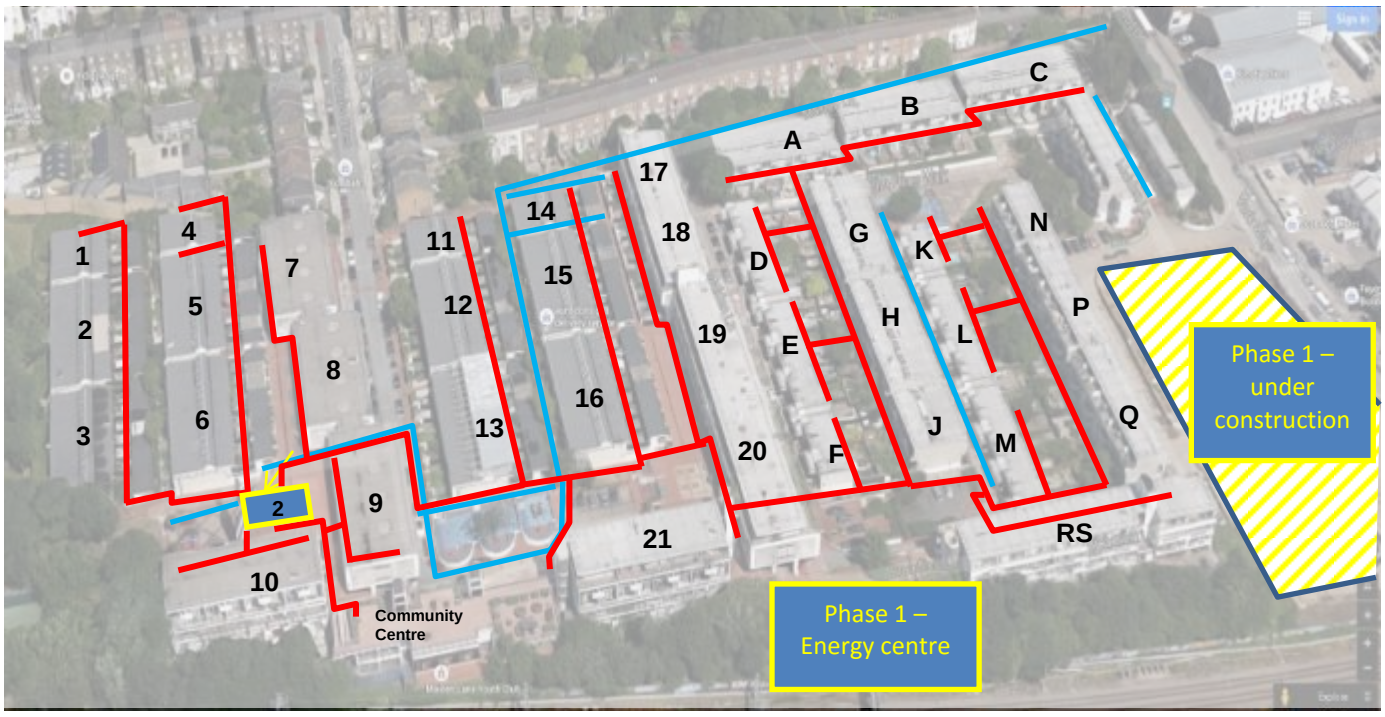
The development is covered via a network of underground services to each dwelling. These services include:

- Mains Gas supply for cooking only
- Potable water supply
- LTHW community heating Flow and Return pipework, and connection for hot water
- Electrical supply (metered)

A summary of the mechanical services are as follows:

- Incoming bulk gas supply (metered) to central boiler room
- Gas fired boilers serving the site wide LTHW pipework

The route of the district heating network is partially shown by the topographical surveys undertaken by Glanville (2012). Tender and Record drawings have also been reviewed to complete the district heating network route map which is superposed onto a 3D image of the site in the figure below. The surveys and drawings are included for reference in Appendix F.



District heating pipework – identified by Tender & Record Drawings (Appendix F)

10 Block Number or Letter

2 Energy centre (Phase 2) located beneath piazza

Gas mains (according to Glanville survey 2011/2012 – yielded incomplete results)

Figure 5: Route map of the existing district heating network

The network is routed beneath the ground, or at high level through the basement storage rooms. Various branch connections exist in each block, which pass via vertical risers to each dwelling and the hot water storage equipment within the property. The equipment comprises a small hot water storage vessel (located in the bathroom in properties viewed) and low level trench radiators, located behind varying types of panelling.

For larger photographs please see Section 12.0.

Central boiler room

Underground pipework

Branch connection at dwelling

In-dwelling hot water storage + radiators

5.0 BULIDING FABRIC REFURBISHMENT

The refurbishment of the building fabric of the Phase 2 properties forms part of the 'Better Homes' scheme, the LB Camden's investment programme for estates across the borough.

The Better Homes scheme consists of refurbishment works including the renewal and repair of kitchens, bathrooms, windows and roofs, and in some cases upgrading heating systems, electrical wiring and lifts.

With regard to the Phase 2 estate, information has been received from Michael Layhe (LB Camden - Interim Mechanical and Electrical Capital Programme Manager) and Lee Glickman (Pellings, operating under Keepmoat/Apollo contract) and is summarised as the following:

Roofs - replacing roofs, in the majority using a Bauder System which includes the replacement of mono pitch glazing north-facing rooflights with double glazed units. There are, however, a number of overlays using liquid applied systems, which are also Bauder systems.

Window / Screens / Doors - to be replaced with engineered timber double glazed units

Paintwork - Redecorate all previously painted surfaces both externally (Dulux weathershield paint) and internally (also Dulux paint)

Façade - Concrete and render repairs carried out using a sika / ronocrete repair system or similar

5.1 Fabric improvements performance

The table below compares the fabric paramaters of the improvements being made to Phase 2, Building Regulations 1a 2013 (new build) and Passivhaus.

Whilst the improvements will certainly reduce energy demand, it should be highlighted that the district heating system can be renewed completely whereas fabric refurbishment will always be limited given that the dwellings cannot be vacated.

	Passivhaus standard	Part L1A 2013 approx	Maiden Lane - Ph2
Energy requirements of the Passivhaus standard			
Heating energy demand, kWh/m²·yr	< 15	45	66 (RdSAP estimate)
Primary energy load, kWh/m²/·yr	120	190	not assessed
U Value for Windows, W/m²K	< 0.8	1.3-2.0	2.0
U Value for exterior shell components, W/m²K	< 0.15	0.15-0.35	Roof improved to 0.26
Some of the comfort requirements of the Passivhaus standard			
Air quality	Good – 600ppm CO_2 above ambient	No standard	No standard
Overheating	Max 10% of the occupied year > 25°C	Max 1% >28°C	No standard
Surface temp (windows)	>17°C when -10°C outside	No standard	No standard
Surface temp	3-3.5°C below room temp.	No standard	No standard
Air-tightness, ACH @ 50Pa	0.6	0.6 - 3	No standard
Air-tightness, m³/m²·h @ 50Pa	2	2 - 10	No standard
Ventilation rate, l/s per person	8	10	Assumed 15
Noise limit in bedroom, dBA	25	25	No standard

5.2 Passivhaus refurbishment standard

The adjacent LB Camden estate Agar Grove is undertaking a deep refurbishment of the existing 148-unit Lulworth tower. Despite targeting Passivhaus certification for the new build units, Agar Grove has considered the Passiivhaus refurbishment methodology 'Enerphit' to be too onerous to undertake.

EnerPHit is the Passivhaus Institute's standard for retrofits and recognises the difficulty of achieving a full Passivhaus standard in existing buildings, by having slightly relaxed requirements for airtightness and space heating demand. The space heating requirement for EnerPHit is 25 kWh/m^2/year (as opposed to 15 kWh/m^2/year for new build Passivhaus) and airtightness requirement is 1.0 (rather than 0.6 air changes/ hour). Given that the UK Building Regulatiosn for new build requires an air tightness of 5, refurbishing the Maiden Lane Phase 2 properties to achieve this criterion alone is considered overly onerous and is not recommended for inclusion with the fabric improvement works.

6.0 RESIDENTS ENGAGEMENT

A Residents Engagement meeting took place onsite on 24th February 2016 and was attended by members of the Residents Committee, Maiden Lane estates manager, LB Camden representatives and members of the McBains Cooper engineering team.

An overview of the district heating appraisal was summarised, indicating the survey and strategy discussions that had taken place to date, and the intended start on site in early 2017. It was explained that the appraisal considered both the wider issues (such as opportunities to source heat from nearby sites or buildings) and detailed considerations (such as pipework and heat emitters within each dwelling).

Key points that were raised during the consultation are as follows:

- Reliability – residents had complained of overheating, faulty controls, often insufficient pressure for hot water supply, and flooding,
- Visual aesthetics – this was noted as an important factor for residents
- Maintenance – ease of maintenance is key, and an easy to understand guide should be provided for this
- Demonstration flat – it was suggested a demonstration flat would be provided whereby new pipework and other related equipment would be installed. This would enable all parties to see the system insitu and give more informed feedback.

In addition to providing tenants with a physical understanding of heating equipment, it will be vitally important that residents understand the expected performance of the new system.

For example, whilst the fabric improvements and new heating equipment will reduce energy consumption overall, it will likely mean that hot water usage will become a greater percentage of the dwelling's energy usage.

Many consumers assume that the majority of their energy bill is attributed to space heating, rather than for hot water. Furthermore, given that the current district heating scheme is not metered on a 'per dwelling' basis, residents that are currently large consumers users may not anticipate the costs of maintaining this consumption once metering is installed. Given the fabric and heating network improvements, such residents may not initially understand that behaviour change may also be required.

- Pipework condition – it was noted that certain sections of the district main had been replaced and thus it might not be necessary to replace the entire length of pipework. The Estates Manager explained that despite new pipework, contaminants and impurities that have built up over the life of the network would also now have been transferred to any new sections. Therefore, the replacement of pipework in its entirety would be required.

- Leaseholder – it was confirmed that Leaseholders would retain the right to alter pipework installed within their dwelling up until the connection with the district heating branch to the dwelling.

- Wall radiators – this style of heat emitter are not favoured by residents as they take up wall space and restrict the arrangements of furniture within a dwelling. The trench style radiators are preferred.

- Programme – it was suggested that Detailed Design and Tendering process should take place in the later half of 2016 with a proposed start on site in early 2017

- Landscaping – the Committee Secretary noted the upcoming landscaping improvements works that are proposed and that the opportunity to undertake district heating related ground works would ideally coicinde with the ground works.

  Further queries to LB Camden have not yielded a confirmed scope and programme timing for these landscape works, and is included as as part of the Next Steps in section 11.0.

The above feedback from the residents is to be considered by the project team and implemented into the renewal strategy where possible. It will be important to inform the residents at a later date of how their views were considered and an explanation given as to why the suggestions were included within the strategy or not.

Following the meeting, it was agreed that Derek Wells (LB Camden) would coordinate with within LB Camden to provide information via monthly or bi-monthly newsletters.

The first newsletter would feature details of the Altecnic Heat Interface Unit (HIU) as installed on other LB Camden estates. This would provide an example to residents at Maiden Lane of the type of equipment that may feature as part of the district heating renewal.

Following the Residents Engagement meeting on 24th February 2016, various residents sent their views and questions to LB Camden via email. The responses forwarded to McBains Cooper are included within Appenidix M. In summary, the repsonses concered the following:

- In-dwelling pipework – Nick Woodford raised his objection to surface mounted pipework and any plastic trunking that would cover the pipework. Derek Wells (LB Camden) responded by explaning that installing pipework beneath existing flooring would be cost prohibitive.

- Water pressure - Nick Woodford highlighted the low pressure of cold and hot water supplied to the flat. Derek Wells (LB Camden) responding by confirming that water supplied to the dwelling via the HIU would be at mains pressure.

- Boiler house chimneys - Nick Woodford raised his concern that the chimneys would be removed. Derek Wells (LB Camden) confirmed that until Detailed Design had been completed, no comment could be offered on this topic.

- Solar panels - Nick Woodford quoted Brixton Energy's solar provision at the Loughborough Junction Estate. The inclusion of a PV array is to be included within the Cost Appraisal.

Furthermore, Eva Reynolds summarised the residents' feedback as follows and listed in detail in Appendix M:

- **Space requirements** – both for the HIU and for radiators, with details of the location within dwelling that each will be installed. Enquiries were also received as to destination of the existing heating equipment and radiators.

- **Wall mounted pipes** – concern expressed regarding the appearance and space requirements of new pipework

- **Start date of works** – a clear indication of when the district heating works will commence

- **Heat metering** – further details were requested regarding the heat met

7.0 CONDITION SUMMARY

Three site visits were undertaken by McBains Cooper in November 2015: site walk around to gain an understanding of the site as a whole, inspection of boiler room and basement storage areas, and a review of heating and hot water infrastructure within three vacant properties.

A survey of the main boiler room was carried out in 2012 for which the inventory has been updated as per **Appendix D** . In terms of the plant items, layout and damage noted, a summary is given below:

Central Boiler room

- Plant age: generally 15 years old (installation Sept 2000)

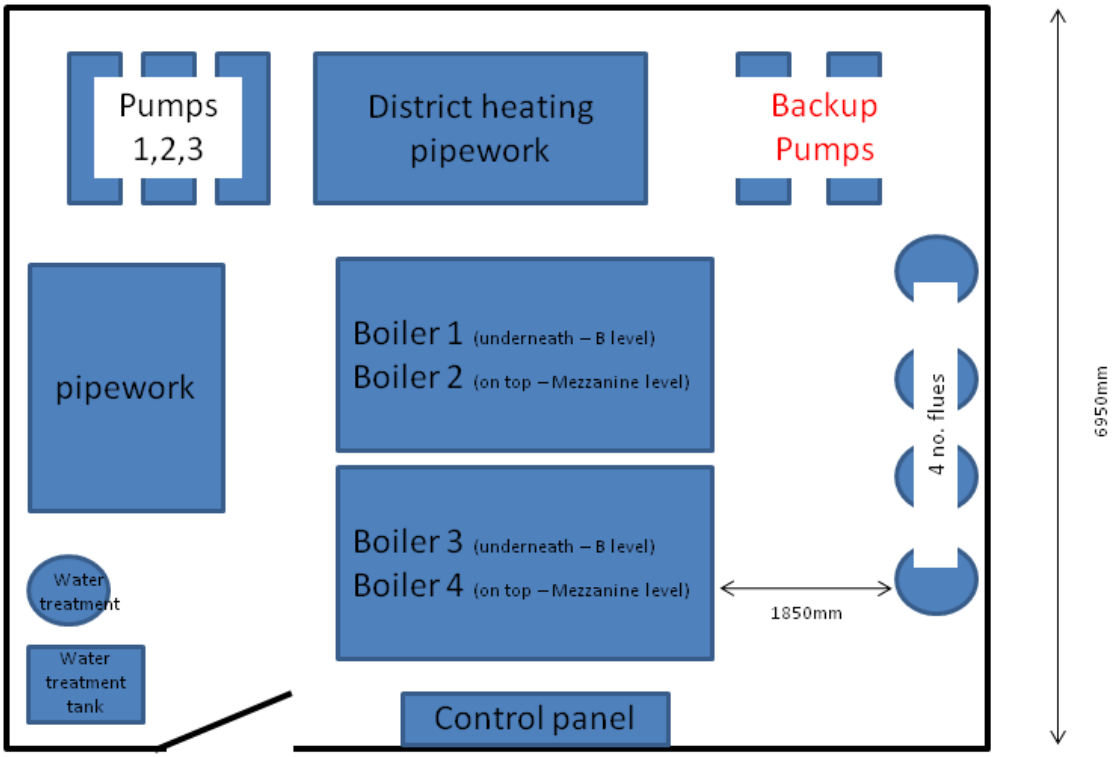
- Plant condition = generally good,
  - Water dosing equipment – evidence of leaking/staining on external casing. Manufacturer to be contacted
  - Boiler 2 – colouration
  - Boiler 1 – front panel open – the boiler is offline
    – Minor deformation of boiler casing
  - Insulation on small section of pipework

- Space availability: the boiler is room is extremely congested and there is no space for new plant

- Boiler room log book – notable entries
  - Maintenance entries undertaken by Apollo
  - 16th March 2015 - District heating system running at Flow 85c return 75c.
  - 22nd July 2015 – hairline split identified in pipework. No further entry confirming rectified. Needs to be checked.

The following figures show an indicative layout of the central boiler room which is predominantly at Basement level, with a small mezzanine area.

BASEMENT LEVEL



MEZZANINE LEVEL

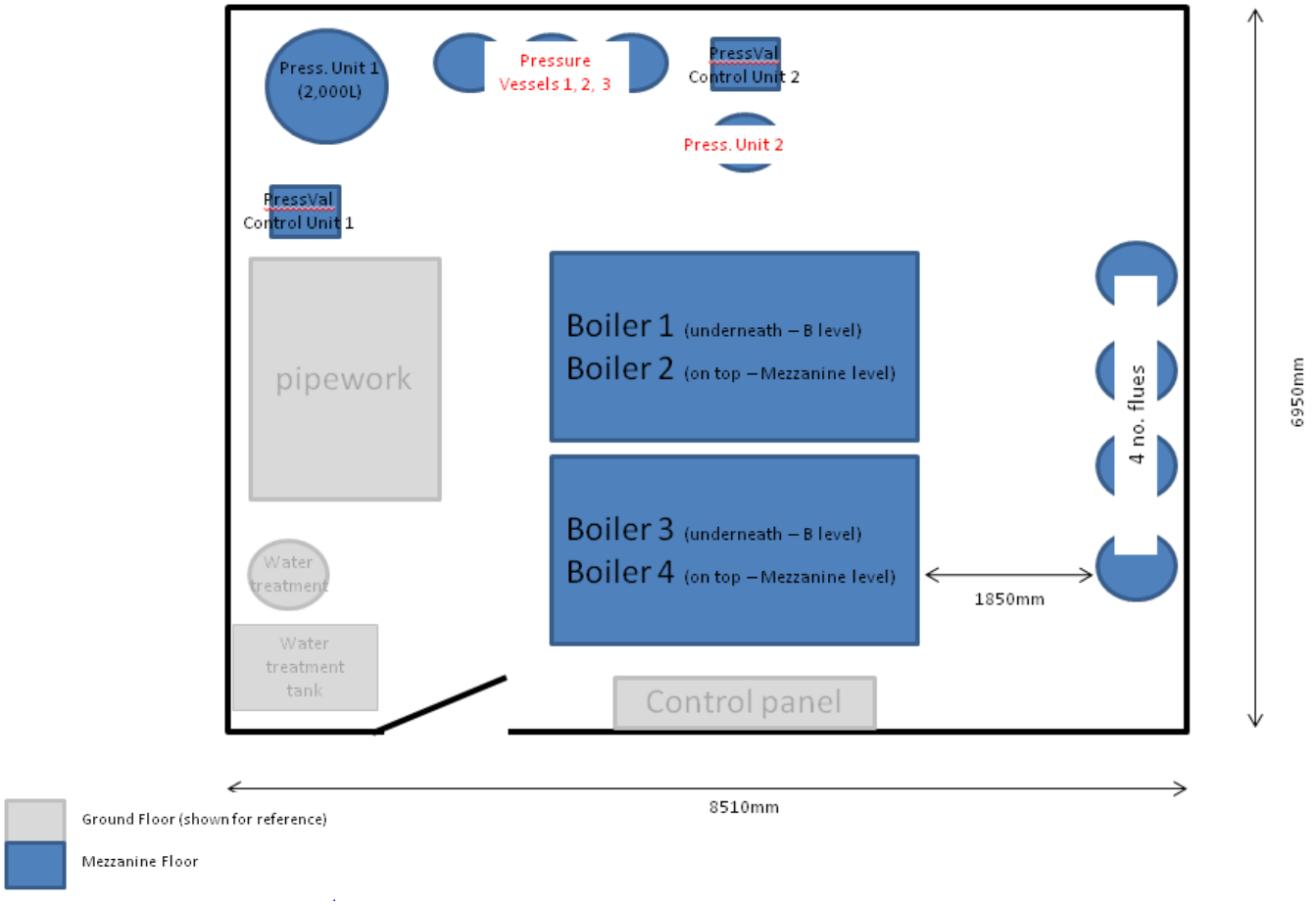


Figure 6: Indicative layout of the existing Phase 2 boiler room

In-dwelling equipment

Three, vacant properties were visited in November 2015: 232 Maiden Lane, 6 Allensbury, and 55 Broadfield.

In those dwellings that are not undergoing refurbishment, the condition of the mechanical systems were poor.

Furthermore, the access to the heating services was also very limited, which makes maintenaince difficult and time consuming to undertake, thereby increasing cost of works and disruption caused to residents.

PHOTO A :
Trench radiator and TRV (temperature control) located beneath wooden bars, and thus is inaccessible.

Residents cannot control the temperature of their heating and are forced to open windows, thus wasting energy.

Aside from the above aspects that were immediately apparent, further problems were identified through anecdotal evidence received from residents and Bryon Freer (LB Camden Phase 2 Refurbishment Works Officer). The most notable are:

(1) Low hot water pressure

(2) Summer overheating, potentially worsened with new insulation being fitted

(3) No insulation on District Heating pipework (neither internally nor externally to the dwelling, causing significant heat loss and overheating)

(4) Overheating during summer due to i) district heating branches within dwelling with no temperature control (thus a further heat source to the dwelling with no temperature control) ii) radiator with TRV (temperature control) but that is broken and set permanently to “Max”.

PHOTO B: Trench radiator and TRV (temperature control) located behind bath panel and thus completely inaccessible to resident, with overheating inevitable

8.0 ESTIMATING ENERGY DEMAND

In order to inform the decision making process in terms of selecting the most suitable renewal solution for the district heating system, it is of primary importance to assess the quantity of energy that is required to provide hot water and space heating to the dwellings across the Phase 2 estate.

Three methods for evaluating the demand are summarised below:

- Metering data – the most accurate prediction of future heating demands would be based on actual metered data on a 'per dwelling' basis. This data could then be adjusted according to any thermal improvements, such as roof insulation, that have been or are scheduled to be completed.
- Energy modelling – in the absence of actual data, the operation of the dwellings are simulated using computer software, including for known specifications parameters such as U values of replacement fabric elements
- Energy benchmarks – based upon measured data from other buildings of the same type, typical values for energy per floor area can be applied to Phase 2 dwellings

The existing energy meters installed are discussed in section 6.1 although the current provision is considered sufficient to draw only high level conclusions.

Energy modelling and benchmarks are reviewed in section 6.2. In order to test the accuracy of these, a period of temporary metering of individual dwellings should be considered.

8.1 Establishing heat and power demands – existing metering records

Energy consumption data was received in November 2015 from Nick Goodes (Principal Accountant) and Louise Coster (Senior Energy Management Officer) at LB Camden.

The data included monthly readings from September 2012 to August 2015 of meters across the Phase 2 estate. Of the 31 meters, individual meter readings were provided for all except 6 no meters, which were grouped into 2 readings. In total, all meters were electrical, with only 3 no. gas meters as per the tables below:

Location	Account	SupplyPoint	Meter	Commodity
Central boiler room	1003343	9880406	M0450A054414D8	Gas (hot water and space heating)
St Pauls Crescent	1042588	9203822404	8019236S	Gas (cooking only)
Meter room adjacent to York Road	1042587	9203900207	M160K0352514D7	Gas (cooking only)

The following table shows an estimated cost of fuel consumed based upon the annual gas usage as taken from the metering information.

Annual GAS usage (kWh) from Sept 2012 - August 2015

Location	2012 / 13	2013 / 14	2014 / 15	Average Annual cost (£)
Central boiler room	11,824,439	10,415,773	11,256,229	223,310
St Pauls Crescent	254,921	257,563	251,563	5,094
Meter room adjacent to York Road	109,355	118,035	141,523	2,459

The fuel cost is an estimation based upon an assumed price of 2p/kWh, and averaged over the 3 year period 2012 to 2015.

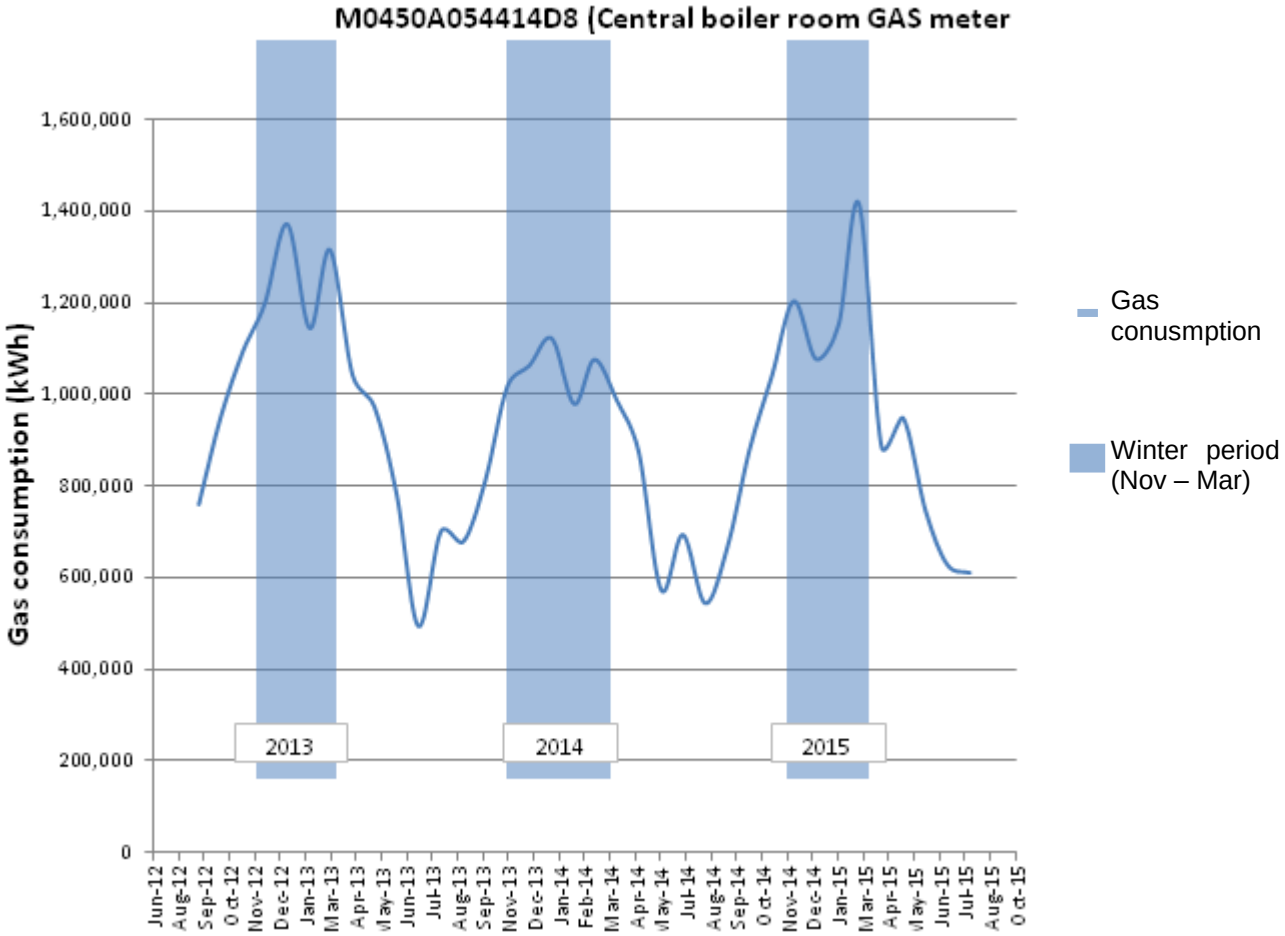
The following table shows an estimated cost of electricity consumed based upon the annual electricity usage as taken from the metering information.

Annual ELECTRICITY usage (kWh) from Sept 2012 - August 2015

Location	2012 / 13	2013 / 14	2014 / 15	Average Annual cost (£)
Entire Phase 2 Estate	465,848	498,893	498,340	34, 140

The electricty cost is an estimation based upon an assumed price of 7p/kWh, and averaged over the 3 year priod 2012 to 2015.

Actual billing information has been requested from LB Camden in order to confirm the current fuel and projected fuel costs. At the time of writing, these costs are yet to be received and shall be included in a further revision of the report.



The graph shows gas consumption for the central boiler room has remained broadly consistent during the course of each the past three years, except for a 15% drop in peak gas consumption during Dec 2013. This can be accounted for by a warmer average temperature in Dec 2013 as confirmed by Met Office data. (http://www.metoffice.gov.uk/climate/uk/summaries/2013/december/regional-values)

Mean monthly temperature (SE England)

- December 2012 / Jan 13 5.4°c
- December 2013 / Jan 14 6.3°c
- December 2014 / Jan 15 5.5°c

As can be seen from the tables on the previous page, the gas usage for hot water and space heating is only metered centrally and thus it is not possible to identify abnormal heat loss or usage on a 'per block' or 'per dwelling' basis.

Furthermore, it is clear that the gas consumption for heating and hot water is a significantly greater cost than that which is used for cooking, and thus any reductions in heat loss (notably those relating to heating services within dwellings) should be targeted.

8.2 Establishing heat and power demands – RdSAP calculations and DECC benchmarks

In the absence of existing metering on a block by block or per dwelling basis, the heat and power demands of the dwellings have been estimated by energy modelling. The Standard Assessment Proceedure (SAP) as required for Building Regulations Approved Document Part L calculations has been followed. The RdSAP version included within SAP 2009 v.9.90 (March 2010) provides a methodology for completing the calculations for existing buildings.

An annual heat-demand profile can be plotted on a load duration curve, such as the example shown in Figure 7. In this instance, it can be seen that the peak heat demand occurs for relatively a short period during the year. Heat-generating sources should therefore be optimised so that the peak demand is met by low capital cost plant such as gas boilers. Typically, a low carbon heat source (such as 'secondary heat' or that from a CHP) is sized to supply the baseload, approximately 40 – 60% of the peak load.

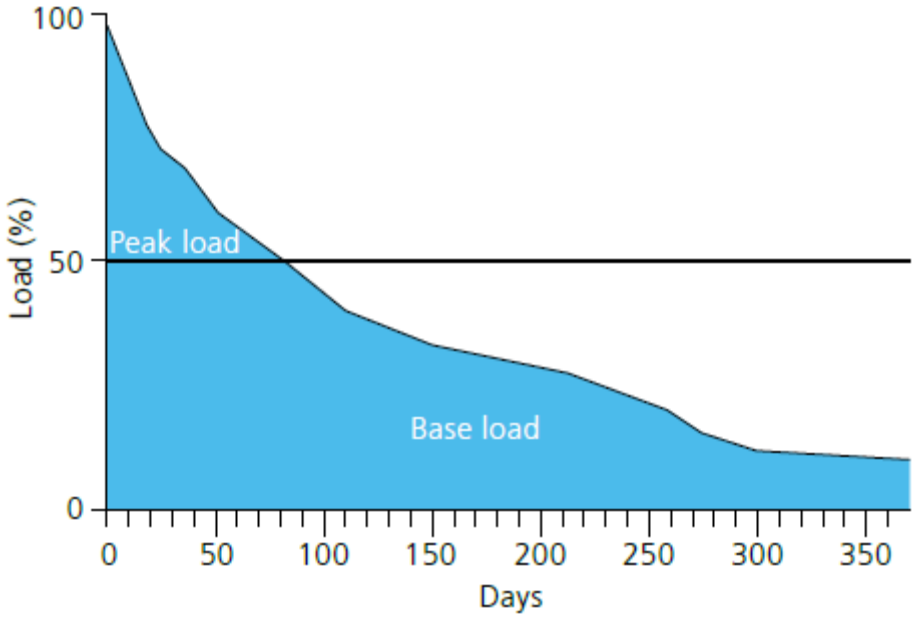


Figure 7: Example Load duration curve of annual heat consumption

The heat load demand has been based upon typical SAP calculations using the RdSAP assumptions where necessary.

The results are compared with heating benchmarks cited within the recent consumer research report undertaken by Which? ('Turning up the heat: getting a fair deal for District Heating Users – March 2015') which sourced data from the Cambridge Architectural Research for the UK Government Department of Energy and Climate Change (DECC), 'Cambridge Housing Model and User Guide -2010'.

Table 1: Total space and water heating requirements (kWh)

Data Source	1 bed dwelling	2 bed dwelling
DECC benchmark (Dwellings built 1972 – 1995)	6,112	7,868
Typical RdSAP calculations (Maiden Lane – Phase 2)	5,400	7,317

It can be seen that the total heating *demand* from the SAP calculations is broadly similar to the DECC benchmark data. Therefore, it is considered reasonable to extract the fuel *consumption* data from the SAP calculations to investigate various scenarios for improving the district heating system at Maiden Lane to compare the energy consumption (and CO_2 emissions) of each.

In order to decide which scenarios for which SAP calculations are performed, a qualitative appraisal of all possible options is undertaken first as discussed in Section 9.0. The chosen scenarios are compared in Section 9.4.

9.0 TECHNICAL OPTIONS APPRAISAL

It is clear from the site visits undertaken in November 2015 that the hot water and heating equipment within the dwellings should be replaced.

The hot water storage in one of the 3 no. vacant properties (visited in Nov 2015) was installed in August 1980 as indicated on the side of the unit (see section 12.0, Photograph E.). The other 2 vacant dwellings inspected were undergoing light refurbishment which in terms of mechanical services was limited to the installation of new wall radiators. Existing heating pipework branches and hot water storage remained, and although it was not possible to verify this during the visit, it is considered very likely that these will also date back to 1980.

In terms of the heat generation and distribution to the apartments, the following options have ben reviewed and are discussed in this section:

- Energy sharing with adjacent developments
- 'Secondary' heat sources
- Retention of existing system with repairs undertaken.
- Combined Heat and Power (CHP)
- Replacement centralisied gas boiler system
- Electric heating
- Individual ultra Low NOx boilers
- Domestic hot water generation
- Renewable energy technologies
- Low or ultra low operating temperatures

The review considers whether each option is recommended for inclusion within the Cost Appraisal.

9.1 Energy sharing with adjacent developments

A preliminary review of the opportunities for sharing energy with adjacent sites (through either export or import of energy) has been undertaken. Studies undertaken by the LB Islington (which is located immediately adjacent to the Maiden Lane estate) and LB Camden highlight areas of either high thermal demand or energy generation.

A further estate ("York Way") owned by the City of London is located approximately 250m to the north of Maiden Lane.

It is also noted that a series of residential led private developments are planned along Camley Street which are in different stages of the planning process or construction.

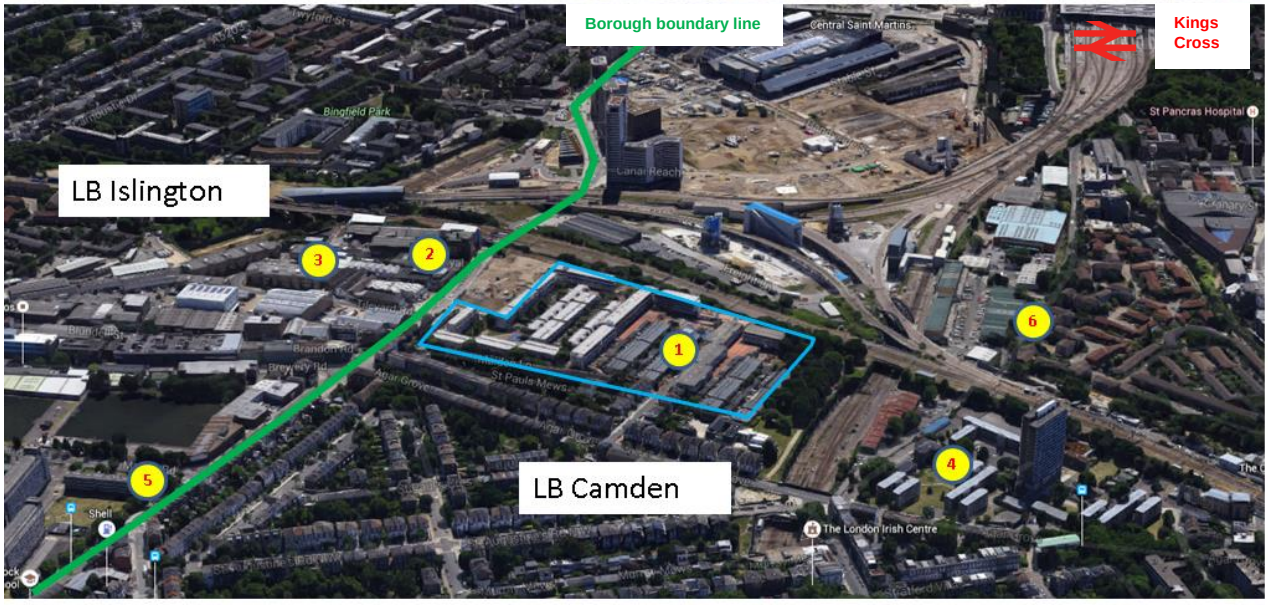


Figure 8: Maiden Lane Phase 2 and possible 'energy sharing' sites

Of the possible 'sharing' sites, the most obvious is the Agar Grove estate (no.4 in Figure 8) which is located just to the west of Maiden Lane, and is also owned and operated by LB Camden. From preliminary proposals and discussions with Jennifer Belk (LB Camden's Decentralised Officer) it is understood that the proposal is for the new build dwellings that will replace the existing housing stock on the Agar Grove site to target Passivhaus accreditation. Therefore, it is likely that the space heating demand will be very low and thus would in fact not be a suitable 'sharing' site.

Figure 9: Possible heating network routes to neighbouring heat loads

Agar Grove

The Agar Grove redevelopment consits of a 500 dwelling scheme which will see 112 of the existing low-rise houses demolished, 360 new properties built, and the central, 18-storey Lulworth House tower block stripped back to its frame and retrofitted to provide new residential dwellings. The 25,600m² estate regeneration will include family terrace housing, maisonettes with gardens, and apartments with gardens**.**

Camley Street

Camley Street was also identified as a 'new energy network cluster' as part of the LB Camden "Borough Wide Heat Demand and Heat Source Mapping – May 2015" as can be seen in Figure 10 below. This means that there are sufficiently large thermal loads from a small number of buildings (existing or planned) within close proximity to each other for which a district heating network should be considered.

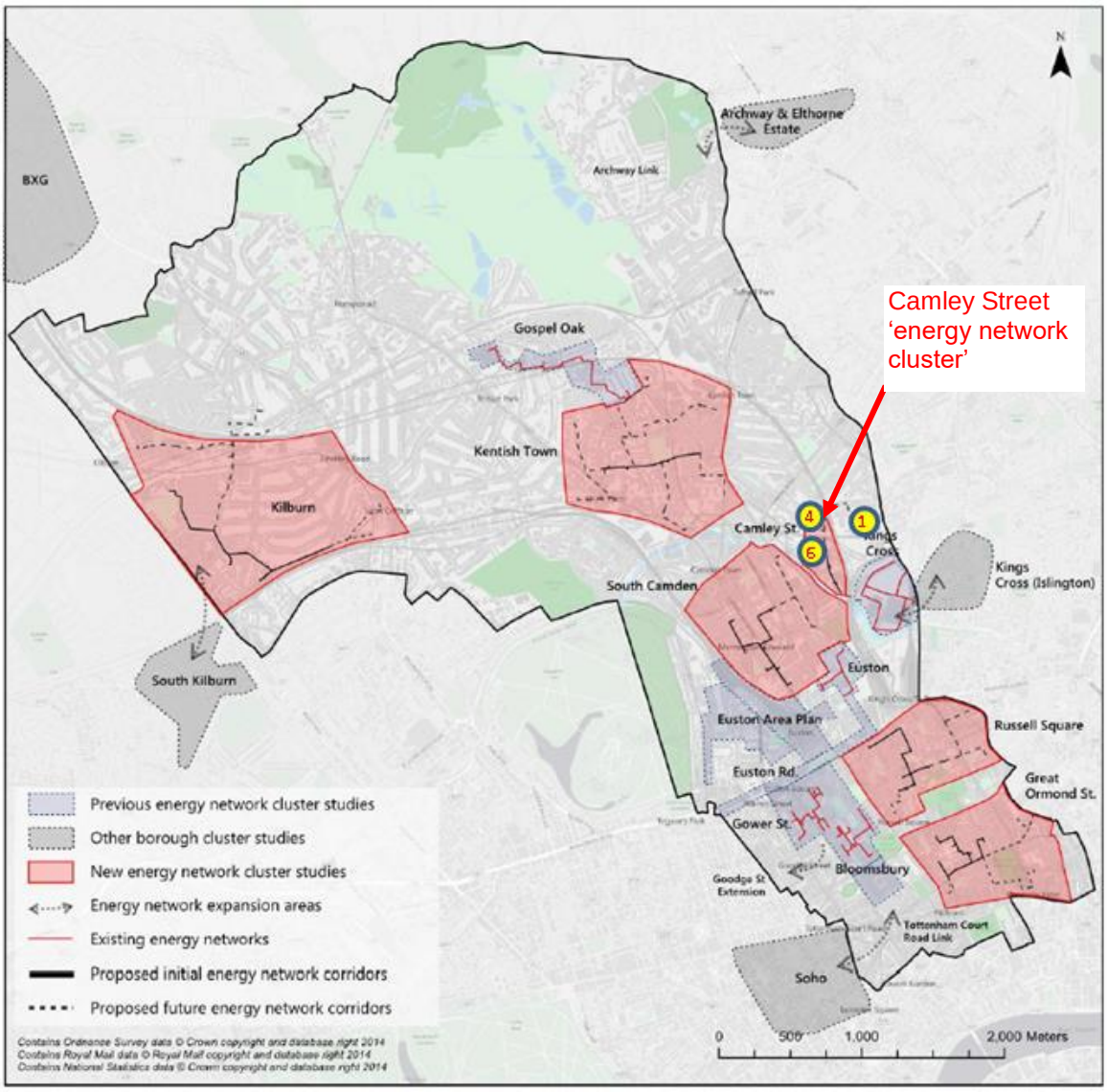


Figure 10 – Camley Street identified as energy network cluster

According to Figure 11 (overleaf), Camley Street is identified as having a 5,000MWhr / yr heating demand, which is understood to be primarily based upon the Cedar Way industrial estate which is located in the northern half of Camley Street. The southern section of Camley Street is set to include new residential led developments over the period 2016 – 2020 and these smaller, but still significant loads are also noted on Figure 11 (overleaf). Therefore, unlike Agar Grove, there is a sifnicant heat demand at Camley Street for 'energy sharing' to be considered, especially given the new development planned in the next few years.

However, a feasibility consultation would have to be undertaken with Network Rail given that heating network between Maiden Lane and Camley Street sites would cross major rail routes. Given McBains Cooper involvement with developments at the southern end of Camley Street, it is clear that establishing a suitable agreement with Network Rail would be complicated and take a considerable length of time.

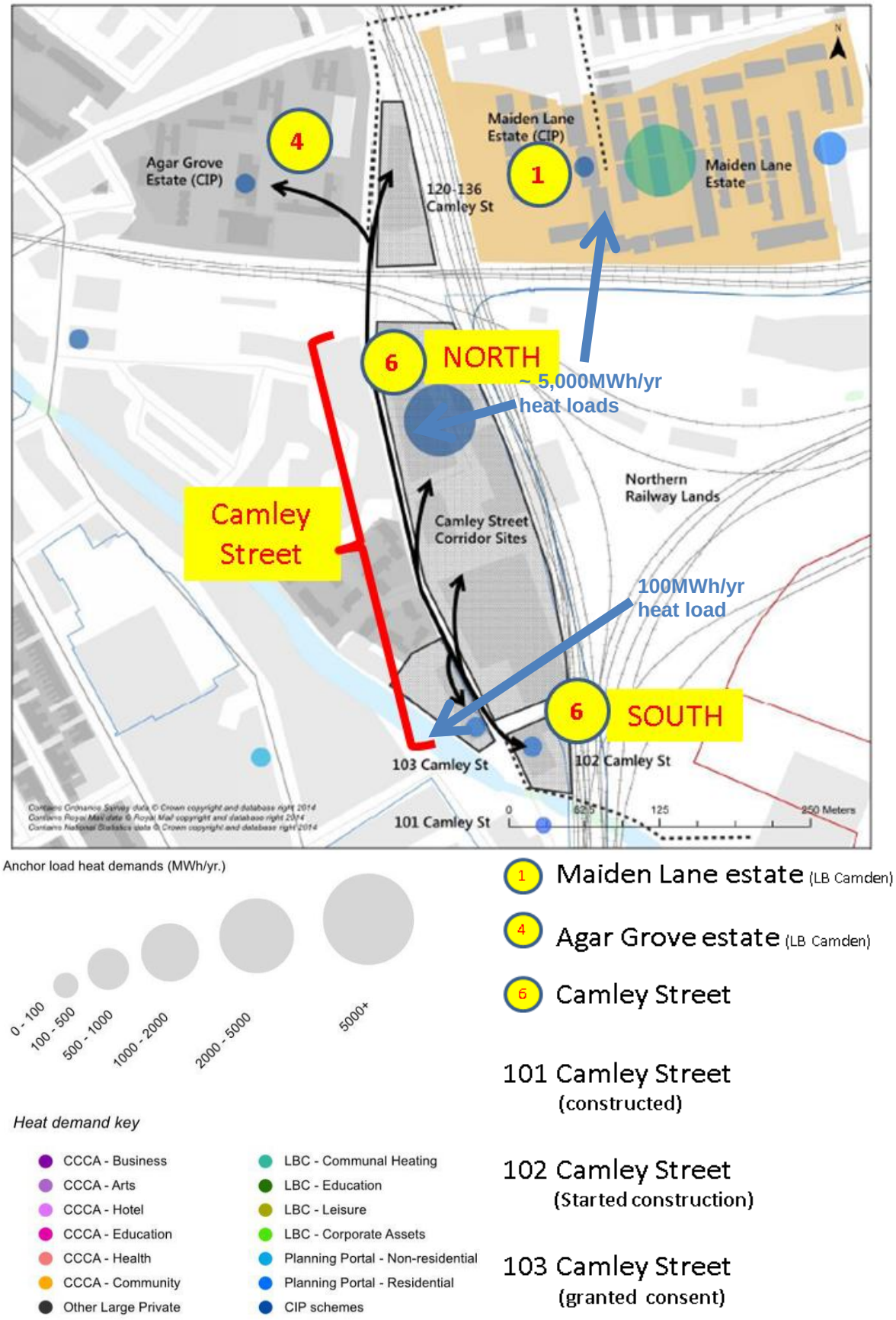


Figure 11 – Estimated heat loads on Camley Street and the local area

9.2 'Secondary' heat sources

Possible 'secondary' heat sources other than buildings have also been reviewed. Secondary heat has been dubbed "London's zero carbon energy resource" and is defined as follows:

> *"…waste heat arising as a by-product of industrial and commercial activities; and the heat that exists naturally within the environment (air, ground, water)…."*

Such sources can include Transport for London ventilation shafts or tunnels, electrical substations, sewers, and cooling heat rejection from large users such as supermarkets or offices.

As can be seen from Figure 12 below, the Maiden Lane site is not located near to any known electrical infrastructure or London Underground ventilation shafts. However, it is directly adjacent to a trunk sewer that runs north-south beneath York Way. It is, therefore, suggested that Sewer Heat Mining is investigated.

Furthermore, the presence of a known communal boiler installation (no.7) should also be considered as part of the exercise.

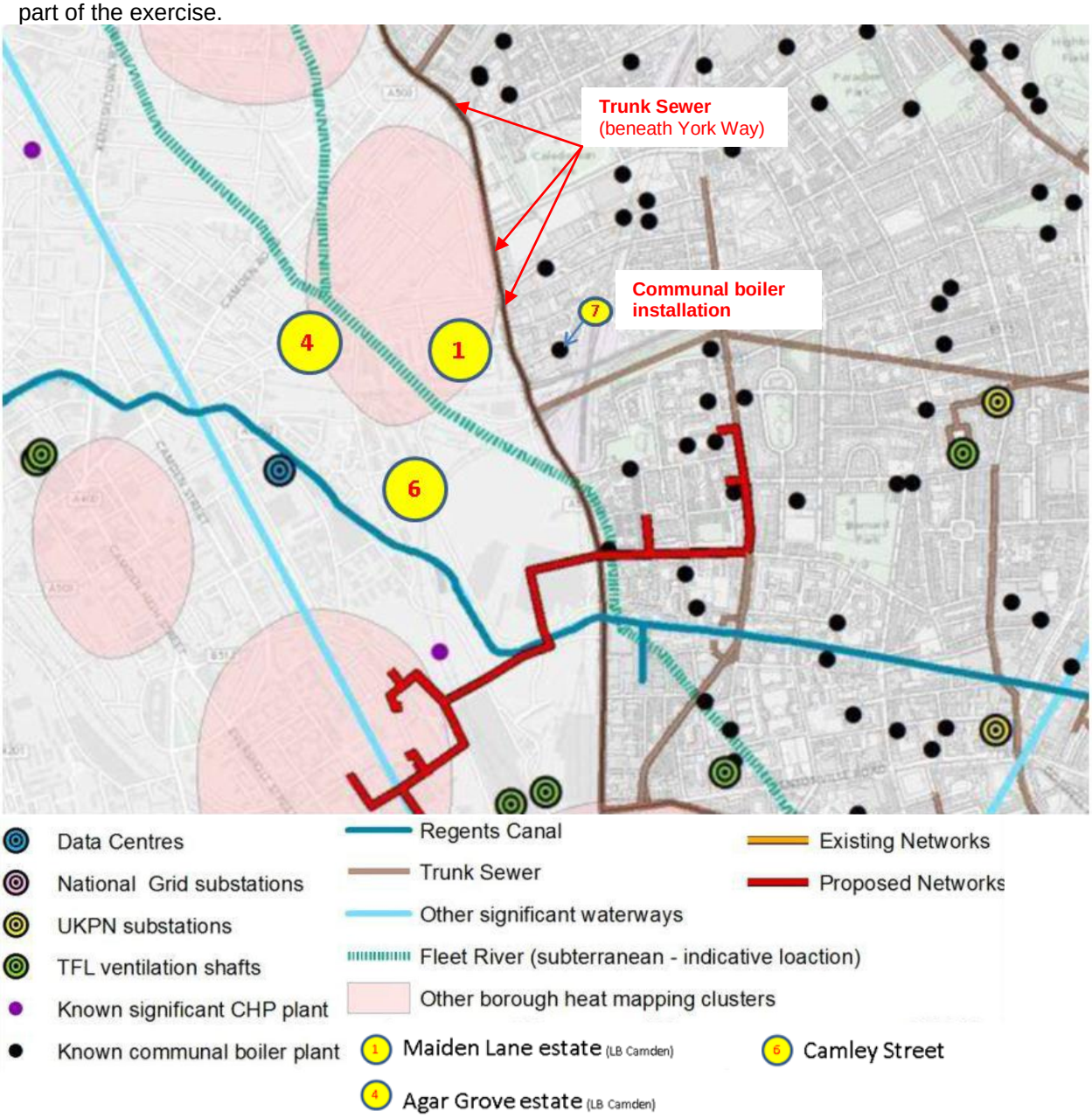


Figure 12: Nearby Secondary heat sources (Source: LB Islington Heat Map 2014)

9.3 Onsite heat sources

Having considered the wider context of the Maiden Lane site, and the opportunities for sourcing heat from the surrounding area, the alternatives for onsite heat generation should be reviewed.

9.3.1 Retention of existing system with repairs undertaken

The possibility to retain the present district heating network has been discussed with the Maiden Lane Estates Manager. Based upon his anecdotal evidence, the condition surveys undertaken by McBains Cooper and the age of the system (confirmed as 36 years old by Record drawings and labelling on the heating equipement, see Photo E in Section 12) it is recommended that a full overhaul of the system is undertaken.

NOT recommended 

9.3.2 Combined Heat and Power (CHP)

The option of a Combined Heat and Power (CHP) unit should be considered as despite using more gas than a conventional boiler to produce a unit of thermal energy, a CHP will also generate electricity and thus overall more energy per cubic metre of gas fuel. The generation of electricity also means that for the same thermal and power output, a CHP will produce significantly less CO_2 emissions than a gas boiler in combination with grid electricity.

CHP runs most efficiently when operated for long, continuous periods at full load. It is, therefore, well suited to meeting a base energy load, as alluded to at the beginning of Section 6.2. Typically, CHP is sized to meet the thermal base load, but its electrical output should also be considered carefully in relation to a development's electrical baseload. Excessive generation of electricity may mean the majority of output is exported to the National Grid, resulting in a significantly lesser financial benefit than if used onsite. The existing and project electricity tariffs that LB Camden has secured for Maiden Lane will also need to be considered.

The above considerations relate to the sizing and integration of CHP into the district heating scheme. However, given the opportunities for carbon reduction and potential financial benefits from onsite electrical generation, it is recommended that CHP is considered in more detail and included within the Economic Options Appraisal.

To be considered 

9.3.3 Replacement centralisied gas boiler system

From site surveys conducted, it is confirmed that the 4 no. existing gas boilers (including the burners) located in the Phase 2 energy centre date from 2000 and therefore 16 years old. The casing of Boiler 1 is partially deformed and the boiler was not in operation at the time of the site visit in November 2015.

According to CIBSE Guide M (Appendix 12.A1: Indicative economic life expectancy - 5.5.1.1.2.8), a typical LTHW gas boiler life expectancy is 20 years and thus all boilers would be scheduled for replacement by the latest in 2020.

A review of the boilers by the manufacturer Hoval is proposed to more accurately quantify the life of each boilers. Given that the Maiden Lane Phase 2 dwellings are almost all occupied, any district heating works will need to be phased, rather than simply shutting down the entire system and replacing all boilers simultaneously. Therefore, retaining one or more of the existing boilers for a longer period may be beneficial as part of a transition period to new plant.

Recommended 

9.3.4 Electric heating

Electric panel heaters are cheap and easy to install and maintain. Furthermore, the complexities of routing pipework, balancing the pressure within a system and problems of overheating due high temperature water passing through exposed pipework, are avoided. However, electricity as a fuel is carbon intensive (approximately twice that of gas) and expensive (approximately thre times that of gas).

Furthermore, even in order to pass the current building regulations (Part L 2013) for new dwellings, significant additional expenditure is required on other measures to compensate for the high associated CO_2 emissions where electric heating is installed. Typically, a combination of PV panels, shower waste water heat recovery and mechanical ventilation with heat recovery (MVHR) would be required, all of which would be very difficult, if not inappropriate to retrofit at Maiden Lane Phase 2.

It can be argued that a decarbonised National Grid (where elecitrcity is produced primarily from renewable energy or low carbon sources) would change this viewpoint considerably. However, in the UK at least, such a decarbonisation of the electricity supply is a long term solution, and a distinct advantage of a district heating network is that it allows future flexibility regarding the heat source.

NOT recommended 

9.3.5 Individual ultra Low NOx boilers

Assuming that pipework and radiators within the dwellings will need to upgraded or replaced entirely, it is appropriate to consider whether installing individual boiler plant at the same time would be a suitable alternative to the more extensive works of replacing a district heating main.

Two important factors to review would be the avaibility of space and a suitable location within each dwelling. For example, boilers would typically be installed in kitchens but this would require a suitable location within the current kitchen layout, and that the corresponding location on the external façade would be suitable for the flue in relation to neighbouring windows. This is unlikely to be achievable across all dwellings and it is important that heating systems provided to residents are as uniform as possible for all properties to avoid disputes arising due to a perception that "better" systems are being installed in only certain areas.

NOT recommended 

9.3.6 Domestic hot water generation

The current hot water and heating systems within the dwellings are fed directly from the district heating mains. Instead of installing individual boilers to each apartment, a domestic hot water cylinder could be fitted with the central heating system maintaining its supply from the main district heating network.

Although this would be more flexible in terms of location with the apartment, in terms of volume this vessel would be larger than an individual boiler. It is considered more appropriate to install either a combination boiler (which will provide both hot water and space heating) or a Heat Interface Unit (HIU) that would perform the same function as a boiler, but drawing heat from the district network rather than combustion within the unit. The complications of installing a boiler within each dwelling is discussed in the previous section 7.3.5.

NOT recommended 

9.3.7 Renewable energy technologies

- Ground or Air Source Heat Pumps – Heat Pumps extract heat from the ground or air at certain temperatures, and releases it at a higher temperature to the heat distribution system in a building e.g. the water circulating in underfloor heating.

  Given that the Maiden Lane Phase 2 estate consists of existing buildings, that are in relatively close proximity to each other, there is not sufficient space to install a ground source based system. Typically, a heat pump system works most efficiently with low temperature heating systems, such as underfloor heating, and achieves poor energy efficiency in terms of extracting heat from air to be supplied at higher temperatures (approx.. 60°c - 80°c) as required for traditional heating such as the existing system at Phase 2.

  NOT recommended 

- Photovoltaics – Photovoltaic arrays convert sunlight into DC electricity which is converted into a.c. electricity via an inverter to be used in buildings.

  The Phase 2 estate has large area of flat roofs which would allow for the installation of PV arrays at near optimum conditions for the UK i.e. facing approximately due south, with a 30° tilt. Further site surveys would be required to confirm the area of PVs that could be installed given that many of the roofs contain roof lights and other factors such as structural suitability and access for maintenance would also be reviewed.

  Recommended 

- Solar thermal – Solar thermal panels use heat from the sun to heat water, typically supplying the domestic hot water. This is due to the fact that hot water demand would be consistent throughout the year, whereas space heating would demand would be highest during winter, and thus during the period in which the least amount of solar energy could be harnessed.

  The roof installation considerations would as those for Photovolatics, but be further complicated by the need for pipework to transfer heated water to storage vessels, located in centrally for each block, or in each dwelling. The space and routing complexities of this pipework and storage vessels are considered overly onerous to retrofit to the Phase 2 dwellings.

  NOT recommended 

- Biomass heating – a biomass boiler provides thermal energy for hot water and space heating in the same manner as a traditional gas boiler but uses organic material (e.g. woodchip, wood pellet, waste wood, biomass crops) as the combustion fuel.

  A biomass boiler is considered unsuitable for the development due to the central London location and the associated implications of fuel supplies and deliveries. Moreover, suitable space for fuel storage, typically in the form of a basement store would need to be considered.

  NOT recommended 

- Wind power – Wind turbines convert the kinetic energy in wind into mechanical energy and then to electricity via an alternator.

  Roof or ground mounted wind turbines are not recommended for this site due to noise, flicker and vibration implications on the surrounding residential buildings. Numerous inner city wind turbine trials have shown that such turbines' energy yields are significantly lower than manufacturers' estimations. This will not be further considered.

  NOT recommended 

9.3.8 Low or ultra low operating temperatures

As discussed in sections 3.0 and 3.5, the latest generations of district heating (4th and 5th) utilise low operating temperatures and advanced demand management monitoring to maximise the efficiency of a district heating system.

Given that operating the system at ultra low temperatures would require the installation of underfloor heating due to low flow temperatures provided by the primary district network, the possibility to run the system at low temperatures with micro booster sub stations could be reviewed in further detail should the economic appraisal indicate a significant life cost benefit.

Recommended 

9.4 Comparison of shortlisted renewal strategies

Based upon the technical appraisal above of various technologies, the list below summarises various renewal strategies for the heating of Maiden Lane Phase 2 for which fuel consumption and CO_2 emissions have been estimated:

1. **Existing** district heating scheme with existing, centralised boilers and hot water storage within each dwelling
2. **New centralised boilers** – otherwise as per Scenario 1.
3. **Improved fabric performance** – otherwise as per Scenario 1.
4. **Improved fabric performance + new centralised boilers + new heating plant in each dwelling**
5. **Improved fabric + new district heating network + centralised CHP + new heating plant in each dwelling**

Note – the assessment of Photovoltaics will be undertaken following further site surveys to assess the suitability of the roof areas as discussed in section 7.3.7.

The fuel consumption and CO_2 emissions are based upon the hot water and space heating demand mentioned in section 6.2 and the measures undertaken as listed above. Table2(overleaf) compares the estimated results of each strategy according to RdSAP calculations.

Fabric improvements

The RdSAP modelling estimates that the fabric improvements that are currently being undertaken will achieve a 19% reduction in energy consumption and a 17% reduction in associated CO_2 emissions.

Reducing demand ('Be Lean') is the first step in the Mayor of London's Energy Hierachy as applied to new build developments. Reducing heat demand forms a commitment set out by LB Camden within the draft LB Camden 'Heating Policy for Council-Owned Housing – June 2015' which considers this part of a comprehensive investment approach.

It is, therefore, recommended that the proposed continuation of fabric improvement across the Phase 2 estate throughout 2016 and 2017 is undertaken.

District heating renewal

The RdSAP modelling predicts that upon completion of all fabric improvements, the installation of new boilers in place of the existing units will achieve an overall energy reduction of 25% and decrease CO_2 emissions by upto 29%.

It is estimated that the inclusion of a CHP unit to provide the base thermal load will increase gas consumption but with the generation of onsite electricity, that CO2 emissions would fall by upto 57%.

Estimating the energy and carbon benefits of operating a low temperature primary network with micro booster sub stations is beyond the capability of RdSAP. Therefore, it is proposed that this strategy is reviewed as part of the Economic Appraisal to evaluate whether it represents a significant life cycle cost benefit. If so, then a more detailed technical review will be undertaken.

Renewable energy

The technical appraisal concludes that photovoltaic (PV) arrays should be assessed as part of the Economic Appraisal. The Phase buildings have large areas of roof that in principle should allow an PV installation of optimium orientation and tilt, and thus electrical output. Structural, suitable roof space available and access issues also need to be considered.

9.5 Recommended renewal strategy

It is recommended that the existing district heating network is replaced, both the mains network across the site and pipework within the blocks and dwellings. The presence of the main network piping within the dwellings themselves is causing overheating and is exacerbated due to lack of or faulty controls. The surface temperature of the existing pipework and radiators, and only partial encasing (see Photo A. Section 5.0) is considered a hazard to the occupants, especially small children.

The existing boilers should be replaced, although a phased approach will likely be necessary given that the existing the majority of the estate will be permanently occupied throughout the entire works period of district heating renewal.

Rather than installing individual hot water or space heating generation within the dwellings, the heat source will remain in the centralised energy centre but Heat Interface Units should be fitted in the apartments to provide greater control of the supply of hot water and space heating to each dwelling.

In the summary, the technical appraisal proposes the following:

- Complete replacement of all pipework, including the district mains network and distribution network through each block and each dwelling,
- Replacement of centralised boilers
- New radiators to be installed in each property
- Heat Interface Units (HIUs) installed in each dwelling

The following will also be included within the Economic Appraisal to assess whether their integration within the system renewal would be beneficial in terms of life cycle costs. If so, a more detailed technical review will be conducted into each:

- Low operating temperatures with advanced demand management
- Photovoltaic (PV) arrays to provide electricity for the district heating network mechanical systems

Table 2: Estimated fuel consumption and regulated CO_2 emissions

Parameters	Units	Possible strategies				
		1	2	3	4	5
		Existing	New boilers	Improved fabric	Fabric + new boilers	Fabric + CHP
RdSAP Age Band		F (1976 - 1982)		Fabric improvement works being undertaken 2015 - 2017		
U values						
Window	W/m^2K	4.8 (single glazing)	4.8 (single glazing)	**2.0 (double glazing)**	**2.0 (double glazing)**	**2.0 (double glazing)**
Wall	W/m^2K	0.45	0.45	0.45	0.45	0.45
Roof	W/m^2K	0.68	0.68	**0.26**	**0.26**	**0.26**
Ventilation	type	Natural	Natural	Natural	Natural	Natural
Air tightness	$m^3/hr/m^2$	15	15	15	15	15
Extract fans	number	2	2	2	2	2
Centralised boiler efficiency		75%	**89%**	75%	**89%**	89%
CHP		No	No	No	No	**Yes**
Estimated Energy Consumption						
Space heating	kWh / m^2	97.2	81.9	70.9	68.9	77.0
Hot Water	kWh / m^2	43.6	36.7	43.6	36.7	50.0
TOTAL	kWh / m^2	140.7	118.6	114.4	105.7	127.0
% reduction		-	16%	19%	25%	10%
CO2 emissions - (Dwelling Emissions Rate – DER)	$kgCO^2 / m^2$	33.2	28.5	27.5	23.6	14.4
% reduction		-	14%	17%	29%	57%

Note – for each strategy, the changes from the Existing strategy (No.1) are indicated in red text.

10.0 ECONOMIC OPTIONS APPRAISAL

Following a LB Camden review of the technical appraisal, fiscal estimations will be calculated for each of the recommended technical options. As mentioned in Section 7.0, historic metering records for individual dwellings or blocks are not available. Therefore, the RdSAP predicted energy demands will be utilitised in conjunction existing and project fuel purchasing costs which have been provided by LB Camden. Preliminary estimations for capital and operational costs are summarised below.

10.1 Capital Costs

The following capital costs are based upon 479 dwellings.

Boiler House		
Boiler Plant		£250,000.00
CHP Unit		£250,000.00
Pumps		£50,000.00
Pipework		£150,000.00
Controls		£200,000.00
Electrical woirks associated		£100,000.00
Commissioning		£27,000.00
stage total		**£1,027,000.00**
Distribution Network		
Pipework		£500,000.00
Pumps		£50,000.00
Civils		£250,000.00
Commissioning		£24,000.00
stage total		**£824,000.00**
Apartment Works		
Heat Interface unit	2500.00	£1,197,500.00
Radiator installation	1500.00	£718,500.00
Pipework	2000.00	£958,000.00
Controls	1000.00	£479,000.00
Electrical works associated	1000.00	£479,000.00
Domestic Hot Water	1500.00	£718,500.00
Commissioning	285.00	£136,515.00
stage total	**9785.00**	**£4,687,015.00**
Total Budget Cost		**£6,538,015.00**
Assumptions:		
1. All Fee are exclusive of VAT		
2. Exclude preliminairies		
3. Excludes major buildersworks/decoration in apartments		
4. Excludes Design fees		
5. Excludes inflation		
6. Assumes MCW can be reused		

10.2 Operational Costs

The following operating costs were based on research undertaken between November 2013 and March 2014, a recent survey of existing district heating schemes collected price information on 51 schemes; representing around 36,000 unmetered households and around 51,000 metered households. The networks were operated by 22 different heat suppliers and varied in age. Schemes were spread across the UK but with the majority (33) located in London. Around two thirds of the properties we collected price data from were social or affordable housing.

Typical comparisons of space heating and domestic hot water costs, including maintenance, life cycle and energy costs are as follows:

- District Heating: 5.51-14.94 p/kWh
- Gas Heating: 9.55-11.60 p/kWh
- Electric Heating: 21.91-22.99 p/kWh

Based on a middle of the road cost for providing heating and domestic hot water of 10.225p/kWh (this includes fuel cost, maintenance cost, lifecycle cost) the following annual running costs should be allowed for each type of apartment/flat:

Studio flat	1 Bedroom flat	2 Bedroom flat	3 Bedroom flat
£467 per annum	£625 per annum	£805 per annum	£1,079 per annum

The above is based on information from the Which? Report Turning up the heat: Getting a fair deal for District Heating users dated March 2015 and DECC report dated 2015 - Assessment of the Costs, Performance, and Characteristics of UK Heat Networks.

10.3 The Heat Trust

The newly established Heat Trust is developing a Heat Cost Comparator to compare district heating costs with comparable costs for gas central heating for the UK.

The Heat Trust is a voluntary consumer protection scheme launched in November 2015 that attempts to represent the interests of end users (both domestic and non-domestic) given that there is no independent industry regulator that exists for district heating, unlike the case for electricity and gas suppliers which are regulated by the government body OFGEM.

The Heat Trust's cost comparator is still under development at the time of writing. However, once launched this tool will allow users to compare their heating charge (from the district heating network to which their property is connected) with estimated costs for a gas central heating alternative. Whereas district heating bills include all the costs of the system, gas bills only cover the fuel costs but other aspects such as boiler maintenance and replacement are not included.

The Comparator will provide an estimated comparison of the cost of:

a) Individual system - heating your home from an individual gas boiler (incl. all additional costs), or,
b) district heating – current cost as charged by the district heating supplier

10.4 Building fabric improvements

The London Borough of Camden is undertaking fabric improvements across the Phase 2 bulidings as part of two projects. The first project is currently in progress and the contract sum is £9.5m. The works comprise the installation of double glazed windows, new roofs, external repairs and decoration.

The second project for the reminder of Phase 2 estate is due to take place during the course of 2016 - 17 at a cost of £2m.

The site plan in Appendix P provides the latest summary of these works, with Project 1 shown in blue, green and red, and Project 2 in yellow.

The above information was provided in March 2016 by Colin Kenny (Contract Manager – LB Camden).

10.5 Grants and additional funding

As part of the Economic Appraisal, various funding mechanisms will be reviewed in order to supplement the LB Camden revenue generated from sale of private apartments in Maiden Lane Phase 1.

The evaluation will included the following funding regimes:

- Feed-in Tariffs (for electricity generation using renewable energy)
- CfDs (Contracts for difference)
- RHI (Renewable Heat Incentive)
- CCLs (Climate Change Levy exemptions) and LECS (renewable levy exemption certificates)
- CRC Energy Efficiency Scheme
- JESSICA ((Joint European Support for Sustainable Investment in City Areas)
- AWS National Grid Affordable Warmth Solutions
- UK Government policy such as the £300m investment in heat networks in Autumn 2015

10.6 Options Cost Appraisal

Following the feedback at the Residents Engagement meeting and subsequent consultation period (as detailed in Section 6.0), an Options Cost Appraisal has been undertaken. A summary of costs over a 30 year period for each of the options was assessed.

A meeting was held with London Borough of Camden to discuss the options and it was agreed that the following options were preferred:

- Option 3 (a “like for like” replacement of the existing system)
- Option 5 (as per Option 3 with the addition of ground source heat pump system)

At the request of LB Camden, two additional options (Options 3a and 5a) have been created which include for the following “Add Ons”:

- Pressure valves on the incoming cold water supply to each dwelling
- Replacement of cold water supply across Phase 2, which would also connect into the proposed HIUs in each dwelling
- Phase 1 to Phase 2 connection to provide an element of redundancy within each system. It was agreed, however, that this connection would not be able to provide 100% backup to each phase.

At the time of writing, LB Camden are in discussions with Thames Water to establish the pressure supplied to Phase 2 from the local Thames Water network.

Furthermore, a review of CO_2 emissions associated with Options 3 and 5 has been completed, taking into account that the UK government's intention is to decarbonise the national electricity grid over the coming decades. It is estimated that Option 5 which utilises a ground source heat pump system, will achieve a CO_2 saving of up to 43% compared with Option 3 (Gas boiler only system) during the 30 year period 2017 – 2037.

For further details of the Cost Appraisal, please refer to Appendix N.

Summary

Option:	Description	Total NPV	Installation cost	Maintenance cost	Plant replacement cost	Fuel cost[1]	Energy management change
Option 1	Retain existing system	£19,223,070	Included in the capital costs	£4,353,991	£8,753,245	£6,666,034	-£550,200
Option 2	Pipework and HIU	£25,122,663	Included in the capital costs	£3,646,744	£16,350,766	£5,666,129	-£540,976
Option 3	Boilers, pipework, HIU	£24,452,630	Included in the capital costs	£3,315,222	£16,313,735	£5,332,828	-£509,154
Option 4	CHP, Boilers, pipework, HIU	£25,483,601	Included in the capital costs	£3,867,758	£16,976,859	£5,128,643	-£489,659
Option 5	GSHP, Boilers, pipework and HIU	£25,426,756	Included in the capital costs	£3,536,236	£18,298,483	£3,971,502	-£379,465
Option 6	PV, Boilers, pipework and HIU	£24,492,347	Included in the capital costs	£3,315,222	£16,396,013	£5,285,718	-£504,606
Including Add-ons							
Option 3a	Boilers, pipework, HIU including Add ons	£25,208,312	Included in the capital costs	£3,315,222	£17,069,416	£5,332,828	-£509,154
Option 5a	GSHP, Boilers, pipework, HIU including Add ons	£26,182,437	Included in the capital costs	£3,536,236	£19,054,164	£3,971,502	-£379,465

Add-ons
Pressure valves on incoming water
Replacement Mains cold water supply
Additional pipework and valves for link between Phase 2 and Phase 1

Exclusions:
VAT
Major building works
Entire redecoraton of dwellings
Replacement of mains cold water system and supply throughout

Notes:
[1] Please note Option 5 and 6 benefit from government subsidies in the form of Renewable Heat Incentive (Option 5) and Feed In tariffs (Option 6).

11.0 RISK ASSESSMENT

Once LB Camden have approved the Technical Options Appraisal, a risk assessment will be undertaken for recommended strategies in parallel with the Economic Appraisal.

Risks at design and construction, operational and consumer levels will be considered.

Typical risks for occupants can include the following:

- Receive reports of key information annually, including price data and efficiency of the network
- Clear, single line of complaints
- Tenants and buyers should receive clear and accurate information – including on price and it should be
- very straightforward for consumers to understand what is included in their heat price.
- Consumers' heat costs should be listed as distinct costs from any management fees or other utility service costs, such as water or electricity.
- For metered schemes such as Maiden Lane Phase 2, all fixed and variable charges should be clearly separated out in bills. The UK Government's Heat Network (Metering and Billing) Regulations 2014 should be consulted to address some of these issues by improving transparency in bills.
- All bills should be standardised to make it simpler for suppliers to comply and easier for consumers to understand.

12.0 NEXT STEPS

The LB Camden is to review the Technical Appraisal undertaken and provide feedback. Upon their consent, McBains Cooper will proceed with the Economic Appraisal as per the Recommended renewal strategies summarised in Section 9.5.

In addition to this, the following items need to clarified in the next revision of this study:

- **Planning** - whether planning consent is required
- **Tender** - Outline Tendering process for the works
- **Surveys** - Ground conditions / structural surveys to check that robustness of existing district heating trenches and risers
- **Post completion** - Outline of Post completion Drop-in sessions for residents to raise queries regarding the operation of the system, and in particular the in-dwelling equipment
- **Metering straetgy**- Review of heat monitoring and metering solutions
- **Landscaping works** – the scope and programme timing for these landscape works are to be confirmed by LB Camden to assess the opportunity to undertake district heating related ground works at the same time.
- **Temporary heat metering** - energy modelling and benchmarks are reviewed in section 8.2. In order to test the accuracy of these, a period of individual dwellings should be considered.
- **Actual billing information** – this has been requested from LB Camden in order to confirm the current fuel and projected fuel costs. At the time of writing, these costs are yet to be received and shall be included in a further revision of the report.
- **Pipework routes** - opportunities for further reducing pipework routes should be investigated, although this would likely require Block by Block sub stations.
- **Advanced demand management** - It is recommended that the findings from the evaluation of 5th generation COHEAT district heating scheme (due spring 2016) are reviewed to assess whether certain features can be incorporated into the Maiden Lane Phase 2 design.

13.0 INDICATIVE PROJECT PROGRAMME

An indicative, high level project programme is included in Appendix Q to provide a basis of discussion at this stage. Upon completion of the Economic and Risk Appraisal, this project programme will be refined. As requested, the programme has been produced in MS Projects software and is available upon request.

14.0 PHOTOGRAPHS

A. District heating junction box at dwelling (No. 6 Allensbury)

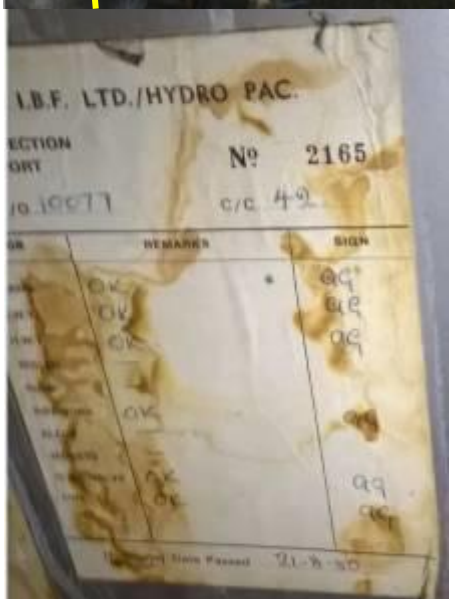
Connection to DH network. (External, above ground, not insulated)

B. Light refurbishment works undertaken in November 2015 (No. 6 Allensbury)

Wall panel radiators have been installed although residents have expressed their preference for trench radiators for future works when the district heating is updated

C. Existing in-dwelling heating equipment - November 2015 (No. 6 Allensbury)

D. Network passing through basement storage areas



E. Hot water storage vessel (232 Maiden Lane) dated 21st August 1980 .

APPENDIX A

INFORMATION REQUESTED AND RECEIVED

No	Information type	Information status	Comments
1	• Existing stock condition survey data	1. Boiler house plant (Excel of each item of plant) 2. Asbestos survey – Boiler rooms (2013) 3. Asbestos Refurbishment/Demolition (Feb 2015)	**Tim Pegg (McBains) updated 2012 survey on 09/11/2015**
2	• Record drawings – I've requested these via Joh Stow's team but you already have some extensive layout drawings that were done as part of the regen works there.	**Record Drawings from John Stow and Bryon Freer (LB Camden)**	**Preliminary review undertaken. Most representative drawings to be included as Appendices**
3	• Existing maintenance regimes – requested and will send once received	**Received from (LB Camden)**	Julian Campbell (Keepmoat – Mechanical Services Contracts Manager) confirmed 06.11.15 that "...Camden have all the information regarding the CP17's etc.."
4	• Breakdown and callout data over a 5 year period – as above	1. Heating repair history (Excel file)	
5	• Details of internal or external works and regeneration programmes (Phase 1) associated with the estate – all under Pellings management	1. New roofs using a bauder system (improved insulation) 2. New double glazed windows (replacing single glazed) 3. External/communal decoration 4. Concrete/Brick repairs 1. In the main we are replacing roofs using a Bauder System which include mono pitch glazing (Northern Lights with double glazed units. There however are a number of overlays using liquid applied systems, again Bauder systems. 2. Window/Screens/Doors to be replaced with engineers timber double glazed units 3. Redecorate all previously painted surfaces both externally (Dulux weathershield) and internally (Dulux again plus Class 'O' where required) 4. Concrete and render repairs carried out using a sika / ronocrete repair system or similar (hammer tests yet to carried out)	Lee Glickman (Pellings) provided information Nov 2015
		Details specifications of dwellings' refurbishment works – 19 blocks (2015) – 12 blocks (2016)	Ed Bowditch confirms 2015 and 2016 split of work
		1. Map showing phasing of properties' refurbishment works provided 2. Map showing tenures of Phase 2 provided	1. Lee Glickman – Pellings 2. Michael Layhe – LB Camden
6	• Age of the existing heating system	Site visit undertaken 09.11.2015	Tim Pegg (McBains) confirms boilers + pressurisation vessels are 15 years old (Sept 2000)
7	• Estimated system efficiency based on gas input, boiler efficiency and heat output –	LB Camden have provided metering records but only 1 no. meter in the centralised boiler room is installed i.e. no meters on 'per block' or 'per dwelling basis'	Michael Layhe – LB Camden estimates efficency <60%
8	· Asbestos register	Asbestos records can be requested later if required. Asbestos surveys should suffice for the time being. (Tim Pegg – McBains)	– all asbestos records are now kept on an internal portal so this isn't easy to simply supply for the entire estate but I've included the survey reports for the boiler house on file (Michael Layhe – Nov 2015)

APPENDIX B
PLANT ROOM INVENTORY

Survey Form – Boiler House Survey

Engineers Name: RPC

Survey Date: 27/01/2012

Time: Arrive 13:20 Depart 13;45

Ref no: DHGHY 8341

Total £100,000

Site Address: Maiden Lane Estate

	Age (years)	Condition (R/P/S/G)	Quantity	Output (kW)	Capacity (ltr)	Manufacturer	Type	Flue (Material)	Flue Fan (Y/N)	Remaining Life (years)	Cost (replace £)
Boiler 1	10	G	4	875		Hoval	SR plus 600			15	£40,000
Boiler 2											
Boiler 3											
Boiler 4											
Burner 1	10	S	4			Nu-way	NGN 55 T35 340			15	inc
Burner 2											
Burner 3											
Burner 4											
Flue 1	10	G	4			unknown	conventional	S	N	15	£10,000
Flue 2											
Flue 3											
Flue 4											
Pressurisation Unit 1	10	G	1		2000	Hoval	pressval			15	£5,000
Presurisation unit 2	10	G	1		1526	Hoval	pressval			15	£3,000
Heating Pump 1	15	P	1			Grundfos	CL 125/228			5	£3,000
Heating Pump 2	20	P	1			Grundfos	CL 125/228			1	£3,000
Heating Pump 3	15	P	2			unknown	unknown			5	£3,000
CW Booster Pump											
Calorifier 1											
Calorifier 2											
Water Softener	5	P	1			ENWA	Enwamatic 1665			5	£5,000
Plate Heat Exchanger	10	S	2	unknown	unknown	unknown	unknown			15	£8,000
Controls	10	S	1			unknown	Trend NDP			15	£20,000
Controls											

Notes: **HAZARD water over the floor**

Key	
R/P/S/G	Replace/Poor/Satisfactory/Good
S/C	Steel/Cement

Survey Form - Boiler House Survey

Engineers Name: TP

Survey Date: 09/11/2015 Time: Arrive 09:30 Depart 11:00

Site Address: Maiden Lane Estate

	Age (years)	Condition (R/P/S/G)	Quantity	Output (kW)	Capacity (ltr)	Manufacturer	Type	Flue (Material)	Flue Fan (Y/N)	Remaining Life (years)	Cost (replace £)
Boiler 1	15	G	4	875		Hoval	SR plus 800 Heatpack			10	£40,000
Boiler 2											
Boiler 3											
Boiler 4											
Burner 1	15	S	4			Nu-way	NGN 55 T3S 340			10	inc
Burner 2											
Burner 3											
Burner 4											
Flue 1	10	G	4			unknown	conventional	S	N	15	£10,000
Flue 2											
Flue 3											
Flue 4											
Pressurisation Unit 1	15	G	1		2000	Hoval	pressval			10	£5,000
Presurisation unit 2	10	G	1		1526	Hoval	pressval			15	£3,000
Vessel 1	unknown					Hoval	unknown			unknown	
Vessel 2	unknown					Hoval	unknown			unknown	
Vessel 3	unknown					Hoval	unknown			unknown	
Heating Pump 1	unknown	P	1			Vogel Pumpen	unknown			unknown	£3,000
Heating Pump 2	unknown	P	1			Vogel Pumpen	unknown			unknown	£3,000
Heating Pump 3	unknown	P	2			Vogel Pumpen	unknown			unknown	£3,000
CW Booster Pump											
Calorifier 1											
Calorifier 2											
Water ~~Softener~~ Dosing	5	P	1			ENWA	Enwamatic 1665			5	£5,000
Plate Heat Exchanger	10	S	2	unknown	unknown	unknown	unknown			15	£8,000
Controls	10	S	1			unknown	Trend NDP			15	£20,000
Controls											

Notes: **HAZARD water over the floor**

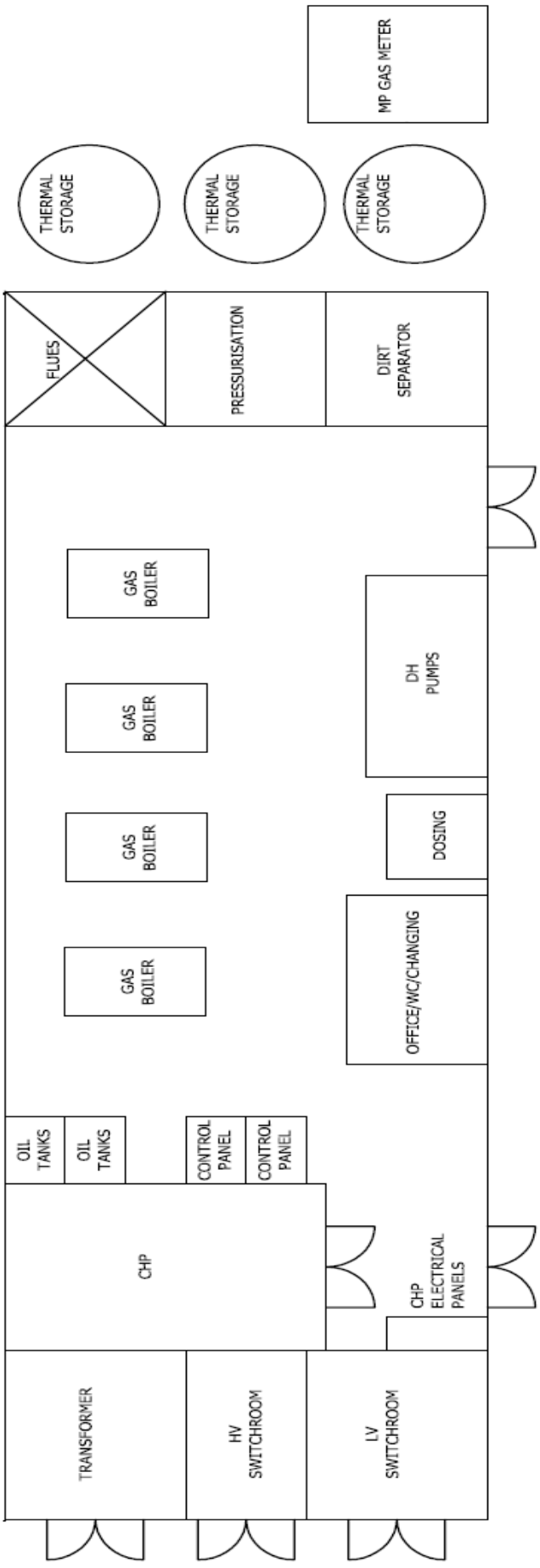
Key	
R/P/S/G	Replace/Poor/Satisfactory/Good
S/C	Steel/Cement

Difference from previous survey

Same as previous survey

APPENDIX C

INDICATIVE FUTURE PLANT ROOM LAYOUT



The inclusion of CHP would require further plant room space, notably for thermal storage and electrical equipment.

APPENDIX D

DISTRICT HEATING PIPEWORK ROUTE

(INCLUDES ARCHIVED RECORD DRAWINGS)

BLOCKS A-C

RECORD DWG

BLOCK A.

BLOCK B

BLOCK C.

FULL SACK STORE

BLOCK D.

BLOCK G.

BLOCK G

BLOCK C.

BLOCK T.

BLOCK U&V

ANCHOR BLOCK

DEMOLISHED

Phase 1

Phase 1

RECORD DRG.

HEATING VENTILATION AIR CONDITIONING

FARNBOROUGH LONDON BRISTOL BIRMINGHAM MANCHESTER GLASGOW

SULZER

TITLE

LAYOUT OF EXTERNAL MAINS
COLD WATER & HEATING

CLIENT

LONDON BOROUGH OF CAMDEN
MAIDEN LANE

SCALE	DATE	REG. No.
1:100	JAN 82	
DRAWN E ROFFEY	DRAWING No 7183/RD/13	

BLOCK A

BLOCKS D - H
K - P

RECORD DWG

BLOCK. G

Block D

BLOCK. E.

BLOCK. H.

BLOCK. K.

BLOCK. L.

BLOCK. N.

BLOCK. P.

BLOCK. T.

Phase 1

RECORD DRG.

HEATING VENTILATION AIR CONDITIONING

FARNBOROUGH · LONDON · BRISTOL · BIRMINGHAM · MANCHESTER · GLASGOW

SULZER

TITLE: LAYOUT OF EXTERNAL MAINS COLD WATER & HEATING

CLIENT: LONDON BOROUGH OF CAMDEN MAIDEN LANE

SCALE: 1:100 | DATE: JAN 82 | REG. No.

DRAWN: E ROFFEY | DRAWING No: 7183/RD/14

Block H

Block P

Blocks F J M Q R S

RECORD DWG

Block 20

BLOCK F

BLOCK J

BLOCK M

BLOCK Q

BLOCK R/S

SACK STORE

FOR CONTINUATION SEE DRG Nº 7193-P0-

HEATING VENTILATION AIR CONDITIONING

FARNBOROUGH · LONDON · BRISTOL · BIRMINGHAM · MANCHESTER · GLASGOW

SULZER

TITLE
LAYOUT OF EXTERNAL MAINS
COLD WATER & HEATING

CLIENT
LONDON BOROUGH OF CAMDEN
MAIDEN LANE

SCALE	DATE	REG. No.
1:100	JAN 82	
DRAWN E ROFFEY	DRAWING No 7193/RD/15	

Blocks 1-21
RECORD DWG

---Route unclear

East Car Park

East Refuse Room

Block F

COMMUNITY HALL

FOR DETAIL OF SERVICES SEE DRG Nº 6981. RD. 37

FOR DETAIL OF SERVICES SEE DRG Nº 6981 RD 55

HEATING VENTILATION AIR CONDITIONING

BIRMINGHAM · BRISTOL · BRMINGHAM · MANCHESTER · GLASGOW · NEWCASTLE

SULZER

TITLE LAYOUT OF EXTERNAL MAINS BLOCKS 1-21

CLIENT LONDON BOROUGH OF CAMDEN MAIDEN LANE

SCALE 1:200 DATE NOVEMBER '79 CHECKED

DRAWN DB DRAWING No. 6981. RD. 2

RECORD DRG.

Blocks 1-10
TENDER DWG

N

BLOCK 3
BLOCK 2
BLOCK 1
BLOCK 6
BLOCK 5
BLOCK 4
BLOCK 10
BLOCK 9
BLOCK 8
BLOCK 7

P.O.S.

WEST LOW COURT ACCESS

WEST LOW COURT

WEST CAR PARK

WEST REFUSE ROOM

ST. PAULS CRESCENT ENTRY ROAD

underbuilding

Community Hall

Block 13

WATER MAINS

HOT WATER F&R.

SITE PLAN.

NOTES.

INDEX	REVISION

MAIDEN LANE
STAGE 1
LONDON BOROUGH
OF CAMDEN

A. [illegible] M.A. DIPL (LOND) R.I.B.A.
DIRECTOR OF ARCHITECTURE

STEENSON VARMING MULCAHY & PARTNERS
CONSULTING ENGINEERS

LAYOUT OF EXTERNAL MAINS (WES
BLOCKS 1-10 INCLUSIVE
(TESTING OF BOILING
INDICATOR.

6 JAN 1978

DATE OCT. '75 SCALE 1 : 200

DRAWING NUMBER
337. M3. 1.

Blocks 13-21

TENDER DWG ➡ N

SITE PLAN

NOTE
THIS DRAWING RELATES TO SERVICES INFORMATION ONLY FOR ARCHITECTURAL OR STRUCTURAL INFORMATION REFER TO APPROPRIATE DRAWINGS

NOTE
FOR PRECISE LOCATION OF SERVICE TERMINALS ie. HEAT EMITTERS, GRILLES, DIFFUSERS, TAPS, SANITARY FITTINGS, LIGHTING FITTINGS, SOCKET OUTLETS etc. SEE ARCHITECTS DETAIL DRAWINGS WHICH SHALL TAKE PRECEDENCE OVER ALL OTHER DRAWINGS.

NOTES.

FOR GENERAL NOTES REGARDING TRENCHES AND VENTILATORS FOR PIPEWORK, REFER TO SEE DRG. No. 337/M4.1

FOR DETAILS OF DRY RISER INLET BOX SEE DRG. No. 337/M4.10

ST. PAUL'S ENTRY ROAD

COMMUNITY HALL

BLOCK 13 · BLOCK 12 · BLOCK 11

EAST LOW COURT ACCESS

BLOCK 16 · BLOCK 15 · BLOCK 14

EAST LOW COURT

BLOCK 21 · BLOCK 20 · BLOCK 19 · BLOCK 18 · BLOCK 17

CAR PARK ENTRY RAMP

BASEMENT EAST CAR PARK CAR PARK

EAST REFUSE ROOM

EAST ENTRY ROAD

DH pipework in Refuse Room

Tender drawing

Dwgs sent to Gas Bd with S.V.M. letter dated 11th Oct 77.

TENDER DRAWING

MAIDEN LANE
STAGE 1
LONDON BOROUGH OF CAMDEN

A. NEBY R.S.A. DIP.T (LOND) R.I.B.A.
DIRECTOR OF ARCHITECTURE

STEDMAN THOMAS MORGAN & PARTNERS
CONSULTING ENGINEERS

LAYOUT OF EXTERNAL MAINS (EAST)
BLOCKS 11-21 INCLUSIVE

DATE OCT '75 · SCALE 1:200

DRAWING NUMBER 337. M3.2 · REVISION

SECTION A-A
Scale 1:20

SECTION B-B
Scale 1:20

SERVICES IN TRENCH DETAIL AT ENTRY TO BUILDING.

GRILLE SCHEDULE						
REF Nº	Nº OFF	TYPE	SIZE	LITRES/SEC	NOTES	FINISH
A	6	SME	200 x 100	25	WITH DAMPER	SATALUX
B	2	SME	150 x 100	10	WITH DAMPER	SATALUX
C	2	SME	150 x 100	15	WITH DAMPER	SATALUX

SCHEDULE BASED ON WATERLOO EQUIPMENT

HEATING ELEMENT SCHEDULE												
REF Nº	Nº OFF	TYPE	SINGLE OR DOUBLE	DIMENSIONS L x H x d	OUTPUT	MODEL REF	PER SURFACE	VALVES TYPE N.R.V.	Nº OFF
1	1	FE	S	2.0	2200	-	-	-	-
2	2	RAD	D	1643.2 x 450	1938	-	44.93	-	-
3	2	FE	S	1.0	650	-	-	-	-
4	1	FE	S	2.7	1755	-	-	-	-
5	1	RAD.	S	1343 x 450	1600	-	36.75	-	-
6	2	FE	D	3.0	3900	-	-	-	-
7	1	FE	S	2.0	1300	-	-	-	-
8	3	FE	D	2.0	2600	-	-	-	-
9	5	FC	-	0.9 x 0.6 x 80	5260	2'08 DW. UNITS		150 x 100	01
10	1	RAD	S	898 x 450	1093	-	24.42	-	-

FE - FINNED ELEMENT CORNISH RUSH 35CM 650 WATTS/MT
FC - FAN CONVECTOR (WITHOUT CONTROLS) WITH SEPARATE THERMOSTAT
RAD - RADIATORS BASED ON CAMRON RAD DOUBLE PANEL WITH FINS
GRILLES BASED ON WATERLOO EQUIPMENT

SITE PLAN

NOTE
THIS DRAWING RELATES TO SERVICES INFORMATION ONLY FOR ARCHITECTURAL OR STRUCTURAL INFORMATION REFER TO APPROPRIATE DRAWINGS

NOTE
FOR PRECISE LOCATIONS OF SERVICE TERMINALS SUCH AS HEAT EMITTERS, GRILLES, DIFFUSERS, LAMPS, SANITARY FITTINGS, PLUMBING FITTINGS, SOCKET OUTLETS ETC. REFER TO ARCHITECTS DETAIL DRAWINGS WHERE SHALL TAKE PRECEDENCE OVER ALL OTHER DRAWINGS

NOTES:

INDEX	REVISION	DATE

MAIDEN LANE
STAGE 1
LONDON BOROUGH OF CAMDEN

A RIGBY RS MA, DP EP (LOND) RIBA
DIRECTOR OF ARCHITECTURE

ASCHERSON VERNHAM MAYCARY & PARTNERS
CONSULTING ENGINEERS

OVE ARUP & PARTNERS
STRUCTURAL ENGINEERS

HOWE & DUNSTONE
MARSH & SCEARS
QUANTITY SURVEYORS

COMMUNITY CENTRE

LAYOUT OF HEATING, GAS & WATER SERVICES

GROUND FLOOR

DATED NOVEMBER 1975 SCALE 1:50

DRAWING NUMBER 337.M3.50

REVISIONS

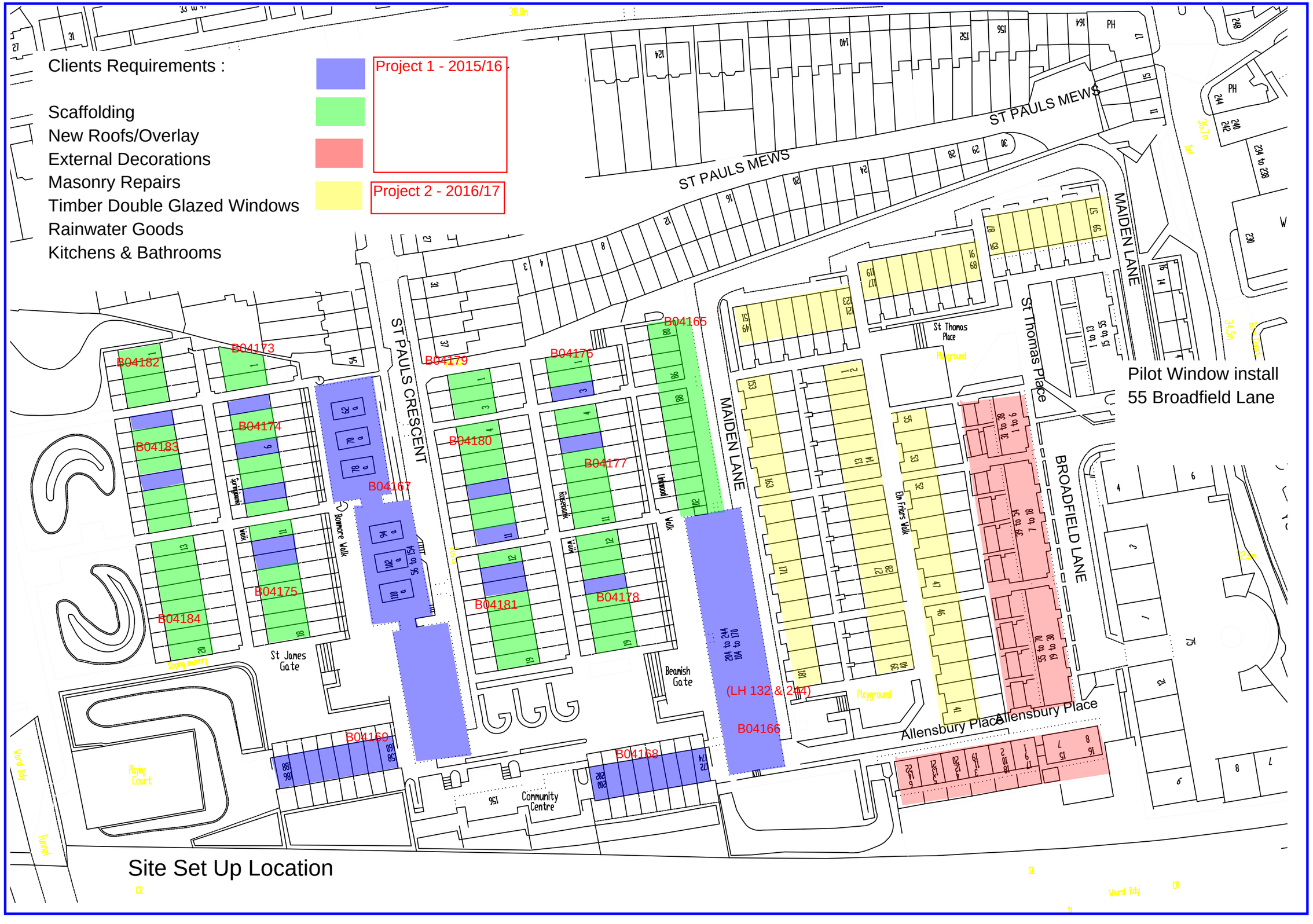
ARCHITECTS DRG Nº ICH 09

TENDER DRAWING

COMMUNITY CENTRE

APPENDIX E

MAPS – FABRIC REFURBISHMENT WORKS


Clients Requirements :
Scaffolding
New Roofs/Overlay
External Decorations
Masonry Repairs
Timber Double Glazed Windows
Rainwater Goods
Kitchens & Bathrooms
Project 1 - 2015/16
Project 2 - 2016/17
Pilot Window install
55 Broadfield Lane
Site Set Up Location
ST PAULS MEWS
ST PAULS CRESCENT
MAIDEN LANE
BROADFIELD LANE
St Thomas Place
Allensbury Place
St James Gate
Beamish Gate
Community Centre
Playing Court
Playground
Bowmore Walk
Elm Friars Walk
(LH 132 & 244)
B04165
B04173
B04182
B04179
B04176
B04174
B04183
B04180
B04177
B04167
B04175
B04184
B04181
B04178
B04169
B04168
B04166

APPENDIX F
ACCOMMODATION SCHEDULE

Block Ref.	Block Address	Bedsit	1B2P Flat	2B4P Flat	2B4P Maisonettes	3B6P Maisonettes	4B6P Maisonettes	4B7P Maisonettes	2B4P Houses	3B4P Houses	4B7P Houses
1	1-30 Allensbury Place		30								
2	1-18 Bowmore Walk									17	1
3	1-70 Broadfield Lane	60	10								
4	1-40 Elm Friars Walk		20		20						
5	41-55 Elm Friars Walk								15		
6	1-19 Linkwood Walk									19	
7											
8	57-151 Maiden Lane (Odds)		24		24						
9	153-181 Maiden Lane (Odds)								15		
10	2-16 Maiden Lane (Evens)	8									
11	80-170 & 204-234 Maiden Lane (Evens)	1	50			12					
12	172-202 & 236-242 Maiden Lane (Evens)		4		8			8			
13	1-19 Rosebank Walk									19	
14	1-20 Springbank Walk									20	
15	56-154 St Paul's Crescent (Evens)		50								
16	158-188 St Paul's Crescent (Evens)				8			8			
		69	188		60	12		16	30	75	1

APPENDIX G

DRAFT LB CAMDEN HEATING POLICY (JUNE 2015)

Heating Policy for Council-Owned Housing

Aims and Objectives

This policy applies to all 33,000 Council-owned homes and new-build Council homes, covering both tenanted and leasehold dwellings and individually and communally heated properties. The policy was first approved by the Council in January 2004 and will be reviewed annually.

The Council is committed to providing homes with affordable, controllable space and water heating systems that are easily and economically maintainable, that provide value for money and are aligned with the objectives of the Camden Plan 2012-2017, Green Action for Change 2011-2020 and the target to reduce Carbon emissions by 27% by 2017.

To achieve these aims, the Council will:

1. Consider as part of an options appraisal process:

    i) Measures to improve health and safety, air quality and continuity of service
    ii) Replacement of energy inefficient appliances with modern 'A-rated' boilers
    iii) Replacement of inefficient systems with individual or communal heating whichever provides best overall value for money and secures the required carbon emission reductions
    iv) Upgrade of partial and background communal heating to full communal heating
    v) Participation in communal heat networks where carbon reduction and value for money can be demonstrated.
    vi) The scope for building fabric improvements to reduce heat demand as part of a comprehensive investment approach
    vii) Residents' views, particularly where the options appraisal identifies more than one viable option

2. Seek resources to finance additional energy efficiency measures including in-dwelling heating controls, heat metering, renewable energy technology or combined heat and power.

3. Identify programmers and heating controls within dwellings that are easy to use, can be standardised across the borough and which are mains powered. Similarly heat meters installed in existing and new homes must be compatible with existing service provision and billing procedures.

4. Explore ways to divest the Council's transportation and management responsibilities for the bulk gas network. In addition the Council will continue to assess the cost-benefit of removing individual sites from the bulk gas network.

5. Heat meters will be fitted to communal heating systems in line with legislative requirements

6. Continue to monitor the difference in gas prices between the Council's commercial bulk purchasing contract and London domestic gas rates in the unlikely event that residents become disadvantaged through participation in the Heating Pool, and to take advice from energy specialists to determine our gas procurement strategy.

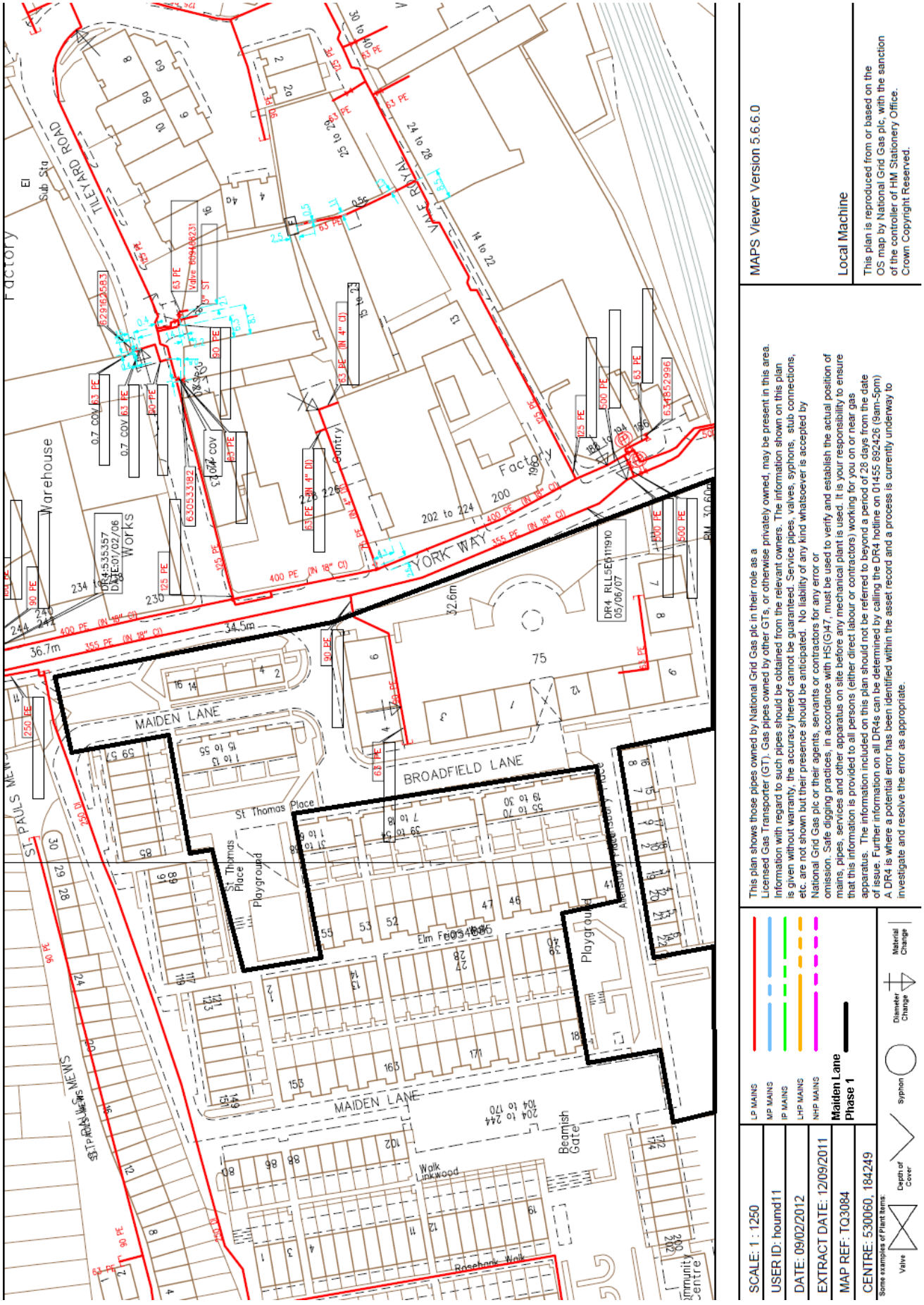
7. Allow residents to switch their cooking supply from bulk gas to electricity and have their heating charges adjusted accordingly. However residents will not be permitted to opt out of the bulk gas network for their heating as this would not provide a cost benefit to either the Council or the resident.

8. Residents in properties served by communal heating will not be permitted to install their own individual heating system. However, where blocks are being converted from communal heating to individual heating the scope for residents to install their own system will be explored by the Council and guidance provided to leaseholders on the requirements to be met and the process to be followed.

9. Ensure that all heating improvements comply with current regulations and in particular, Part L (Conservation of Fuel and Power), B, F and J of the Building Regulations.

10. When developing new homes install heating systems that balance Planning policy requirements with the criteria set out in the options appraisal document with regards cost in use, reducing the impact of system failure and carbon reduction targets.

APPENDIX H
GAS SUPPLY INFRASTRUCTURE

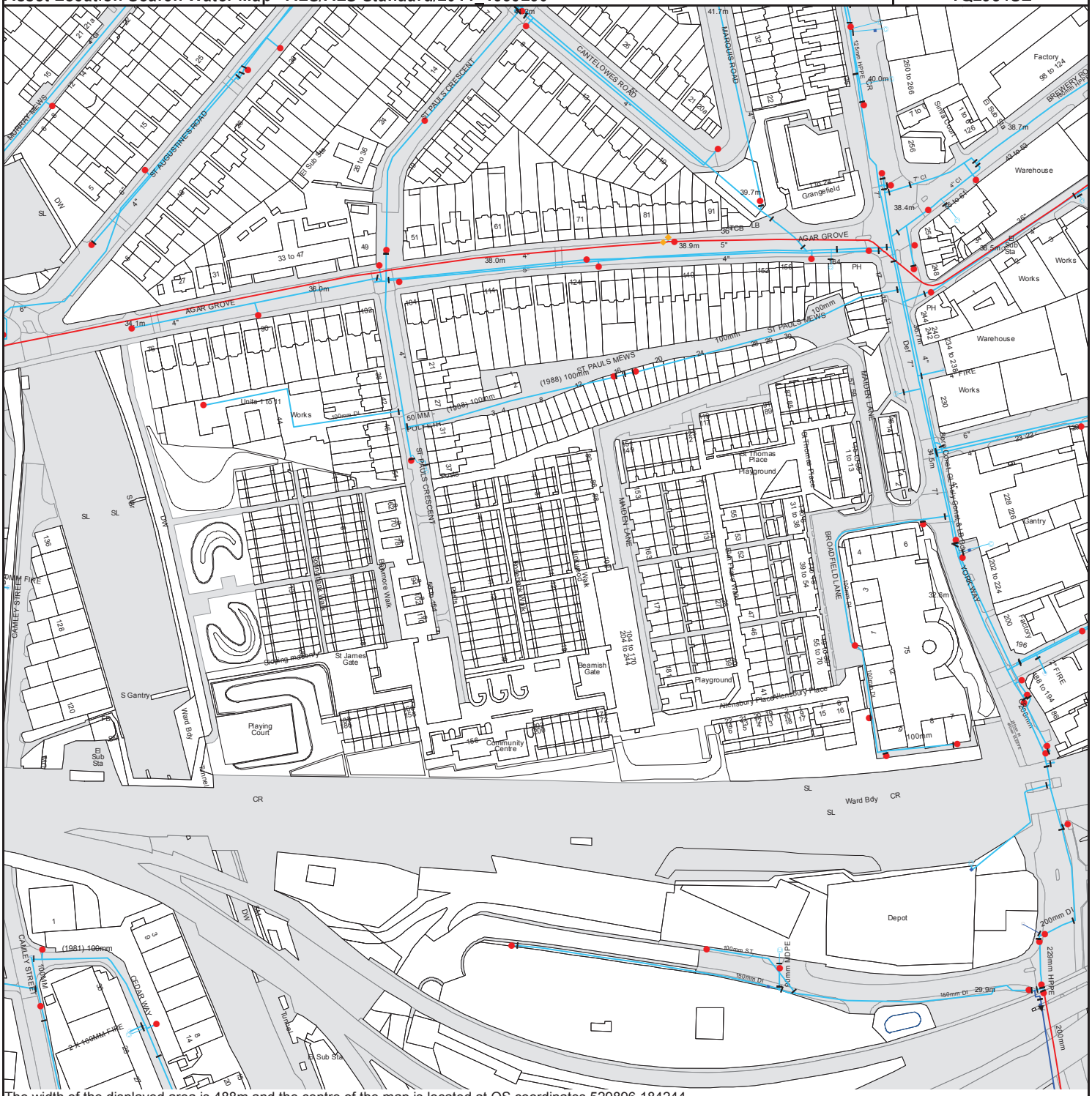

MAIDEN LANE
YORK WAY
BROADFIELD LANE
TELFORD ROAD
ST PAULS MEWS
St Thomas Place
St Thomas Playground
Playground
Beamish Gate
Rosebank Walk
Factory
Warehouse
Works
Country
MAPS Viewer Version 5.6.6.0
Local Machine
This plan is reproduced from or based on the OS map by National Grid Gas plc, with the sanction of the controller of HM Stationery Office. Crown Copyright Reserved.
This plan shows those pipes owned by National Grid Gas plc in their role as a Licensed Gas Transporter (GT). Gas pipes owned by other GTs, or otherwise privately owned, may be present in this area. Information with regard to such pipes should be obtained from the relevant owners. The information shown on this plan is given without warranty, the accuracy thereof cannot be guaranteed. Service pipes, valves, syphons, stub connections, etc. are not shown but their presence should be anticipated. No liability of any kind whatsoever is accepted by National Grid Gas plc or their agents, servants or contractors for any error or omission. Safe digging practices, in accordance with HS(G)47, must be used to verify and establish the actual position of mains, pipes, services and other apparatus on site before any mechanical plant is used. It is your responsibility to ensure that this information is provided to all persons (either direct labour or contractors) working for you on or near gas apparatus. The information included on this plan should not be referred to beyond a period of 28 days from the date of issue. Further information on all DR4s can be determined by calling the DR4 hotline on 01455 892426 (9am-5pm) A DR4 is where a potential error has been identified within the asset record and a process is currently underway to investigate and resolve the error as appropriate.
LP MAINS
MP MAINS
IP MAINS
LHP MAINS
NHP MAINS
Maiden Lane
Phase 1
SCALE: 1 : 1250
USER ID: houmd11
DATE: 09/02/2012
EXTRACT DATE: 12/09/2011
MAP REF: TQ3084
CENTRE: 530060, 184249
Some examples of Plant Items:
Valve
Depth of Cover
Syphon
Diameter Change
Material Change

APPENDIX I
WATER SUPPLY INFRASTRUCTURE

Asset Location Search Sewer Map - ALS/ALS Standard/2011_1935290	TQ2984SE

The width of the displayed area is 488m and the centre of the map is located at OS coordinates 529896,184244

Asset Location Search Water Map - ALS/ALS Standard/2011_1935290	TQ2984SE



The width of the displayed area is 488m and the centre of the map is located at OS coordinates 529896,184244

ALS Water Map Key

Water Pipes (Operated & Maintained by Thames Water)

4"

Distribution Main: The most common pipe shown on water maps. With few exceptions, domestic connections are only made to distribution mains.

16"

Trunk Main: A main carrying water from a source of supply to a treatment plant or reservoir, or from one treatment plant or reservoir to another. Also a main transferring water in bulk to smaller water mains used for supplying individual customers.

3" SUPPLY

Supply Main: A supply main indicates that the water main is used as a supply for a single property or group of properties.

3" FIRE

Fire Main: Where a pipe is used as a fire supply, the word FIRE will be displayed along the pipe.

3" METERED

Metered Pipe: A metered main indicates that the pipe in question supplies water for a single property or group of properties and that quantity of water passing through the pipe is metered even though there may be no meter symbol shown.

Transmission Tunnel: A very large diameter water pipe. Most tunnels are buried very deep underground. These pipes are not expected to affect the structural integrity of buildings shown on the map provided.

Proposed Main: A main that is still in the planning stages or in the process of being laid. More details of the proposed main and its reference number are generally included near the main.

PIPE DIAMETER	DEPTH BELOW GROUND
Up to 300mm (12")	900mm (3')
300mm - 600mm (12" - 24")	1100mm (3' 8")
600mm and bigger (24" plus)	1200mm (4')

Valves

- General Purpose Valve
- Air Valve
- Pressure Control Valve
- Customer Valve

Hydrants

- Single Hydrant

Meters

- Meter

End Items

Symbol indicating what happens at the end of a water main.

- Blank Flange
- Capped End
- Emptying Pit
- Undefined End
- Manifold
- Customer Supply
- Fire Supply

Operational Sites

- Booster Station
- Other
- Other (Proposed)
- Pumping Station
- Service Reservoir
- Shaft Inspection
- Treatment Works
- Unknown
- Water Tower

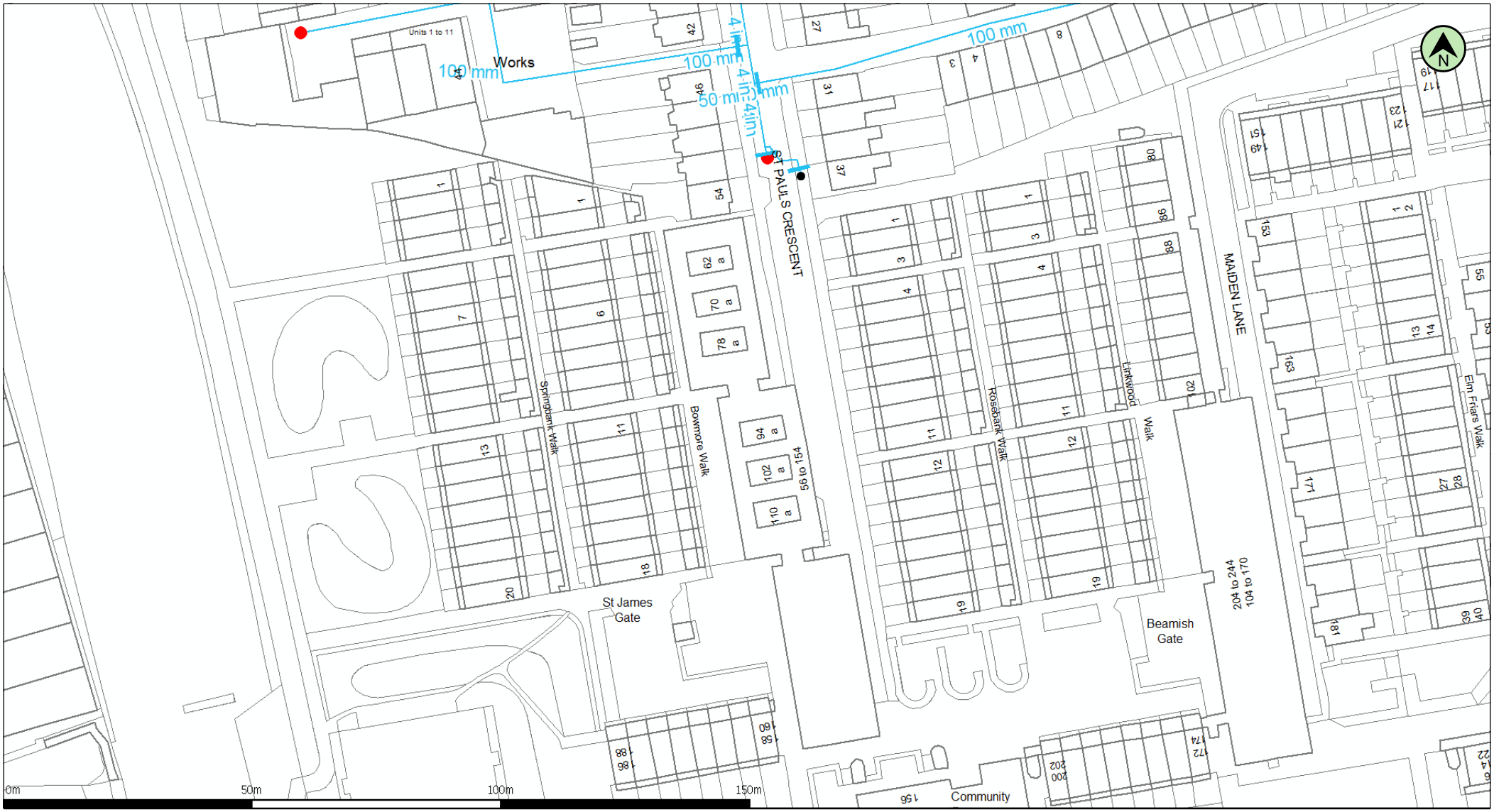
Other Symbols

- Data Logger

Other Water Pipes (Not Operated or Maintained by Thames Water)

Other Water Company Main: Occasionally other water company water pipes may overlap the border of our clean water coverage area. These mains are denoted in purple and in most cases have the owner of the pipe displayed along them.

Private Main: Indiates that the water main in question is not owned by Thames Water. These mains normally have text associated with them indicating the diameter and owner of the pipe.



Date: 16/10/15 | Scale: 1:1080 | Map Centre: 529832,184233 | Data updated: 30/09/15 | Clean Water Plan A4

Water Main	Meter
Private Water	Valve
Proposed Water	Hydrant
Abandoned Asset	End Item

david.cattell@camden.gov.uk

Maiden Lane

Thames Water

APPENDIX J

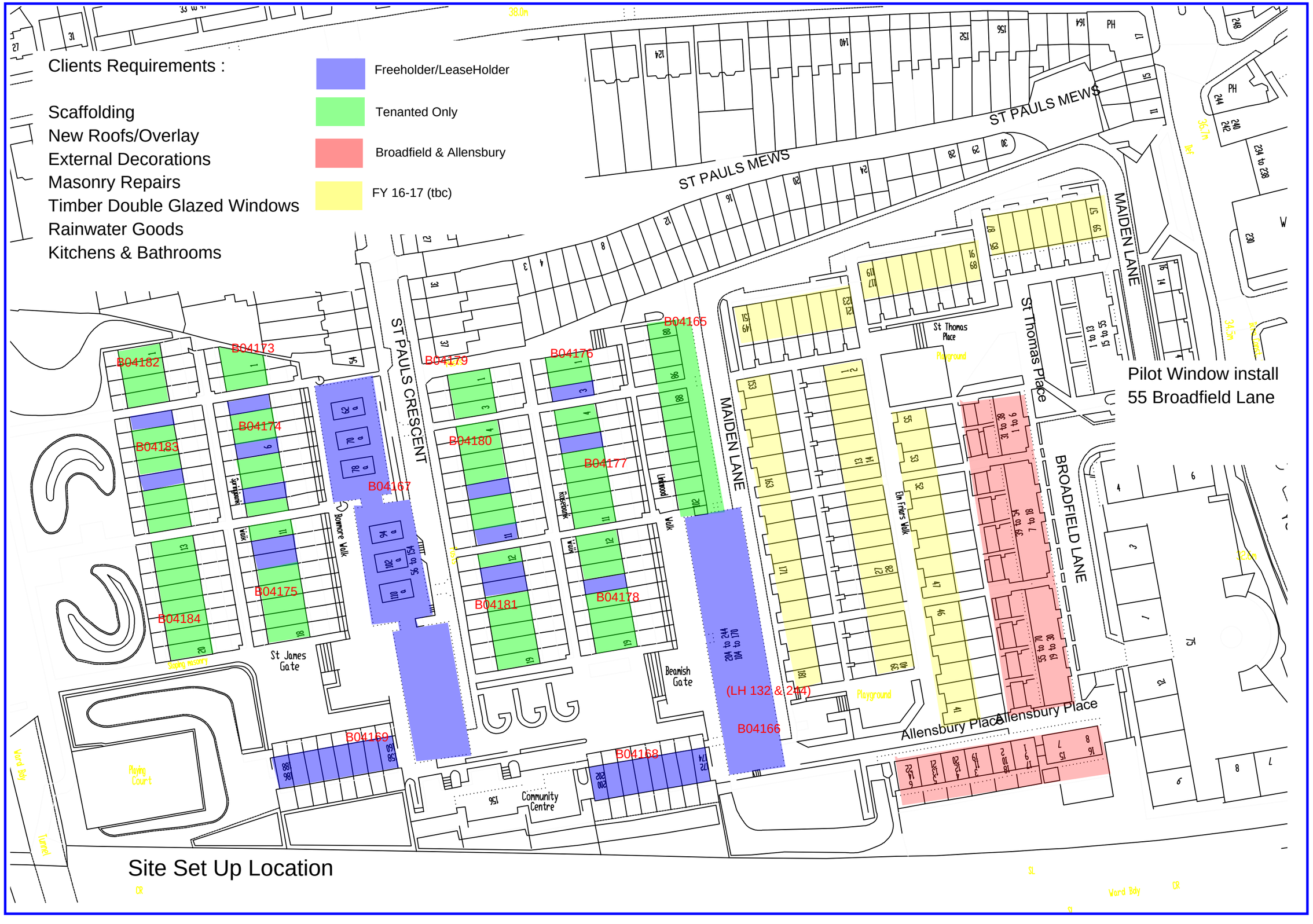
SITE PLAN


N
DRAFT
DRAFT
ST PAULS MEWS
AGAR GROVE
Warehouse
Works
Factory
Works
Phase 1 (new build, under construction)
Phase 2 (existing estate to be served by renewed district heating shcme

APPENDIX K

SITE PLAN – TENURE TYPES

Apollo, Maiden Lane Estate - FY 15-16

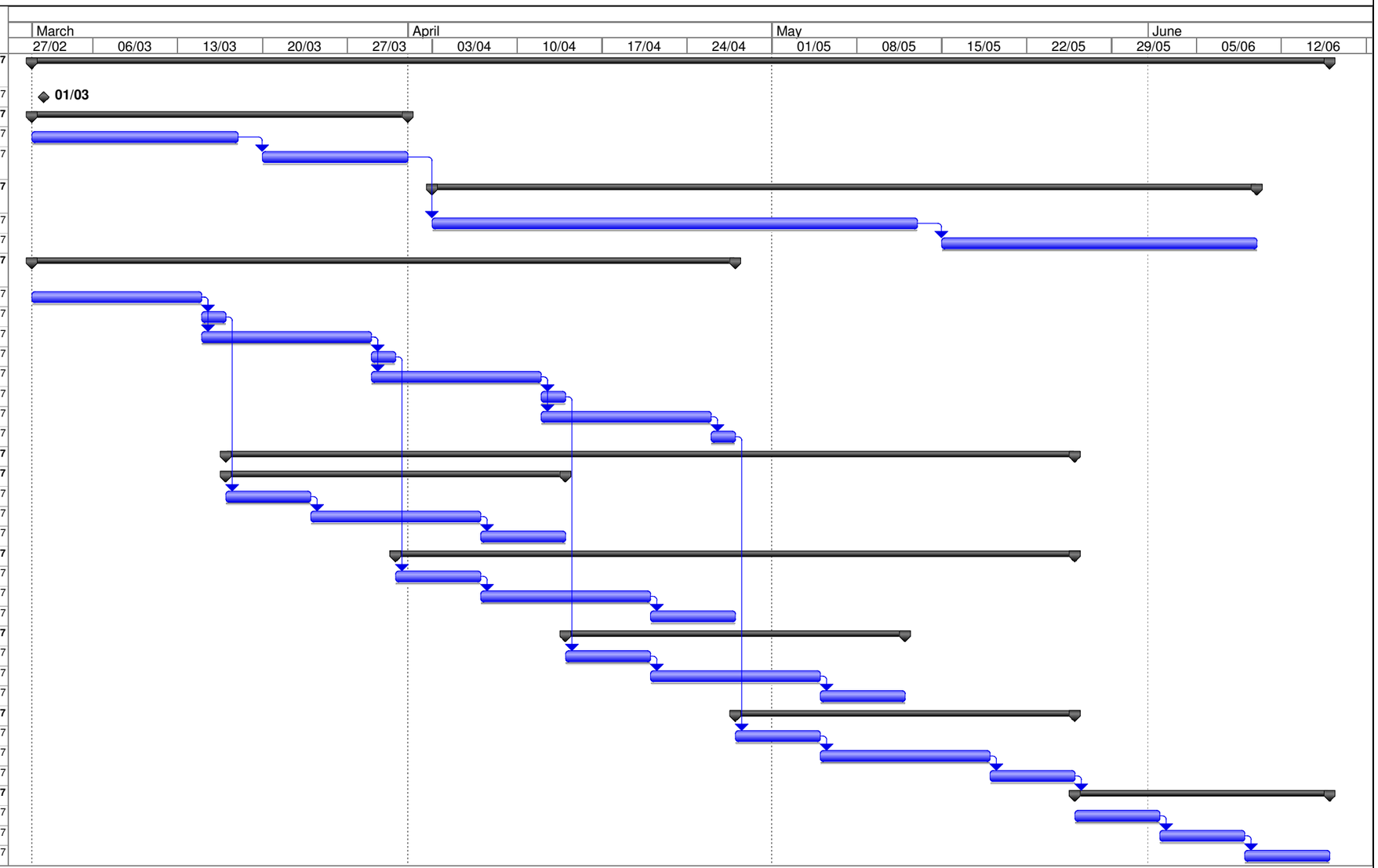


APPENDIX L
INDICATIVE PROJECT PROGRAMME

Maiden Lane Phase 2 - District Heating Scheme

McBains Cooper

ID	Task Name	Duration	Start	Finish
1	**Maiden Lane Phase 2 - District Heating Scheme**	**77 days?**	**Wed 01/03/17**	**Thu 15/06/17**
2	Start on Start	1 day?	Wed 01/03/17	Wed 01/03/17
3	**Energy Centre**	**23 days?**	**Wed 01/03/17**	**Fri 31/03/17**
4	Install CHP	13 days?	Wed 01/03/17	Fri 17/03/17
5	Replace Ancillary Plant as Required	10 days?	Mon 20/03/17	Fri 31/03/17
6	**District Main Pipe Work Replacement**	**50 days?**	**Mon 03/04/17**	**Fri 09/06/17**
7	Underground	30 days?	Mon 03/04/17	Fri 12/05/17
8	Basement	20 days?	Mon 15/05/17	Fri 09/06/17
9	**Block Network Distribution Replacement**	**42 days**	**Wed 01/03/17**	**Thu 27/04/17**
10	Block 1	10 days	Wed 01/03/17	Tue 14/03/17
11	Block 1 Meter Install	2 days	Wed 15/03/17	Thu 16/03/17
12	Block 2	10 days	Wed 15/03/17	Tue 28/03/17
13	Block 2 Meter Install	2 days	Wed 29/03/17	Thu 30/03/17
14	Block 3	10 days	Wed 29/03/17	Tue 11/04/17
15	Block 3 Meter Install	2 days	Wed 12/04/17	Thu 13/04/17
16	Block 4	10 days	Wed 12/04/17	Tue 25/04/17
17	Block 4 Meter Install	2 days	Wed 26/04/17	Thu 27/04/17
18	**Dwelling Installations**	**50 days**	**Fri 17/03/17**	**Thu 25/05/17**
19	**Block 1**	**20 days**	**Fri 17/03/17**	**Thu 13/04/17**
20	HIU Installation	5 days	Fri 17/03/17	Thu 23/03/17
21	Pipework Replacement	10 days	Fri 24/03/17	Thu 06/04/17
22	Radiator Replacement	5 days	Fri 07/04/17	Thu 13/04/17
23	**Block 2**	**40 days**	**Fri 31/03/17**	**Thu 25/05/17**
24	HIU Installation	5 days	Fri 31/03/17	Thu 06/04/17
25	Pipework Replacement	10 days	Fri 07/04/17	Thu 20/04/17
26	Radiator Replacement	5 days	Fri 21/04/17	Thu 27/04/17
27	**Block 3**	**20 days**	**Fri 14/04/17**	**Thu 11/05/17**
28	HIU Installation	5 days	Fri 14/04/17	Thu 20/04/17
29	Pipework Replacement	10 days	Fri 21/04/17	Thu 04/05/17
30	Radiator Replacement	5 days	Fri 05/05/17	Thu 11/05/17
31	**Block 4**	**20 days**	**Fri 28/04/17**	**Thu 25/05/17**
32	HIU Installation	5 days	Fri 28/04/17	Thu 04/05/17
33	Pipework Replacement	10 days	Fri 05/05/17	Thu 18/05/17
34	Radiator Replacement	5 days	Fri 19/05/17	Thu 25/05/17
35	**Testing & Commissioning**	**15 days**	**Fri 26/05/17**	**Thu 15/06/17**
36	Flow Rates	5 days	Fri 26/05/17	Thu 01/06/17
37	Temperatures	5 days	Fri 02/06/17	Thu 08/06/17
38	Metering Calibration	5 days	Fri 09/06/17	Thu 15/06/17



Project: Maiden Lane Phase 2 - Distric
Date: Tue 29/03/16

Task | Progress | Summary | External Tasks | Deadline
Split | Milestone | Project Summary | External Milestone

APPENDIX M

RESIDENTS FEEDBACK FOLLOWING RESIDENTS ENGAGEMENT MEETING

Feedback from Nick Woodford

From: Wells, Derek [mailto:Derek.Wells@camden.gov.uk]
Sent: 11 August 2016 15:30
To: Nick Woodford
Cc: Reynolds, Eva; Louise Armstrong; Tim Pegg; Layhe, Michael
Subject: RE: Proposed Heating system for Maiden Lane Estate

Dear Louise & Nick.

It is Camden's policy that all new pipework be run on the surface.

The reason for this is twofold-firstly to ensure our ability to access for future maintenance/repair, and secondly on the question of cost, bearing in mind that many residencies will have laminate and other expensive flooring fitted, the cost factor of raising/replacing same effectively rules this out as an option.

We are at present carrying out similar schemes at ,amongst others, Highgate Newtown and Brookfield Croftdown estates –where the finished installations have been favourably received by residents.

As I advised to Leaseholders on both these estates, a show flat will be available to view prior to commencement of works and I would ask you to reserve judgement until you view this.
If then you are still unhappy, you will have the option to opt out, and instruct your own engineers to install your own bespoke installation.

Best Regards,

Derek Wells
Contract Manager Planned Works

Telephone: 0207 974 2358

From: Nick Woodford [mailto:nickwoodford@gmail.com]
Sent: 10 August 2016 15:52
To: Wells, Derek
Cc: Reynolds, Eva; Louise Armstrong; Tim Pegg; Layhe, Michael
Subject: Re: Proposed Heating system for Maiden Lane Estate

Dear Derek,

Thank you for your email and responses. I feel the use of the Talon Plastic Pipework Trunking for the 15mm copper pipes is not a good solution as it will greatly detract from the clean lines of the modernist interiors. I would be very resistant to this solution being used in my flat and I would ask that either the existing pipes be re-used or that new internal pipes be run either in the ceiling void under the plasterboard or in the floor; as a last resort exposed surface mounted pipes should be run at high level using minimal metal clips.

Maiden Lane may not currently be celebrated for its architecture and social ambition but it is sure to be at some point in the future. Using a cheap easy solution to modernization today damages its chances of becoming a future heritage asset for Camden and is a missed opportunity. For this reason I believe the proposal to use Talon Plastic Pipework Trunking throughout the estate should be urgently reconsidered for a more innovative and less permanently intrusive solution.

Thank you for the answer to the other points raised – I have no further comments or questions regarding these.

Kind regards,

Louise

From: Nick Woodford [mailto:nickwoodford@gmail.com]
Sent: 10 August 2016 15:52
To: Wells, Derek
Cc: Reynolds, Eva; Louise Armstrong; Tim Pegg; Layhe, Michael
Subject: Re: Proposed Heating system for Maiden Lane Estate

Dear Derek,

Thank you for your email and responses. I feel the use of the Talon Plastic Pipework Trunking for the 15mm copper pipes is not a good solution as it will greatly detract from the clean lines of the modernist interiors. I would be very resistant to this solution being used in my flat and I would ask that either the existing pipes be re-used or that new internal pipes be run either in the ceiling void under the plasterboard or in the floor; as a last resort exposed surface mounted pipes should be run at high level using minimal metal clips.

Maiden Lane may not currently be celebrated for its architecture and social ambition but it is sure to be at some point in the future. Using a cheap easy solution to modernization today damages its chances of becoming a future heritage asset for Camden and is a missed opportunity. For this reason I believe the proposal to use Talon Plastic Pipework Trunking throughout the estate should be urgently reconsidered for a more innovative and less permanently intrusive solution.

Thank you for the answer to the other points raised – I have no further comments or questions regarding these.

Kind regards,

Louise

On 10 August 2016 at 12:45, Wells, Derek <Derek.Wells@camden.gov.uk> wrote:

Dear Louise /Nick,

I thank you for your mail and would apologise for the delay in reply, due to annual leave.

Your questions are answered individually in blue type as under.

I hope that this mail answers the questions raised, and would ask you not to hesitate to contact me further if I can be of additional assistance.

Best Regards,

Derek Wells
Contract Manager Planned Works
Better Homes Delivery
Supporting Communities
London Borough of Camden

Telephone: 0207 974 2358
Mobile: 07771 545186
Web: camden.gov.uk

Ground Floor
33-35 Jamestown Road
London NW1 7DB

From: Nick Woodford [mailto:nickwoodford@gmail.com]
Sent: 04 August 2016 10:19
To: Reynolds, Eva; Wells, Derek; Louise Armstrong
Subject: Proposed Heating system for Maiden Lane Estate

Dear Eva and Derek,

Thank you for your leaflet dropped through our door regarding the new heating and hot water system. I am leasehold resident in a top floor studio flat on Broadfield Lane (70 Broadfield Lane).

I am in favour of the new system in principle but wondered if you could give some clarification on the following.

1. The new pipes will be surface mounted – will these be copper? I presume there is some protection from them being too hot and potentially hazardous how will this work?

The distribution pipework will be in small bore copper tube which will be encased in Talon Plastic Pipework Trunking

2. Cold water supply in the bathrooms currently comes from a header tank. This has terrible water pressure compared with the improved mains pressure. Will the replacement heating system be a chance to switch ALL cold water supply to mains and do away with the tank?

The proposed HIU's will provide both hot and cold water at Mains Pressure.

3. The current boiler house chimneys of the district heating system are an iconic part of the Maiden Lane estate – will these stay in their current form and design?

The finalised design of the Plant Room will attempt to utilise as many of the existing design features as possible. The question unfortunately cannot be accurately answered until the full design has been completed by our independent consultants-McBaines Cooper.

4. I would like to see solar panels used across all the roofs of the estate. Brixton Energy run a very successful project on the roofs of the Loughborough Junction Estate in Lambeth this is potentially a good precedent in terms of system and operator – it could be good for residents to have a share in the new system.

The options appraisal looked at all options available going forward. The Solar option was considered but rejected on the basis of area available for panels together with considerations regarding maintenance etc.

5. What are the dimensions / spec of the proposed heating interface units. I am re-configuring the layout of my studio and want to ensure I leave correct space for new unit in the design.

Without wishing to pre-empt the consultants recommendations, I have enclosed detail of the Altecnic SAK30 HIU that we are currently installing on other estates within Camden.

Thank you for the chance to feedback and I look forward to your responses.

Kind regards,

Louise Armstrong

c/o Nick Woodford

--

author I photographer I architectural assistant

Peckham Coal Line: peckhamcoalline.org
nickwoodford.co.uk

Collated Residents Feedback from Eva Reynolds (LB Camden)

HEATING MATTERS

DO YOU KNOW THAT THE COUNCIL WILL BE REPLACING THE HEATING SYSTEM?

At a meeting with residents on the 8th of June, Camden and their consultants McBaines-Cooper presented their proposals for the heating refurbishment on our estate.
Residents and TRA members had a chance to see the proposals and ask questions.

The HEATING "Draft Option Appraisal" document (as it is known) is now on Camden's website although it is very technical:

http://www.camden.gov.uk/maidenlane

The slides from the consultants' presentation are also there - which are a very simplified version. Residents are asked to look at the proposals and comment by the 22nd of August. After which there will be an update from Camden.

The TRA have collected a representation of opinions on the Estate and submitted them to Camden on behalf of residents (see overleaf). But Camden NEEDS to hear from as many people as possible. Residents are asked to look at the proposals and comment by the 22nd of August. We hope you will find the comments overleaf helpful.

This is our estate and our heating. We will be living with what is installed and paying the bills for many years to come so we need to make sure our voice is heard. At the moment these are just proposals.

Please, take the time to have a look at the heating proposals, comment and come to the meetings if you can. Now is the time we can voice our opinions; it is much more difficult to get the council to change things later on in the process.

We think some of the stuff proposed is good and will be an improvement **but there are still issues**. Please tell the Council what you think:

You can give feedback either:

To the Consultation Officer:

Eva Reynolds
020 7974 3969
Eva.reynolds@camden.gov.uk

To the Contract Manager:

Derek Wells
020 7974 2358
Derek.wells@camden.gov.uk

Here is the feedback your TRA has submitted:

1. When and in what order will the works happen? Actual dates and a breakdown for the whole Estate is imperative. Example: When will they be fitting the HIU's?
2. Joined up thinking: Coordination with landscape works before any works begin. Are they going to manage to renew any pipe work they need to in our paths, gardens and roadways before we get our high spec new landscaping scheme.
3. We are not convinced their surveys of the pipe routes in the appendix are that thorough, they are all approximate, unknown etc. location etc. Camden needs to identify clear routes quickly so that co-ordination with ongoing landscape renovation (which they have mentioned) can be co-ordinated early.
4. What is the anticipated yearly metered cost to tenants and leaseholders? This can be based on a before and after example. And will that be directly cut from our service charges/rents.
5. Clarification on use of individual metering: not rolled out yet but probable in the future. What does this mean in real terms? An explanation of the metering: Will we or won't we be individually metered?
6. A lack of structured feedback forms from the consultation officer. We are not heating experts. How is this being collated? A public breakdown of feedback received to ensure fairness and openness.
7. At the Leaseholder meeting in June, Pat O'Neill said that he will look into the individual boiler option for Leaseholders. This is still an outstanding point. Can leaseholders install their own HUI's? Confirmation that Leaseholders can keep their radiators and existing pipe work within their flats.
8. What is the specification/website for the HIU device they are going to use?
9. Freeholders on the Estate have twice requested a meeting to discuss heating proposals. This is still outstanding. Why? Freeholders also understand that Leaseholders will now be able to keep their existing pipe work; does this apply to the Freeholders too if they opt to remain connected to the communal system?
10. When will you be consulting on the price with Leaseholders and Freeholders?
11. Clear English/ Can the consultation officer provide information in future in clear plain non technical English?
12. For the heat source CHP is the better option which is, in our opinion, better than pure gas. If they are not connecting us to the new CHP plant, then what is the proposed heat source that they will install in the existing boiler room, will it be sustainable/non fossil fuel and pay us back eventually.
13. Will the electricity generated on site benefit residents in some way? How are bills to be calculated; will heating bills be discounted by the electricity generated?
14. They have mentioned underfloor heating? What is the likelihood of this?
15. There is an indicative roll out of 4 blocks? In 2017 in the appendix in the programme. Q: How are McBaines Cooper labelling the estate? It would be less confusing for everyone if Sisk/ Apollo/ Camden/ McBaines-Cooper etc., used the actual names of the blocks so we understand what is what? Also, do these 4 blocks represent the whole exiting estate being switched over early 2017?
16. It's great that McBaines-Cooper are on board for this; can Camden confirm they will be retained through construction/delivery so that quality doesn't suffer on site?
17. Everyone we speak to is worrying about surface mounting. Especially considering the electricity trunking was unwanted and has not always been carried out aesthetically as was promised. This will result in double trunking. Can they bring (more than one) examples to next meeting?

Maiden Lane Tenants and Residents Association, www.maidenlanetra.co.uk

APPENDIX N
OPTIONS COST APPRAISAL

Life-cycle cost calculator

Date: 28/11/2016

Maiden Lane

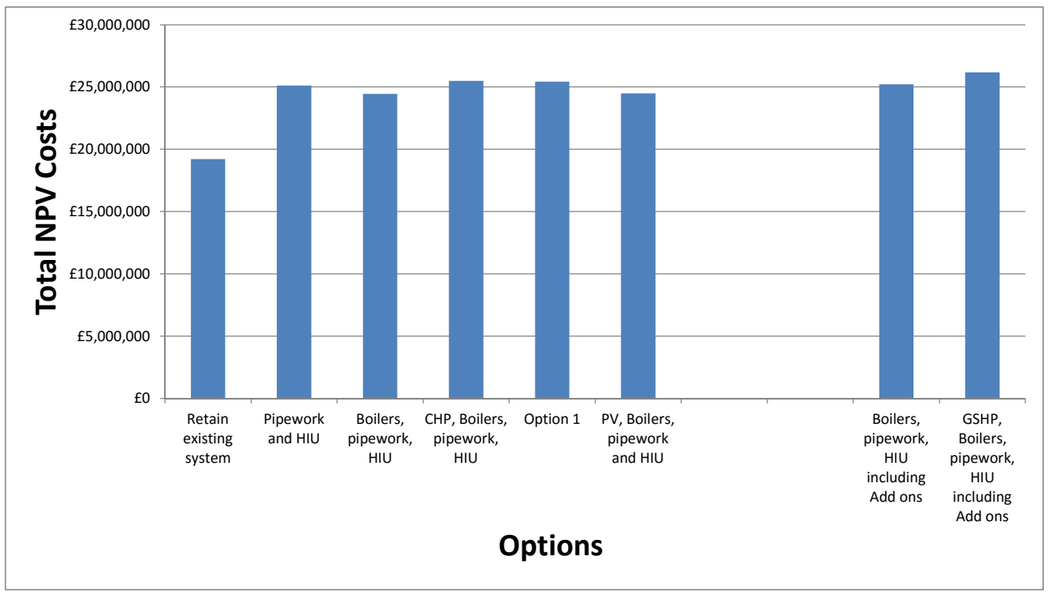
Summary

Option:	Description	Total NPV	Installation cost	Maintenance cost	Plant replacement cost	Fuel cost[1]	Energy management change
Option 1	Retain existing system	£19,223,070	Included in the capital costs	£4,353,991	£8,753,245	£6,666,034	-£550,200
Option 2	Pipework and HIU	£25,122,663	Included in the capital costs	£3,646,744	£16,350,766	£5,666,129	-£540,976
Option 3	Boilers, pipework, HIU	£24,452,630	Included in the capital costs	£3,315,222	£16,313,735	£5,332,828	-£509,154
Option 4	CHP, Boilers, pipework, HIU	£25,483,601	Included in the capital costs	£3,867,758	£16,976,859	£5,128,643	-£489,659
Option 5	Option 1	£25,426,756	Included in the capital costs	£3,536,236	£18,298,483	£3,971,502	-£379,465
Option 6	PV, Boilers, pipework and HIU	£24,492,347	Included in the capital costs	£3,315,222	£16,396,013	£5,285,718	-£504,606
Including Add-ons							
Option 3a	Boilers, pipework, HIU including Add ons	£25,208,312	Included in the capital costs	£3,315,222	£17,069,416	£5,332,828	-£509,154
Option 5a	GSHP, Boilers, pipework, HIU including Add ons	£26,182,437	Included in the capital costs	£3,536,236	£19,054,164	£3,971,502	-£379,465

Add-ons
Pressure valves on incoming water
Replacement Mains cold water supply
Additional pipework and valves for link between Phase 2 and Phase 1

Exclusions:
VAT
Major building works
Entire redecoraton of dwellings
Replacement of mains cold water system and supply throughout

Notes:
[1] Please note Option 5 and 6 benefit from government subsidies in the form of Renewable Heat Incentive (Option 5) and Feed In tariffs (Option 6).



30 Year Costing (excluding Leaseholder Contribution)

Maiden lane

Given figures

Discount Factor	5.00%	Affects the NPV
Commissioning minor changes	5.00%	

Option 1 — Retain existing system

	Percentage Annual Increase	Year 0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Capital cost																																
Energy Centre																																
Boiler Plant						£ 250,000.00																				£ 250,000.00						
~~CHP Unit~~																																
Pumps						£ 50,000.00															£ 50,000.00											
Pipeworks						£ 150,000.00																									£ 150,000.00	
Controls						£ 200,000.00										£ 200,000.00										£ 200,000.00						
Electrical works associated						£ 100,000.00																				£ 100,000.00						
~~GSHP/PV~~																																
Boiler house vent						£ 20,000.00																										
Commissioning major changes						£ 27,000.00																				£ 27,000.00						
Commissioning minor changes		£ -	£ -	£ -	£ -	£ 38,500.00	£ -	£ -	£ -	£ -	£ -	£ -	£ -	£ -	£ -	£ 10,000.00	£ -	£ -	£ -	£ -	£ 2,500.00	£ -	£ -	£ -	£ -	£ 27,500.00	£ -	£ -	£ -	£ -	£ 7,500.00	£ -
Distribution network																																
Pipework		£ 30,000.00	£ 30,000.00	£ 30,000.00	£ 30,000.00	£ 500,000.00																				£ 500,000.00						
~~Pumps~~																																
Civils						£ 250,000.00																										
Commissioning major changes						£ 24,000.00																£ 24,000.00										
Commissioning minor changes		£ 1,500.00	£ 1,500.00	£ 1,500.00	£ 1,500.00	£ 25,000.00	£ -	£ -	£ -	£ -	£ -	£ -	£ -	£ -	£ -	£ -	£ -	£ -	£ -	£ -	£ -	£ -	£ -	£ -	£ -	£ 25,000.00	£ -	£ -	£ -	£ -	£ -	£ -
Apartments works																																
~~Heat Interface Unit (include metering per dwelling)~~																																
~~Radiator Installation~~																																
Pipework (maintenance) [1]		£ 239,500.00	£ 239,500.00	£ 239,500.00	£ 239,500.00	£ 239,500.00	£ 239,500.00	£ 239,500.00	£ 239,500.00	£ 239,500.00	£ 239,500.00	£ 239,500.00	£ 239,500.00	£ 239,500.00	£ 239,500.00	£ 239,500.00	£ 239,500.00	£ 239,500.00	£ 239,500.00	£ 239,500.00	£ 239,500.00	£ 239,500.00	£ 239,500.00	£ 239,500.00	£ 239,500.00	£ 239,500.00	£ 239,500.00	£ 239,500.00	£ 239,500.00	£ 239,500.00	£ 239,500.00	£ 239,500.00
~~Controls~~																																
~~Heat metering (per block)~~																																
Electrical works associated																																
Domestic Hot water																																
Commissioning major changes																																
Commissioning minor changes		£ 11,975.00	£ 11,975.00	£ 11,975.00	£ 11,975.00	£ 11,975.00	£ 11,975.00	£ 11,975.00	£ 11,975.00	£ 11,975.00	£ 11,975.00	£ 11,975.00	£ 11,975.00	£ 11,975.00	£ 11,975.00	£ 11,975.00	£ 11,975.00	£ 11,975.00	£ 11,975.00	£ 11,975.00	£ 11,975.00	£ 11,975.00	£ 11,975.00	£ 11,975.00	£ 11,975.00	£ 11,975.00	£ 11,975.00	£ 11,975.00	£ 11,975.00	£ 11,975.00	£ 11,975.00	£ 11,975.00
Other																																
Preliminaries	12%					£226,317.00																				£165,717.00						
Builderworks & minor redecoration	10%					£163,597.50																				£113,097.50						
Design fees	7%					£130,360.44																				£90,768.44						
~~Grants~~																																
MCW can be reused	£0.00	£0.00				£0.00																										
Inflation	2.5%	100.000%	102.500%	105.063%	107.689%	110.381%	113.141%	115.969%	118.869%	121.840%	124.886%	128.008%	131.209%	134.489%	137.851%	141.297%	144.830%	148.451%	152.162%	155.966%	159.865%	163.862%	167.958%	172.157%	176.461%	180.873%	185.394%	190.029%	194.780%	199.650%	204.641%	209.757%
Capital cost inc. Inflation		£ 282,975.00	£ 290,049.38	£ 297,300.61	£ 304,733.12	£ 2,656,049.70	£ 284,520.88	£ 291,633.90	£ 298,924.75	£ 306,397.87	£ 314,057.82	£ 321,909.26	£ 329,956.99	£ 338,205.92	£ 346,661.07	£ 652,052.09	£ 364,210.78	£ 373,316.05	£ 382,648.95	£ 392,215.18	£ 485,949.69	£ 451,397.86	£ 422,372.85	£ 432,932.17	£ 443,755.47	£ 3,166,279.57	£ 466,220.59	£ 477,876.11	£ 489,823.01	£ 502,068.58	£ 836,929.46	£ 527,485.81
Fuel cost		£ 301,610.36	£ 309,150.62	£ 316,879.39	£ 324,801.37	£ 332,921.41	£ 341,244.44	£ 349,775.55	£ 358,519.94	£ 367,482.94	£ 376,670.02	£ 386,086.77	£ 395,738.93	£ 405,632.41	£ 415,773.22	£ 426,167.55	£ 436,821.74	£ 447,742.28	£ 458,935.84	£ 470,409.23	£ 482,169.46	£ 494,223.70	£ 506,579.29	£ 519,243.78	£ 532,224.87	£ 545,530.49	£ 559,168.75	£ 573,147.97	£ 587,476.67	£ 602,163.59	£ 617,217.68	£ 632,648.12
Energy management change	-10.0%	£ -	£ -	£ -	£ -	-£ 33,292.14	-£ 34,124.44	-£ 34,977.56	-£ 35,851.99	-£ 36,748.29	-£ 37,667.00	-£ 38,608.68	-£ 39,573.89	-£ 40,563.24	-£ 41,577.32	-£ 42,616.75	-£ 43,682.17	-£ 44,774.23	-£ 45,893.58	-£ 47,040.92	-£ 48,216.95	-£ 49,422.37	-£ 50,657.93	-£ 51,924.38	-£ 53,222.49	-£ 54,553.05	-£ 55,916.88	-£ 57,314.80	-£ 58,747.67	-£ 60,216.36	-£ 61,721.77	-£ 63,264.81
Maintenance Cost	2.5%	£ 197,000.00	£ 201,925.00	£ 206,973.13	£ 212,147.45	£ 217,451.14	£ 222,887.42	£ 228,459.60	£ 234,171.09	£ 240,025.37	£ 246,026.01	£ 252,176.66	£ 258,481.07	£ 264,943.10	£ 271,566.68	£ 278,355.84	£ 285,314.74	£ 292,447.61	£ 299,758.80	£ 307,252.77	£ 314,934.09	£ 322,807.44	£ 330,877.62	£ 339,149.57	£ 347,628.30	£ 356,319.01	£ 365,226.99	£ 374,357.66	£ 383,716.60	£ 393,309.52	£ 403,142.26	£ 413,220.81
Net annual Cost/Surplus		**£ 781,585.36**	**£ 801,125.00**	**£ 821,153.12**	**£ 841,681.95**	**£ 3,173,130.11**	**£ 814,528.30**	**£ 834,891.50**	**£ 855,763.79**	**£ 877,157.89**	**£ 899,086.83**	**£ 921,564.01**	**£ 944,603.11**	**£ 968,218.18**	**£ 992,423.64**	**£ 1,313,958.73**	**£ 1,042,665.08**	**£ 1,068,731.71**	**£ 1,095,450.00**	**£ 1,122,836.25**	**£ 1,234,836.30**	**£ 1,219,006.63**	**£ 1,209,171.84**	**£ 1,239,401.13**	**£ 1,270,386.16**	**£ 4,013,576.03**	**£ 1,334,699.46**	**£ 1,368,066.95**	**£ 1,402,268.62**	**£ 1,437,325.33**	**£ 1,795,567.63**	**£ 1,510,089.93**
		£ 781,585.36	£ 762,976.19	£ 744,810.09	£ 727,076.52	£ 2,610,541.99	£ 638,204.23	£ 623,008.90	£ 608,175.35	£ 593,694.98	£ 579,559.39	£ 565,760.36	£ 552,289.87	£ 539,140.11	£ 526,303.44	£ 663,638.45	£ 501,539.73	£ 489,598.31	£ 477,941.21	£ 466,561.66	£ 488,666.65	£ 459,430.78	£ 434,023.00	£ 423,689.12	£ 413,601.28	£ 1,244,481.13	£ 394,140.45	£ 384,756.15	£ 375,595.29	£ 366,652.55	£ 436,226.55	£ 349,400.76
Net Present Valve		**£ 19,223,069.85**	**Summary**																													

Summary

Camden Economic options apparisal		Year 0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Installation cost	**Included in the capital costs**																															
Maintenance cost	**£ 4,353,990.92**	£ 197,000.00	£ 192,309.52	£ 187,730.73	£ 183,260.95	£ 178,897.59	£ 174,638.12	£ 170,480.07	£ 166,421.02	£ 162,458.62	£ 158,590.56	£ 154,814.59	£ 151,128.53	£ 147,530.23	£ 144,017.61	£ 140,588.62	£ 137,241.27	£ 133,973.62	£ 130,783.77	£ 127,669.87	£ 124,630.11	£ 121,662.73	£ 118,766.00	£ 115,938.24	£ 113,177.80	£ 110,483.09	£ 107,852.54	£ 105,284.62	£ 102,777.85	£ 100,330.76	£ 97,941.93	£ 95,609.98
Plant replacement cost	**£ 8,753,244.50**	£ 282,975.00	£ 276,237.50	£ 269,660.42	£ 263,239.93	£ 2,185,138.66	£ 222,929.55	£ 217,621.71	£ 212,440.24	£ 207,382.14	£ 202,444.47	£ 197,624.36	£ 192,919.02	£ 188,325.71	£ 183,841.76	£ 329,330.62	£ 175,191.61	£ 171,020.38	£ 166,948.47	£ 162,973.51	£ 192,306.79	£ 170,127.11	£ 151,607.51	£ 147,997.81	£ 144,474.05	£ 981,761.69	£ 137,676.23	£ 134,398.23	£ 131,198.27	£ 128,074.50	£ 203,328.93	£ 122,048.32
Fuel and other standing charges	**£ 6,666,034.46**	£ 301,610.36	£ 294,429.17	£ 287,418.95	£ 280,575.64	£ 273,895.27	£ 267,373.95	£ 261,007.90	£ 254,793.43	£ 248,726.92	£ 242,804.85	£ 237,023.78	£ 231,380.36	£ 225,871.30	£ 220,493.41	£ 215,243.57	£ 210,118.72	£ 205,115.90	£ 200,232.19	£ 195,464.75	£ 190,810.83	£ 186,267.72	£ 181,832.77	£ 177,503.42	£ 173,277.15	£ 169,151.50	£ 165,124.08	£ 161,192.56	£ 157,354.64	£ 153,608.10	£ 149,950.76	£ 146,380.51
Energy management change	**-£ 550,200.03**	£ -	£ -	£ -	£ -	-£ 27,389.53	-£ 26,737.40	-£ 26,100.79	-£ 25,479.34	-£ 24,872.69	-£ 24,280.49	-£ 23,702.38	-£ 23,138.04	-£ 22,587.13	-£ 22,049.34	-£ 21,524.36	-£ 21,011.87	-£ 20,511.59	-£ 20,023.22	-£ 19,546.48	-£ 19,081.08	-£ 18,626.77	-£ 18,183.28	-£ 17,750.34	-£ 17,327.71	-£ 16,915.15	-£ 16,512.41	-£ 16,119.26	-£ 15,735.46	-£ 15,360.81	-£ 14,995.08	-£ 14,638.05
Summary	**£ 19,223,069.85**																															

Assumptions

`		**479**
Number of blocks of apartments		**33**
Cost for one HIU (each dwelling)	**£**	**2,500.00**
Cost for Radiator installation (each dwelling)	**£**	**1,500.00**
Cost for pipework (each dwelling)	**£**	**2,000.00**
Cost for control (each dwelling)	**£**	**1,000.00**
Cost for Electrical works associated (each dw	**£**	**1,000.00**
Cost for domestic hot water (each dwelling)	**£**	**1,500.00**
Cost for commissioning (each dwelling)	**£**	**285.00**
Cost heat meter eack block	**£**	**7,900.00**

notes

[1] McBains Cooper assumption: based upon an estimated £500 per dwelling i.e. £7,257 per block

NPV

Future valve x $\frac{1}{(1+r)^n}$

Year	PV of £1 (pfi)	PV of £1 pa (pfi)	EAC of £1 (pfi)	$1/(1+i)^t$
0	1.0000			1.0000
1	0.9524	0.9524	1.0500	0.9524
2	0.9070	1.8594	0.5378	0.9070
3	0.8638	2.7232	0.3672	0.8638
4	0.8227	3.5460	0.2820	0.8227
5	0.7835	4.3295	0.2310	0.7835
6	0.7462	5.0757	0.1970	0.7462
7	0.7107	5.7864	0.1728	0.7107
8	0.6768	6.4632	0.1547	0.6768
9	0.6446	7.1078	0.1407	0.6446
10	0.6139	7.7217	0.1295	0.6139
11	0.5847	8.3064	0.1204	0.5847
12	0.5568	8.8633	0.1128	0.5568
13	0.5303	9.3936	0.1065	0.5303
14	0.5051	9.8986	0.1010	0.5051
15	0.4810	10.3797	0.0963	0.4810
16	0.4581	10.8378	0.0923	0.4581
17	0.4363	11.2741	0.0887	0.4363
18	0.4155	11.6896	0.0855	0.4155
19	0.3957	12.0853	0.0827	0.3957
20	0.3769	12.4622	0.0802	0.3769
21	0.3589	12.8212	0.0780	0.3589
22	0.3418	13.1630	0.0760	0.3418
23	0.3256	13.4886	0.0741	0.3256
24	0.3101	13.7986	0.0725	0.3101
25	0.2953	14.0939	0.0710	0.2953
26	0.2812	14.3752	0.0696	0.2812
27	0.2678	14.6430	0.0683	0.2678
28	0.2551	14.8981	0.0671	0.2551
29	0.2429	15.1411	0.0660	0.2429
30	0.2314	15.3725	0.0651	0.2314

30 Year Costing (excluding Leaseholder Contribution)

Maiden lane

Given figures

Discount Factor	5.00%	Affects the NPV
Commissioning minor changes	5.00%	

Option 2 **Pipework and HIU**

	Persentage Annual Increase	Year 0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Capital cost																																
Energy Centre																																
Boiler Plant						£ 250,000.00																				£ 250,000.00						
Switched																																
Pumps						£ 50,000.00																				£ 50,000.00						
Pipeworks						£ 150,000.00																									£ 150,000.00	
Controls						£ 200,000.00										£ 200,000.00										£ 200,000.00						
Electrical works associated						£ 100,000.00																				£ 100,000.00						
Labelling																																
Boiler house vent						£ 20,000.00																										
Commissioning major changes						£ 27,000.00																				£ 27,000.00						
Commissioning minor changes		£ -	£ -	£ -	£ -	£ 38,500.00	£ -	£ -	£ -	£ -	£ -	£ -	£ -	£ -	£ -	£ 10,000.00	£ -	£ -	£ -	£ -	£ -	£ -	£ -	£ -	£ -	£ 30,000.00	£ -	£ -	£ -	£ 7,500.00	£ -
Distribution network																																
Pipework		£ 500,000.00																				£ 500,000.00					£ 500,000.00				
Pumps		£ 50,000.00																				£ 50,000.00										
Civils		£ 250,000.00																														
Commissioning major changes		£ 24,000.00																				£ 24,000.00										
Commissioning minor changes		£ 27,500.00	£ -	£ -	£ -	£ -	£ -	£ -	£ -	£ -	£ -	£ -	£ -	£ -	£ -	£ -	£ -	£ -	£ -	£ -	£ -	£ 27,500.00	£ -	£ -	£ -	£ -	£ 25,000.00	£ -	£ -	£ -	£ -	£ -
Apartments works																																
Heat Interface Unit (include metering per dwelling)		£ 1,197,500.00															£ 1,197,500.00															£ 1,197,500.00
Radiator Installation		£ 718,500.00																				£ 718,500.00										
Pipework		£ 958,000.00																									£ 958,000.00					
Controls		£ 479,000.00										£ 479,000.00										£ 479,000.00										£ 479,000.00
Heat metering (per block)		£ 260,700.00										£ 260,700.00																				£ 260,700.00
Electrical works associated		£ 479,000.00															£ 479,000.00															£ 479,000.00
Domestic Hot water		£ 718,500.00																									£718,500.00					
Commissioning major changes		£ 136,515.00																				£ 136,515.00										
Commissioning minor changes		£ 240,560.00	£ -	£ -	£ -	£ -	£ -	£ -	£ -	£ -	£ -	£ 36,985.00	£ -	£ -	£ -	£ -	£ 83,825.00	£ -	£ -	£ -	£ -	£ 72,910.00	£ -	£ -	£ -	£ -	£ 83,825.00	£ -	£ -	£ -	£ -	£ 120,810.00
Other																																
Preliminaries	12%	£724,773.00				£100,260.00																£272,295.00				£78,840.00	£274,239.00					£304,441.20
Builderworks & minor redecoration	10%	£603,977.50				£58,550.00																£226,912.50				£40,700.00	£228,532.50					£253,701.00
Design fees	7%	£473,518.36				£48,003.20																£177,899.40				£34,008.80	£179,169.48					£198,901.58
Grants																																
MCW can be reused	£0.00	£0.00																														
Inflation	2.5%	100.000%	102.500%	105.063%	107.689%	110.381%	113.141%	115.969%	118.869%	121.840%	124.886%	128.008%	131.209%	134.489%	137.851%	141.297%	144.830%	148.451%	152.162%	155.966%	159.865%	163.862%	167.958%	172.157%	176.461%	180.873%	185.394%	190.029%	194.780%	199.650%	204.641%	209.757%
Capital cost inc. Inflation		£ 7,842,043.86	£ -	£ -	£ -	£ 1,150,518.75	£ -	£ -	£ -	£ -	£ -	£ 994,222.46	£ -	£ -	£ -	£ 296,724.50	£ 2,549,475.47	£ -	£ -	£ -	£ -	£ 4,827,744.03	£ -	£ -	£ -	£ 1,466,060.85	£ 5,501,145.25	£ -	£ -	£ -	£ 322,309.16	£ 6,909,500.42
Fuel cost		£ 256,368.81	£ 262,778.03	£ 269,347.48	£ 276,081.17	£ 282,983.20	£ 290,057.78	£ 297,309.22	£ 304,741.95	£ 312,360.50	£ 320,169.51	£ 328,173.75	£ 336,378.09	£ 344,787.55	£ 353,407.24	£ 362,242.42	£ 371,298.48	£ 380,580.94	£ 390,095.46	£ 399,847.85	£ 409,844.05	£ 420,090.15	£ 430,592.40	£ 441,357.21	£ 452,391.14	£ 463,700.92	£ 475,293.44	£ 487,175.78	£ 499,355.17	£ 511,839.05	£ 524,635.03	£ 537,750.90
Energy management change	-10.0%	£ -	-£ 26,277.80	-£ 26,934.75	-£ 27,608.12	-£ 28,298.32	-£ 29,005.78	-£ 29,730.92	-£ 30,474.20	-£ 31,236.05	-£ 32,016.95	-£ 32,817.38	-£ 33,637.81	-£ 34,478.75	-£ 35,340.72	-£ 36,224.24	-£ 37,129.85	-£ 38,058.09	-£ 39,009.55	-£ 39,984.78	-£ 40,984.40	-£ 42,009.01	-£ 43,059.24	-£ 44,135.72	-£ 45,239.11	-£ 46,370.09	-£ 47,529.34	-£ 48,717.58	-£ 49,935.52	-£ 51,183.91	-£ 52,463.50	-£ 53,775.09
Maintenance Cost	2.5%	£ 165,000.00	£ 169,125.00	£ 173,353.13	£ 177,686.95	£ 182,129.13	£ 186,682.36	£ 191,349.41	£ 196,133.15	£ 201,036.48	£ 206,062.39	£ 211,213.95	£ 216,494.30	£ 221,906.66	£ 227,454.32	£ 233,140.68	£ 238,969.20	£ 244,943.43	£ 251,067.01	£ 257,343.69	£ 263,777.28	£ 270,371.71	£ 277,131.01	£ 284,059.28	£ 291,160.76	£ 298,439.78	£ 305,900.78	£ 313,548.30	£ 321,387.00	£ 329,421.68	£ 337,657.22	£ 346,098.65
Net annual Cost/Surplus		**£ 8,263,412.67**	**£ 405,625.23**	**£ 415,765.86**	**£ 426,160.00**	**£ 1,587,332.75**	**£ 447,734.35**	**£ 458,927.71**	**£ 470,400.91**	**£ 482,160.93**	**£ 494,214.95**	**£ 1,500,792.79**	**£ 519,234.58**	**£ 532,215.45**	**£ 545,520.83**	**£ 855,883.36**	**£ 3,122,613.30**	**£ 587,466.27**	**£ 602,152.93**	**£ 617,206.75**	**£ 632,636.92**	**£ 5,476,196.87**	**£ 664,664.17**	**£ 681,280.77**	**£ 698,312.79**	**£ 2,181,831.26**	**£ 6,234,810.13**	**£ 752,006.50**	**£ 770,806.66**	**£ 790,076.82**	**£ 1,132,137.91**	**£ 7,739,574.88**
		£ 8,263,412.67	£ 386,309.74	£ 377,111.89	£ 368,133.03	£ 1,305,902.58	£ 350,811.58	£ 342,458.93	£ 334,305.14	£ 326,345.50	£ 318,575.36	£ 921,356.58	£ 303,585.71	£ 296,357.48	£ 289,301.35	£ 432,279.26	£ 1,502,030.39	£ 269,125.07	£ 262,717.33	£ 256,462.15	£ 250,355.91	£ 2,063,921.01	£ 238,576.13	£ 232,895.74	£ 227,350.61	£ 676,515.86	£ 1,841,156.71	£ 211,494.86	£ 206,459.27	£ 201,543.57	£ 275,048.74	£ 1,790,763.09
Net Present Valve		**£ 25,122,663.22**	**Summary**																													

Summary

Camden Economic options apparisal		Year 0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Installation cost	**Included in the capital costs**																															
Maintenance cost	**£ 3,646,743.67**	£ 165,000.00	£ 161,071.43	£ 157,236.39	£ 153,492.67	£ 149,838.08	£ 146,270.51	£ 142,787.88	£ 139,388.17	£ 136,069.40	£ 132,829.65	£ 129,667.04	£ 126,579.73	£ 123,565.93	£ 120,623.88	£ 117,751.89	£ 114,948.27	£ 112,211.41	£ 109,539.71	£ 106,931.62	£ 104,385.63	£ 101,900.25	£ 99,474.06	£ 97,105.63	£ 94,793.59	£ 92,536.60	£ 90,333.35	£ 88,182.55	£ 86,082.97	£ 84,033.37	£ 82,032.58	£ 80,079.42
Plant replacement cost	**£ 16,350,766.31**	£ 7,842,043.86	£ -	£ -	£ -	£ 946,534.62	£ -	£ -	£ -	£ -	£ -	£ 610,366.35	£ -	£ -	£ -	£ 149,866.04	£ 1,226,341.29	£ -	£ -	£ -	£ -	£ 1,819,525.95	£ -	£ -	£ -	£ 454,578.36	£ 1,624,503.44	£ -	£ -	£ 78,303.83	£ 1,598,702.58
Fuel and other standing charges	**£ 5,666,129.29**	£ 256,368.81	£ 250,264.79	£ 244,306.10	£ 238,489.29	£ 232,810.98	£ 227,267.86	£ 221,856.72	£ 216,574.42	£ 211,417.88	£ 206,384.12	£ 201,470.22	£ 196,673.31	£ 191,990.61	£ 187,419.40	£ 182,957.04	£ 178,600.92	£ 174,348.51	£ 170,197.36	£ 166,145.04	£ 162,189.21	£ 158,327.56	£ 154,557.85	£ 150,877.91	£ 147,285.57	£ 143,778.77	£ 140,355.47	£ 137,013.67	£ 133,751.44	£ 130,566.89	£ 127,458.15	£ 124,423.43
Energy management change	-£ 540,976.05	£ -	-£ 25,026.48	-£ 24,430.61	-£ 23,848.93	-£ 23,281.10	-£ 22,726.79	-£ 22,185.67	-£ 21,657.44	-£ 21,141.79	-£ 20,638.41	-£ 20,147.02	-£ 19,667.33	-£ 19,199.06	-£ 18,741.94	-£ 18,295.70	-£ 17,860.09	-£ 17,434.85	-£ 17,019.74	-£ 16,614.50	-£ 16,218.92	-£ 15,832.76	-£ 15,455.79	-£ 15,087.79	-£ 14,728.56	-£ 14,377.88	-£ 14,035.55	-£ 13,701.37	-£ 13,375.14	-£ 13,056.69	-£ 12,745.81	-£ 12,442.34
Summary	**£ 25,122,663.22**																															

Assumptions

Number of dwellings	**479**
Number of blocks of apartments	**33**
Cost for one HIU (each dwelling)	**£ 2,500.00**
Cost for Radiator installation (each dwelling)	**£ 1,500.00**
Cost for pipework (each dwelling)	**£ 2,000.00**
Cost for control (each dwelling)	**£ 1,000.00**
Cost for Electrical works associated (each dwe	**£ 1,000.00**
Cost for domestic hot water (each dwelling)	**£ 1,500.00**
Cost for commissioning (each dwelling)	**£ 285.00**
Cost heat meter eack block	**£ 7,900.00**

NPV Future valve x $\frac{1}{(1+r)^n}$

Year	PV of £1 (pfi)	PV of £1 pa (pfi)	EAC of £1 (pfi)	$1/(1+i)^t$
0	1.0000			1.0000
1	0.9524	0.9524	1.0500	0.9524
2	0.9070	1.8594	0.5378	0.9070
3	0.8638	2.7232	0.3672	0.8638
4	0.8227	3.5460	0.2820	0.8227
5	0.7835	4.3295	0.2310	0.7835
6	0.7462	5.0757	0.1970	0.7462
7	0.7107	5.7864	0.1728	0.7107
8	0.6768	6.4632	0.1547	0.6768
9	0.6446	7.1078	0.1407	0.6446
10	0.6139	7.7217	0.1295	0.6139
11	0.5847	8.3064	0.1204	0.5847
12	0.5568	8.8633	0.1128	0.5568
13	0.5303	9.3936	0.1065	0.5303
14	0.5051	9.8986	0.1010	0.5051
15	0.4810	10.3797	0.0963	0.4810
16	0.4581	10.8378	0.0923	0.4581
17	0.4363	11.2741	0.0887	0.4363
18	0.4155	11.6896	0.0855	0.4155
19	0.3957	12.0853	0.0827	0.3957
20	0.3769	12.4622	0.0802	0.3769
21	0.3589	12.8212	0.0780	0.3589
22	0.3418	13.1630	0.0760	0.3418
23	0.3256	13.4886	0.0741	0.3256
24	0.3101	13.7986	0.0725	0.3101
25	0.2953	14.0939	0.0710	0.2953
26	0.2812	14.3752	0.0696	0.2812
27	0.2678	14.6430	0.0683	0.2678
28	0.2551	14.8981	0.0671	0.2551
29	0.2429	15.1411	0.0660	0.2429
30	0.2314	15.3725	0.0651	0.2314

30 Year Costing (excluding Leaseholder Contribution)

Maiden lane

Given figures

Discount Factor	5.00%	Affects the NPV
Commissioning minor changes	5.00%	

Option 3 **Boilers, pipework, HIU**

	Persentage Annual Increase	Year 0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Capital cost																																
Energy Centre																																
Boiler Plant		£ 250,000.00																				£ 250,000.00										
Switchgear																																
Pumps		£ 50,000.00																				£50,000.00										
Pipeworks		£ 150,000.00																									£ 150,000.00					
Controls		£ 200,000.00										£ 200,000.00										£ 200,000.00										£ 200,000.00
Electrical works associated		£ 100,000.00																				£ 100,000.00										
Upgrading																																
Boiler house vent		£ 20,000.00																														£ 20,000.00
Commissioning major changes		£ 27,000.00																				£ 27,000.00										
Commissioning minor changes		£ 38,500.00	£ -	£ -	£ -	£ -	£ -	£ -	£ -	£ -	£ -	£ 10,000.00	£ -	£ -	£ -	£ -	£ -	£ -	£ -	£ -	£ -	£ 30,000.00	£ -	£ -	£ -	£ -	£ 7,500.00	£ -	£ -	£ -	£ -	£ 11,000.00
Distribution network																																
Pipework		£ 500,000.00																				£ 500,000.00										
Pumps		£ 50,000.00																				£ 50,000.00										
Civils		£ 250,000.00																														
Commissioning major changes		£ 24,000.00																				£ 24,000.00										
Commissioning minor changes		£ 27,500.00	£ -	£ -	£ -	£ -	£ -	£ -	£ -	£ -	£ -	£ -	£ -	£ -	£ -	£ -	£ -	£ -	£ -	£ -	£ -	£ 27,500.00	£ -	£ -	£ -	£ -	£ -	£ -	£ -	£ -	£ -	£ -
Apartments works																																
Heat Interface Unit (include metering per dwelling)		£ 1,197,500.00															£ 1,197,500.00															£ 1,197,500.00
Radiator Installation		£ 718,500.00																				£ 718,500.00										
Pipework		£ 958,000.00																									£ 958,000.00					
Controls		£ 479,000.00										£ 479,000.00										£ 479,000.00										£ 479,000.00
Heat metering (per block)		£ 260,700.00										£ 260,700.00										£ 260,700.00										£ 260,700.00
Electrical works associated		£ 479,000.00															£ 479,000.00															£ 479,000.00
Domestic Hot water		£ 718,500.00																									£718,500.00					
Commissioning major changes		£ 136,515.00																				£ 136,515.00										
Commissioning minor changes		£ 240,560.00	£ -	£ -	£ -	£ -	£ -	£ -	£ -	£ -	£ -	£ 36,985.00	£ -	£ -	£ -	£ -	£ 83,825.00	£ -	£ -	£ -	£ -	£ 72,910.00	£ -	£ -	£ -	£ -	£ 83,825.00	£ -	£ -	£ -	£ -	£ 120,810.00
Other																																
Preliminaries	12%	£825,033.00																				£351,135.00					£230,139.00					£332,161.20
Builderworks & minor redecoration	10%	£662,527.50																				£267,612.50					£191,782.50					£276,801.00
Design fees	7%	£521,521.50																				£211,938.20					£150,357.48					£217,011.98
Grants																																
MCW can be reused	£0.00	£0.00																														
Inflation	2.5%	100.000%	102.500%	105.063%	107.689%	110.381%	113.141%	115.969%	118.869%	121.840%	124.886%	128.008%	131.209%	134.489%	137.851%	141.297%	144.830%	148.451%	152.162%	155.966%	159.865%	163.862%	167.958%	172.157%	176.461%	180.873%	185.394%	190.029%	194.780%	199.650%	204.641%	209.757%
Capital cost inc. Inflation		£ 8,884,357.06	£ -	£ -	£ -	£ -	£ -	£ -	£ -	£ -	£ -	£ 1,263,040.22	£ -	£ -	£ -	£ -	£ 2,549,475.47	£ -	£ -	£ -	£ -	£ 6,155,922.82	£ -	£ -	£ -	£ -	£ 4,616,513.58	£ -	£ -	£ -	£ -	£ 7,538,624.70
Fuel cost		£ 241,288.29	£ 247,320.50	£ 253,503.51	£ 259,841.10	£ 266,337.13	£ 272,995.55	£ 279,820.44	£ 286,815.95	£ 293,986.35	£ 301,336.01	£ 308,869.41	£ 316,591.15	£ 324,505.93	£ 332,618.57	£ 340,934.04	£ 349,457.39	£ 358,193.82	£ 367,148.67	£ 376,327.39	£ 385,735.57	£ 395,378.96	£ 405,263.44	£ 415,395.02	£ 425,779.90	£ 436,424.39	£ 447,335.00	£ 458,518.38	£ 469,981.34	£ 481,730.87	£ 493,774.14	£ 506,118.50
Energy management change	-10.0%	£ -	-£ 24,732.05	-£ 25,350.35	-£ 25,984.11	-£ 26,633.71	-£ 27,299.56	-£ 27,982.04	-£ 28,681.60	-£ 29,398.64	-£ 30,133.60	-£ 30,886.94	-£ 31,659.11	-£ 32,450.59	-£ 33,261.86	-£ 34,093.40	-£ 34,945.74	-£ 35,819.38	-£ 36,714.87	-£ 37,632.74	-£ 38,573.56	-£ 39,537.90	-£ 40,526.34	-£ 41,539.50	-£ 42,577.99	-£ 43,642.44	-£ 44,733.50	-£ 45,851.84	-£ 46,998.13	-£ 48,173.09	-£ 49,377.41	-£ 50,611.85
Maintenance Cost	2.5%	£ 150,000.00	£ 153,750.00	£ 157,593.75	£ 161,533.59	£ 165,571.93	£ 169,711.23	£ 173,954.01	£ 178,302.86	£ 182,760.43	£ 187,329.45	£ 192,012.68	£ 196,813.00	£ 201,733.32	£ 206,776.66	£ 211,946.07	£ 217,244.72	£ 222,675.84	£ 228,242.74	£ 233,948.81	£ 239,797.53	£ 245,792.47	£ 251,937.28	£ 258,235.71	£ 264,691.60	£ 271,308.89	£ 278,091.61	£ 285,043.91	£ 292,170.00	£ 299,474.25	£ 306,961.11	£ 314,635.14
Net annual Cost/Surplus		**£ 9,275,645.35**	**£ 376,338.45**	**£ 385,746.91**	**£ 395,390.58**	**£ 405,275.35**	**£ 415,407.23**	**£ 425,792.41**	**£ 436,437.22**	**£ 447,348.15**	**£ 458,531.86**	**£ 1,733,035.37**	**£ 481,745.03**	**£ 493,788.66**	**£ 506,133.37**	**£ 518,786.71**	**£ 3,081,231.85**	**£ 545,050.29**	**£ 558,676.54**	**£ 572,643.46**	**£ 586,959.54**	**£ 6,757,556.15**	**£ 616,674.37**	**£ 632,091.23**	**£ 647,893.51**	**£ 664,090.85**	**£ 5,297,206.70**	**£ 697,710.45**	**£ 715,153.21**	**£ 733,032.04**	**£ 751,357.84**	**£ 8,308,766.49**
		£ 9,275,645.35	£ 358,417.57	£ 349,883.82	£ 341,553.25	£ 333,421.03	£ 325,482.44	£ 317,732.85	£ 310,167.79	£ 302,782.84	£ 295,573.72	£ 1,063,933.38	£ 281,666.34	£ 274,960.00	£ 268,413.33	£ 262,022.54	£ 1,482,125.20	£ 249,693.82	£ 243,748.72	£ 237,945.18	£ 232,279.82	£ 2,546,851.84	£ 221,350.56	£ 216,080.31	£ 210,935.54	£ 205,913.26	£ 1,564,279.82	£ 196,224.60	£ 191,552.58	£ 186,991.81	£ 182,539.62	£ 1,922,461.19
Net Present Valve		**£ 24,452,630.14**	**Summary**																													

Summary

Camden Economic options appraisal		Year 0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Installation cost	**Included in the capital costs**																															
Maintenance cost	**£ 3,315,221.52**	£ 150,000.00	£ 146,428.57	£ 142,942.18	£ 139,538.79	£ 136,216.44	£ 132,973.19	£ 129,807.16	£ 126,716.52	£ 123,699.46	£ 120,754.23	£ 117,879.13	£ 115,072.48	£ 112,332.66	£ 109,658.08	£ 107,047.17	£ 104,498.43	£ 102,010.37	£ 99,581.55	£ 97,210.56	£ 94,896.02	£ 92,636.60	£ 90,430.96	£ 88,277.84	£ 86,175.99	£ 84,124.18	£ 82,121.22	£ 80,165.96	£ 78,257.24	£ 76,393.98	£ 74,575.07	£ 72,799.48
Plant replacement cost	**£ 16,313,734.98**	£ 8,884,357.06	£ -	£ -	£ -	£ -	£ -	£ -	£ -	£ -	£ -	£ 775,397.13	£ -	£ -	£ -	£ -	£ 1,226,341.29	£ -	£ -	£ -	£ -	£ 2,320,102.49	£ -	£ -	£ -	£ -	£ 1,363,269.26	£ -	£ -	£ -	£ 1,744,267.75
Fuel and other standing charges	**£ 5,332,827.57**	£ 241,288.29	£ 235,543.33	£ 229,935.16	£ 224,460.51	£ 219,116.21	£ 213,899.16	£ 208,806.32	£ 203,834.74	£ 198,981.54	£ 194,243.88	£ 189,619.03	£ 185,104.29	£ 180,697.04	£ 176,394.73	£ 172,194.86	£ 168,094.98	£ 164,092.72	£ 160,185.75	£ 156,371.80	£ 152,648.66	£ 149,014.17	£ 145,466.22	£ 142,002.73	£ 138,621.72	£ 135,321.20	£ 132,099.27	£ 128,954.05	£ 125,883.71	£ 122,886.48	£ 119,960.61	£ 117,104.41
Energy management change	**-£ 509,153.93**	£ -	-£ 23,554.33	-£ 22,993.52	-£ 22,446.05	-£ 21,911.62	-£ 21,389.92	-£ 20,880.63	-£ 20,383.47	-£ 19,898.15	-£ 19,424.39	-£ 18,961.90	-£ 18,510.43	-£ 18,069.70	-£ 17,639.47	-£ 17,219.49	-£ 16,809.50	-£ 16,409.27	-£ 16,018.57	-£ 15,637.18	-£ 15,264.87	-£ 14,901.42	-£ 14,546.62	-£ 14,200.27	-£ 13,862.17	-£ 13,532.12	-£ 13,209.93	-£ 12,895.40	-£ 12,588.37	-£ 12,288.65	-£ 11,996.06	-£ 11,710.44
Summary	**£ 24,452,630.14**																															

Assumptions

Number of dwellings	**479**
Number of blocks of apartments	**33**
Cost for one HIU (each dwelling)	**£ 2,500.00**
Cost for Radiator installation (each dwelling)	**£ 1,500.00**
Cost for pipework (each dwelling)	**£ 2,000.00**
Cost for control (each dwelling)	**£ 1,000.00**
Cost for Electrical works associated (each dw	**£ 1,000.00**
Cost for domestic hot water (each dwelling)	**£ 1,500.00**
Cost for commissioning (each dwelling)	**£ 285.00**
Cost heat meter eack block	**£ 7,900.00**

NPV Future valve x $\frac{1}{(1+i)^n}$

Year	PV of £1 (pfi)	PV of £1 pa (pfi)	EAC of £1 (pfi)	$1/(1+i)^2$
0	1.0000			1.0000
1	0.9524	0.9524	1.0500	0.9524
2	0.9070	1.8594	0.5378	0.9070
3	0.8638	2.7232	0.3672	0.8638
4	0.8227	3.5460	0.2820	0.8227
5	0.7835	4.3295	0.2310	0.7835
6	0.7462	5.0757	0.1970	0.7462
7	0.7107	5.7864	0.1728	0.7107
8	0.6768	6.4632	0.1547	0.6768
9	0.6446	7.1078	0.1407	0.6446
10	0.6139	7.7217	0.1295	0.6139
11	0.5847	8.3064	0.1204	0.5847
12	0.5568	8.8633	0.1128	0.5568
13	0.5303	9.3936	0.1065	0.5303
14	0.5051	9.8986	0.1010	0.5051
15	0.4810	10.3797	0.0963	0.4810
16	0.4581	10.8378	0.0923	0.4581
17	0.4363	11.2741	0.0887	0.4363
18	0.4155	11.6896	0.0855	0.4155
19	0.3957	12.0853	0.0827	0.3957
20	0.3769	12.4622	0.0802	0.3769
21	0.3589	12.8212	0.0780	0.3589
22	0.3418	13.1630	0.0760	0.3418
23	0.3256	13.4886	0.0741	0.3256
24	0.3101	13.7986	0.0725	0.3101
25	0.2953	14.0939	0.0710	0.2953
26	0.2812	14.3752	0.0696	0.2812
27	0.2678	14.6430	0.0683	0.2678
28	0.2551	14.8981	0.0671	0.2551
29	0.2429	15.1411	0.0660	0.2429
30	0.2314	15.3725	0.0651	0.2314

30 Year Costing (excluding Leaseholder Contribution)

Maiden lane

Given figures

Discount Factor	5.00%	Affects the NPV
Commissioning minor changes	5.00%	

Option 4 **CHP, Boilers, pipework, HIU**

	Persentage Annual Increase	Year 0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Capital cost																																
Energy Centre																																
Boiler Plant		£ 250,000.00																				£ 250,000.00										
CHP Unit		£ 250,000.00															£250,000.00															£250,000.00
Pumps		£ 50,000.00																				£50,000.00										
Pipeworks		£ 150,000.00																									£ 150,000.00					
Controls		£ 200,000.00										£ 200,000.00										£ 200,000.00										£ 200,000.00
Electrical works associated		£ 100,000.00																				£ 100,000.00										
Upgrading																																
Boiler house vent		£ 20,000.00																														£ 20,000.00
Commissioning major changes		£ 27,000.00																				£ 27,000.00										
Commissioning minor changes		£ 51,000.00	£ -	£ -	£ -	£ -	£ -	£ -	£ -	£ -	£ -	£ 10,000.00	£ -	£ -	£ -	£ -	£ 12,500.00	£ -	£ -	£ -	£ -	£ 30,000.00	£ -	£ -	£ -	£ -	£ 7,500.00	£ -	£ -	£ -	£ -	£ 23,500.00
Distribution network																																
Pipework		£ 500,000.00																				£ 500,000.00										
Pumps		£ 50,000.00																				£ 50,000.00										
Civils		£ 250,000.00																														
Commissioning major changes		£ 24,000.00																				£ 24,000.00										
Commissioning minor changes		£ 27,500.00	£ -	£ -	£ -	£ -	£ -	£ -	£ -	£ -	£ -	£ -	£ -	£ -	£ -	£ -	£ -	£ -	£ -	£ -	£ -	£ 27,500.00	£ -	£ -	£ -	£ -	£ -	£ -	£ -	£ -	£ -	£ -
Apartments works																																
Heat Interface Unit (include metering per dwelling)		£ 1,197,500.00															£ 1,197,500.00															£ 1,197,500.00
Radiator Installation		£ 718,500.00																				£ 718,500.00										
Pipework		£ 958,000.00																									£ 958,000.00					
Controls		£ 479,000.00										£ 479,000.00										£ 479,000.00										£ 479,000.00
Heat metering (per block)		£ 260,700.00										£ 260,700.00										£ 260,700.00										£ 260,700.00
Electrical works associated		£ 479,000.00															£ 479,000.00															£ 479,000.00
Domestic Hot water		£ 718,500.00																									£718,500.00					
Commissioning major changes		£ 136,515.00																				£ 136,515.00										
Commissioning minor changes		£ 240,560.00	£ -	£ -	£ -	£ -	£ -	£ -	£ -	£ -	£ -	£ 36,985.00	£ -	£ -	£ -	£ -	£ 83,825.00	£ -	£ -	£ -	£ -	£ 72,910.00	£ -	£ -	£ -	£ -	£ 83,825.00	£ -	£ -	£ -	£ -	£ 120,810.00
Other																																
Preliminaries	12%	£856,533.00																				£351,135.00					£230,139.00					£363,661.20
Builderworks & minor redecoration	10%	£688,777.50																				£267,612.50					£191,782.50					£303,051.00
Design fees	7%	£524,601.56																				£211,908.20					£150,357.48					£220,091.98
Grants																																
MCW can be reused	£0.00	£0.00																														
Inflation	2.5%	100.000%	102.500%	105.063%	107.689%	110.381%	113.141%	115.969%	118.869%	121.840%	124.886%	128.008%	131.209%	134.489%	137.851%	141.297%	144.830%	148.451%	152.162%	155.966%	159.865%	163.862%	167.958%	172.157%	176.461%	180.873%	185.394%	190.029%	194.780%	199.650%	204.641%	209.757%
Capital cost inc. Inflation		£ 9,207,687.06	£ -	£ -	£ -	£ -	£ -	£ -	£ -	£ -	£ -	£ 1,283,040.22	£ -	£ -	£ -	£ -	£ 2,929,653.74	£ -	£ -	£ -	£ -	£ 6,155,922.62	£ -	£ -	£ -	£ -	£ 4,616,513.58	£ -	£ -	£ -	£ -	£ 8,216,831.23
Fuel cost		£ 232,049.78	£ 237,851.02	£ 243,797.30	£ 249,892.23	£ 256,139.53	£ 262,543.02	£ 269,106.60	£ 275,834.26	£ 282,730.12	£ 289,798.37	£ 297,043.33	£ 304,469.42	£ 312,081.15	£ 319,883.18	£ 327,880.26	£ 336,077.27	£ 344,479.20	£ 353,091.18	£ 361,918.46	£ 370,966.42	£ 380,240.58	£ 389,746.59	£ 399,490.26	£ 409,477.51	£ 419,714.45	£ 430,207.31	£ 440,962.50	£ 451,986.56	£ 463,286.22	£ 474,868.38	£ 486,740.09
Energy management change	-10.0%	£ -	£ 23,785.10	£ 24,379.73	£ 24,989.22	£ 25,613.95	£ 26,254.30	£ 26,910.66	£ 27,583.43	£ 28,273.01	£ 28,979.84	£ 29,704.33	£ 30,446.94	£ 31,208.12	£ 31,988.32	£ 32,788.03	£ 33,607.73	£ 34,447.92	£ 35,309.12	£ 36,191.85	£ 37,096.64	£ 38,024.06	£ 38,974.66	£ 39,949.03	£ 40,947.75	£ 41,971.45	£ 43,020.73	£ 44,096.25	£ 45,198.66	£ 46,328.62	£ 47,486.84	£ 48,674.01
Maintenance Cost	2.5%	£ 175,000.00	£ 179,375.00	£ 183,859.38	£ 188,455.86	£ 193,167.26	£ 197,996.44	£ 202,946.35	£ 208,020.01	£ 213,220.51	£ 218,551.02	£ 224,014.80	£ 229,615.17	£ 235,355.54	£ 241,239.43	£ 247,270.42	£ 253,452.18	£ 259,788.48	£ 266,283.20	£ 272,940.28	£ 279,763.78	£ 286,757.88	£ 293,926.82	£ 301,274.99	£ 308,806.87	£ 316,527.04	£ 324,440.22	£ 332,551.22	£ 340,865.00	£ 349,386.63	£ 358,121.29	£ 367,074.33
Net annual Cost/Surplus		**£ 9,614,736.84**	**£ 393,440.92**	**£ 403,276.94**	**£ 413,358.87**	**£ 423,692.84**	**£ 434,285.16**	**£ 445,142.29**	**£ 456,270.84**	**£ 467,677.62**	**£ 479,369.56**	**£ 1,754,394.01**	**£ 503,637.64**	**£ 516,228.58**	**£ 529,134.29**	**£ 542,362.65**	**£ 3,485,575.46**	**£ 569,819.76**	**£ 584,065.26**	**£ 598,666.89**	**£ 613,633.56**	**£ 6,784,897.02**	**£ 644,698.76**	**£ 660,816.23**	**£ 677,336.63**	**£ 694,270.05**	**£ 5,328,140.38**	**£ 729,417.47**	**£ 747,652.91**	**£ 766,344.23**	**£ 785,502.83**	**£ 9,021,971.63**
		£ 9,614,736.84	£ 374,705.64	£ 365,784.07	£ 357,074.93	£ 348,573.15	£ 340,273.78	£ 332,172.03	£ 324,263.17	£ 316,542.62	£ 309,005.89	£ 1,077,045.74	£ 294,466.50	£ 287,455.39	£ 280,611.21	£ 273,929.99	£ 1,676,621.39	£ 261,041.00	£ 254,825.74	£ 248,758.46	£ 242,835.64	£ 2,557,156.33	£ 231,409.70	£ 225,899.94	£ 220,521.37	£ 215,270.86	£ 1,573,414.62	£ 205,141.91	£ 200,257.57	£ 195,489.54	£ 190,835.02	£ 2,087,480.78
Net Present Valve		**£ 25,483,600.81**	**Summary**																													

Summary

	Year 0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Camden Economic options apparisal																															
Installation cost	**Included in the capital costs**																														
Maintenance cost	**£ 3,867,758.44**	£ 175,000.00	£ 170,833.33	£ 166,765.87	£ 162,795.26	£ 158,919.18	£ 155,135.39	£ 151,441.69	£ 147,835.94	£ 144,316.03	£ 140,879.94	£ 137,525.65	£ 134,251.23	£ 131,054.77	£ 127,934.42	£ 124,888.36	£ 121,914.83	£ 119,012.10	£ 116,178.48	£ 113,412.32	£ 110,712.03	£ 108,076.03	£ 105,502.79	£ 102,990.82	£ 100,538.66	£ 98,144.88	£ 95,808.10	£ 93,526.95	£ 91,300.12	£ 89,126.31	£ 87,004.25	£ 84,932.72
Plant replacement cost	**£ 16,976,859.92**	£ 9,207,687.06	£ -	£ -	£ -	£ -	£ -	£ -	£ -	£ -	£ -	£ 775,397.13	£ -	£ -	£ -	£ -	£ 1,409,213.54	£ -	£ -	£ -	£ -	£ 2,320,102.49	£ -	£ -	£ -	£ -	£ 1,363,269.26	£ -	£ -	£ -	£ -	£ 1,901,189.45
Fuel and other standing charges	**£ 5,128,642.74**	£ 232,049.78	£ 226,524.78	£ 221,131.33	£ 215,866.30	£ 210,726.63	£ 205,709.33	£ 200,811.49	£ 196,030.26	£ 191,362.87	£ 186,806.62	£ 182,358.84	£ 178,016.96	£ 173,778.46	£ 169,640.88	£ 165,601.81	£ 161,658.91	£ 157,809.89	£ 154,052.51	£ 150,384.59	£ 146,804.01	£ 143,308.68	£ 139,896.56	£ 136,565.69	£ 133,314.13	£ 130,139.98	£ 127,041.41	£ 124,016.62	£ 121,063.84	£ 118,181.37	£ 115,367.53	£ 112,620.68
Energy management change	**-£ 489,659.30**	£ -	-£ 22,652.48	-£ 22,113.13	-£ 21,586.63	-£ 21,072.66	-£ 20,570.93	-£ 20,081.15	-£ 19,603.03	-£ 19,136.29	-£ 18,680.66	-£ 18,235.88	-£ 17,801.70	-£ 17,377.85	-£ 16,964.09	-£ 16,560.18	-£ 16,165.89	-£ 15,780.99	-£ 15,405.25	-£ 15,038.46	-£ 14,680.40	-£ 14,330.87	-£ 13,989.66	-£ 13,656.57	-£ 13,331.41	-£ 13,014.00	-£ 12,704.14	-£ 12,401.66	-£ 12,106.38	-£ 11,818.14	-£ 11,536.75	-£ 11,262.07
Summary	**£ 25,483,600.81**																														

Assumptions

Number of dwellings	**479**
Number of blocks of apartments	**33**
Cost for one HIU (each dwelling)	**£ 2,500.00**
Cost for Radiator installation (each dwelling)	**£ 1,500.00**
Cost for pipework (each dwelling)	**£ 2,000.00**
Cost for control (each dwelling)	**£ 1,000.00**
Cost for Electrical works associated (each dw	**£ 1,000.00**
Cost for domestic hot water (each dwelling)	**£ 1,500.00**
Cost for commissioning (each dwelling)	**£ 285.00**
Cost heat meter eack block	**£ 7,900.00**

CHP costs

			Comment:
Operation hours	13	Hrs per day	
Electrical capacity	165	kWe	
Thermal capacity	286	kWth	
Fuel input	550	kW	
Electrical output	782,925	kWhe /yr	(Hrs per day x kWth x 365 days)
Thermal output	1,357,070	kWhth/yr	
Fuel consumed	2,609,750	kWh	
Gas tariff	0.02046	£	
Electricity tariff	0.08	£	
Gas cost	53,395	£	
Electricity generated	62,634	£	
Net costs	- 9,239	£	Saving by using 100% generated electricity onsite at Maiden Lane
Gas fuel using boiler only	1,507,856	kWh	Assumed 90% efficiency
Gas cost	30,851	£	

NPV Future valve x $\frac{1}{(1+i)^n}$

Year	PV of £1 (p6)	PV of £1 pa (p6)	EAC of £1 (p6)	1/(1+i)^
0	1.0000			1.0000
1	0.9524	0.9524	1.0500	0.9524
2	0.9070	1.8594	0.5378	0.9070
3	0.8638	2.7232	0.3672	0.8638
4	0.8227	3.5460	0.2820	0.8227
5	0.7835	4.3295	0.2310	0.7835
6	0.7462	5.0757	0.1970	0.7462
7	0.7107	5.7864	0.1728	0.7107
8	0.6768	6.4632	0.1547	0.6768
9	0.6446	7.1078	0.1407	0.6446
10	0.6139	7.7217	0.1295	0.6139
11	0.5847	8.3064	0.1204	0.5847
12	0.5568	8.8633	0.1128	0.5568
13	0.5303	9.3936	0.1065	0.5303
14	0.5051	9.8986	0.1010	0.5051
15	0.4810	10.3797	0.0963	0.4810
16	0.4581	10.8378	0.0923	0.4581
17	0.4363	11.2741	0.0887	0.4363
18	0.4155	11.6896	0.0855	0.4155
19	0.3957	12.0853	0.0827	0.3957
20	0.3769	12.4622	0.0802	0.3769
21	0.3589	12.8212	0.0780	0.3589
22	0.3418	13.1630	0.0760	0.3418
23	0.3256	13.4886	0.0741	0.3256
24	0.3101	13.7986	0.0725	0.3101
25	0.2953	14.0939	0.0710	0.2953
26	0.2812	14.3752	0.0696	0.2812
27	0.2678	14.6430	0.0683	0.2678
28	0.2551	14.8981	0.0671	0.2551
29	0.2429	15.1411	0.0660	0.2429
30	0.2314	15.3725	0.0651	0.2314

30 Year Costing (excluding Leaseholder Contribution)

Maiden lane

Given figures

Discount Factor	5.00%	Affects the NPV
Commissioning minor changes	5.00%	

Option 5 — GSHP, Boilers, pipework and HIU

	Persentage Annual Increase	Year 0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Capital cost																																
Energy Centre																																
Boiler Plant		£ 250,000.00																				£ 250,000.00										
pipework																																
Pumps		£ 50,000.00																				£50,000.00										
Pipeworks		£ 150,000.00																									£ 150,000.00					
Controls		£ 200,000.00										£ 200,000.00										£ 200,000.00										£ 200,000.00
Electrical works associated		£ 100,000.00																				£ 100,000.00										
GSHP		£ 900,000.00																				£ 900,000.00										
Boiler house vent		£ 20,000.00																														£ 20,000.00
Commissioning major changes		£ 27,000.00																				£ 27,000.00										
Commissioning minor changes		£ 83,500.00	£ -	£ -	£ -	£ -	£ -	£ -	£ -	£ -	£ -	£ 10,000.00	£ -	£ -	£ -	£ -	£ -	£ -	£ -	£ -	£ -	£ 75,000.00	£ -	£ -	£ -	£ -	£ 7,500.00	£ -	£ -	£ -	£ -	£ 11,000.00
Distribution network																																
Pipework		£ 500,000.00																				£ 500,000.00										
Pumps		£ 50,000.00																				£ 50,000.00										
Civils		£ 250,000.00																														
Commissioning major changes		£ 24,000.00																				£ 24,000.00										
Commissioning minor changes		£ 27,500.00	£ -	£ -	£ -	£ -	£ -	£ -	£ -	£ -	£ -	£ -	£ -	£ -	£ -	£ -	£ -	£ -	£ -	£ -	£ -	£ 27,500.00	£ -	£ -	£ -	£ -	£ -	£ -	£ -	£ -	£ -	£ -
Apartments works																																
Heat Interface Unit (include metering per dwelling)		£ 1,197,500.00															£ 1,197,500.00															£ 1,197,500.00
Radiator Installation		£ 718,500.00																				£ 718,500.00										
Pipework		£ 958,000.00																									£ 958,000.00					
Controls		£ 479,000.00										£ 479,000.00										£ 479,000.00										£ 479,000.00
Heat metering (per block)		£ 260,700.00										£ 260,700.00										£ 260,700.00										£ 260,700.00
Electrical works associated		£ 479,000.00															£ 479,000.00															£ 479,000.00
Domestic Hot water		£ 718,500.00																									£718,500.00					
Commissioning major changes		£ 136,515.00																				£ 136,515.00										
Commissioning minor changes		£ 240,560.00	£ -	£ -	£ -	£ -	£ -	£ -	£ -	£ -	£ -	£ 36,985.00	£ -	£ -	£ -	£ -	£ -	£ -	£ 83,825.00	£ -	£ -	£ -	£ -	£ 72,910.00	£ -	£ -	£ -	£ -	£ 83,825.00	£ -	£ -	£ -	£ 120,810.00
Other																																
Preliminaries	12%	£938,433.00																				£464,535.00					£230,139.00					£332,161.20
Builderworks & minor redecoration	10%	£757,027.50																				£362,112.50					£191,782.50					£276,801.00
Design fees	7%	£595,629.56																				£285,996.20					£150,357.48					£217,011.98
Grants for the GSHP		-£64,440.00	-£66,051.00	-£67,702.28	-£69,394.83	-£71,129.70	-£72,907.95	-£74,730.64	-£76,598.91	-£78,513.88	-£80,476.73	-£82,488.65	-£84,550.86	-£86,664.64	-£88,831.25	-£91,052.03	-£93,328.33	-£95,661.54	-£98,053.08	-£100,504.41	-£103,017.02	-£105,592.44	£0.00	£0.00	£0.00	£0.00	£0.00	£0.00	£0.00	£0.00	£0.00	£0.00	£0.00
Use onsite - GSHP generated heat		£0.00	£0.00	£0.00	£0.00	£0.00	£0.00	£0.00	£0.00	£0.00	£0.00	£0.00	£0.00	£0.00	£0.00	£0.00	£0.00	£0.00	£0.00	£0.00	£0.00	£0.00	£0.00	£0.00	£0.00	£0.00	£0.00	£0.00	£0.00	£0.00	£0.00	£0.00
Use offsite (exported) - GSHP generated heat		£0.00	£0.00	£0.00	£0.00	£0.00	£0.00	£0.00	£0.00	£0.00	£0.00	£0.00	£0.00	£0.00	£0.00	£0.00	£0.00	£0.00	£0.00	£0.00	£0.00	£0.00	£0.00	£0.00	£0.00	£0.00	£0.00	£0.00	£0.00	£0.00	£0.00	£0.00
MCW can be reused	£0.00	£0.00																														
Inflation	2.5%	100.000%	102.500%	105.063%	107.689%	110.381%	113.141%	115.969%	118.869%	121.840%	124.886%	128.008%	131.209%	134.489%	137.851%	141.297%	144.830%	148.451%	152.162%	155.966%	159.865%	163.862%	167.958%	172.157%	176.461%	180.873%	185.394%	190.029%	194.780%	199.650%	204.641%	209.757%
Capital cost inc. Inflation		£ 10,111,345.06	£ -	£ -	£ -	£ -	£ -	£ -	£ -	£ -	£ -	£ 1,263,040.22	£ -	£ -	£ -	£ -	£ 2,549,475.47	£ -	£ -	£ -	£ -	£ 8,166,485.33	£ -	£ -	£ -	£ -	£ 4,616,513.58	£ -	£ -	£ -	£ -	£ 7,538,624.70
Fuel cost		£ 176,848.29	£ 179,618.22	£ 182,373.81	£ 185,110.46	£ 187,823.24	£ 190,506.91	£ 193,155.81	£ 195,763.92	£ 198,324.81	£ 200,831.60	£ 203,276.97	£ 205,653.09	£ 207,951.63	£ 210,163.71	£ 212,279.90	£ 214,290.14	£ 216,183.73	£ 217,949.31	£ 219,574.81	£ 221,047.40	£ 222,353.45	£ 405,263.44	£ 415,395.02	£ 425,779.90	£ 436,424.39	£ 447,335.00	£ 458,518.38	£ 469,981.34	£ 481,730.87	£ 493,774.14	£ 506,118.50
Energy management change	-10.0%	£ -	-£ 17,961.82	-£ 18,237.38	-£ 18,511.05	-£ 18,782.32	-£ 19,050.69	-£ 19,315.58	-£ 19,576.39	-£ 19,832.48	-£ 20,083.16	-£ 20,327.70	-£ 20,565.31	-£ 20,795.16	-£ 21,016.37	-£ 21,227.99	-£ 21,429.01	-£ 21,618.37	-£ 21,794.93	-£ 21,957.48	-£ 22,104.74	-£ 22,235.34	-£ 40,526.34	-£ 41,539.50	-£ 42,577.99	-£ 43,642.44	-£ 44,733.50	-£ 45,851.84	-£ 46,998.13	-£ 48,173.09	-£ 49,377.41	-£ 50,611.85
Maintenance Cost	2.5%	£ 160,000.00	£ 164,000.00	£ 168,100.00	£ 172,302.50	£ 176,610.06	£ 181,025.31	£ 185,550.95	£ 190,189.72	£ 194,944.46	£ 199,818.08	£ 204,813.53	£ 209,933.87	£ 215,182.21	£ 220,561.77	£ 226,075.81	£ 231,727.71	£ 237,520.90	£ 243,458.92	£ 249,545.39	£ 255,784.03	£ 262,178.63	£ 268,733.10	£ 275,451.42	£ 282,337.71	£ 289,396.15	£ 296,631.06	£ 304,046.83	£ 311,648.00	£ 319,439.20	£ 327,425.18	£ 335,610.81
Net annual Cost/Surplus		**£ 10,448,193.35**	**£ 325,656.40**	**£ 332,236.43**	**£ 338,901.91**	**£ 345,650.98**	**£ 352,481.53**	**£ 359,391.17**	**£ 366,377.25**	**£ 373,436.79**	**£ 380,566.52**	**£ 1,650,803.02**	**£ 395,021.64**	**£ 402,338.68**	**£ 409,709.11**	**£ 417,127.72**	**£ 2,974,064.30**	**£ 432,086.25**	**£ 439,613.30**	**£ 447,162.73**	**£ 454,726.69**	**£ 8,628,782.06**	**£ 633,470.19**	**£ 649,306.94**	**£ 665,539.62**	**£ 682,178.11**	**£ 5,315,746.14**	**£ 716,713.37**	**£ 734,631.21**	**£ 752,996.99**	**£ 771,821.91**	**£ 8,329,742.16**
		£ 10,448,193.35	£ 310,148.95	£ 301,348.23	£ 292,756.21	£ 284,367.92	£ 276,178.50	£ 268,183.23	£ 260,377.47	£ 252,756.72	£ 245,316.57	£ 1,013,449.85	£ 230,960.97	£ 224,037.23	£ 217,277.49	£ 210,677.84	£ 1,430,575.78	£ 197,943.69	£ 191,801.83	£ 185,805.35	£ 179,950.79	£ 3,252,097.21	£ 227,379.29	£ 221,965.49	£ 216,680.60	£ 211,521.54	£ 1,569,754.57	£ 201,569.00	£ 196,769.73	£ 192,084.74	£ 187,511.29	£ 1,927,314.49
Net Present Valve		**£ 25,426,755.94**	**Summary**																													

Summary

Year		0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Camden Economic options apparisal																																
Installation cost	**Included in the capital costs**																															
Maintenance cost	**£ 3,536,236.28**	£ 160,000.00	£ 156,190.48	£ 152,471.66	£ 148,841.38	£ 145,297.54	£ 141,838.07	£ 138,460.97	£ 135,164.28	£ 131,946.09	£ 128,804.51	£ 125,737.74	£ 122,743.98	£ 119,821.51	£ 116,968.61	£ 114,183.65	£ 111,464.99	£ 108,811.06	£ 106,220.32	£ 103,691.27	£ 101,222.43	£ 98,812.37	£ 96,459.69	£ 94,163.03	£ 91,921.06	£ 89,732.46	£ 87,595.97	£ 85,510.35	£ 83,474.39	£ 81,486.91	£ 79,546.74	£ 77,652.77
Plant replacement cost	**£ 18,296,482.92**	£ 10,111,345.06	£ -	£ -	£ -	£ -	£ -	£ -	£ -	£ -	£ -	£ 775,397.13	£ -	£ -	£ -	£ -	£ 1,226,341.29	£ -	£ -	£ -	£ -	£ 3,077,862.43	£ -	£ -	£ -	£ -	£ 1,363,269.26	£ -	£ -	£ -	£ 1,744,267.75
Fuel and other standing charges	**£ 3,971,502.12**	£ 176,848.29	£ 171,064.97	£ 165,418.42	£ 159,905.37	£ 154,522.65	£ 149,267.15	£ 144,135.84	£ 139,125.76	£ 134,234.04	£ 129,457.84	£ 124,794.43	£ 120,241.10	£ 115,795.25	£ 111,454.30	£ 107,215.77	£ 103,077.22	£ 99,036.26	£ 95,090.56	£ 91,237.87	£ 87,475.96	£ 83,802.68	£ 145,466.22	£ 142,002.73	£ 138,621.72	£ 135,321.20	£ 132,099.27	£ 128,954.05	£ 125,883.71	£ 122,886.48	£ 119,960.61	£ 117,104.41
Energy management change	**-£ 379,465.38**	£ -	-£ 17,106.50	-£ 16,541.84	-£ 15,990.54	-£ 15,452.26	-£ 14,926.71	-£ 14,413.58	-£ 13,912.58	-£ 13,423.40	-£ 12,945.78	-£ 12,479.44	-£ 12,024.11	-£ 11,579.52	-£ 11,145.43	-£ 10,721.58	-£ 10,307.72	-£ 9,903.63	-£ 9,509.06	-£ 9,123.79	-£ 8,747.60	-£ 8,380.27	-£ 14,546.62	-£ 14,200.27	-£ 13,862.17	-£ 13,532.12	-£ 13,209.93	-£ 12,895.40	-£ 12,588.37	-£ 12,288.65	-£ 11,996.06	-£ 11,710.44
Summary	**£ 25,426,755.94**																															

Assumptions

Number of dwellings		**479**
Number of blocks of apartments		**33**
Cost for one HIU (each dwelling)	**£**	**2,500.00**
Cost for Radiator installation (each dwelling)	**£**	**1,500.00**
Cost for pipework (each dwelling)	**£**	**2,000.00**
Cost for control (each dwelling)	**£**	**1,000.00**
Cost for Electrical works associated (each dwell	**£**	**1,000.00**
Cost for domestic hot water (each dwelling)	**£**	**1,500.00**
Cost for commissioning (each dwelling)	**£**	**285.00**
Cost heat meter eack block	**£**	**7,900.00**

Grants

PV			Homepages
Grants, Solar PV per kWh	**£**	**0.0175**	Based on "Tariffs payable per kWh of electricity produced" on Feed-in-tariffs homepage 11/10/2016 — http://www.fitariffs.co.uk/eligible/levels/
Panel area PV m²		**210**	Based on PV array installed on Block 10 which has a total roof area of approximately 462m2 and estimated 30kW electrical baseload for the energy centre
Capacity of the PV kW		**30**	Panel area divided by 7kW/m² source previous projects McBainsCooper.
Capacity of the PV kWh/year		**22500**	Based on 750kWh/kW Source: BSRIA Illustrated Guide to renewables
Use onsite - PV generated electricity		**4500**	Based on 20% of total kWh
Grant Use onsite - PV generated electricity	**£**	**0.100**	per kWh
Use offsite (exported) - PV generated electricity		**18000**	Based on 80% of total kWh
Used offsite (exported) - PV generated electricity	**£**	**0.04390**	per kWh
GSHP			
Grants GSHP, per kWh	**£**	**0.0895**	Based on "Tariffs and payments:Non Domestic RHI" from Ofgem's homepage 11/10/2016 — https://www.ofgem.gov.uk/environmental-programmes/non-domestic-rhi/contacts-guidance-and-resources/tariffs-and-payments-non-domestic-rhi
GSHP, kW		**600**	Based on information from Genius Energy Lab - 2016 — http://www.geniusenergylab.com/
GSHP, hours per year		**1200**	Based on 5 months per (30 days) per year, 8 hours a day
GSHP kWh per year		**720000**	
Use onsite - GSHP generated heat		**720000**	Based on 100% of total kWh
Grant Use onsite - GSHP generated heat	**£**	**-**	per kWh
Use offsite (exported) - GSHP generated heat		**0**	Based on 0% of total kWh
Used offsite (exported) - GSHP generated heat	**£**	**0.04390**	per kWh
Cost for GSHP/kW	**£**	**1,500**	Source: Report "Heat pumps in Distict Heating" 2016
			Source: Report "Heat pumps in Distict Heating" 2016

Please note that the RHI only lasts 20 years

It is our understanding that the system will be classed as "Non Domestic" system given that it serves multiple dwellings and not a single private house.

NPV — Future valve x $\frac{1}{(1+r)^n}$

Year	PV of £1 (p8)	PV of £1 pa (p8)	EAC of £1 (p8)	1/(1+r)^
0	1.0000			1.0000
1	0.9524	0.9524	1.0500	0.9524
2	0.9070	1.8594	0.5378	0.9070
3	0.8638	2.7232	0.3672	0.8638
4	0.8227	3.5460	0.2820	0.8227
5	0.7835	4.3295	0.2310	0.7835
6	0.7462	5.0757	0.1970	0.7462
7	0.7107	5.7864	0.1728	0.7107
8	0.6768	6.4632	0.1547	0.6768
9	0.6446	7.1078	0.1407	0.6446
10	0.6139	7.7217	0.1295	0.6139
11	0.5847	8.3064	0.1204	0.5847
12	0.5568	8.8633	0.1128	0.5568
13	0.5303	9.3936	0.1065	0.5303
14	0.5051	9.8986	0.1010	0.5051
15	0.4810	10.3797	0.0963	0.4810
16	0.4581	10.8378	0.0923	0.4581
17	0.4363	11.2741	0.0887	0.4363
18	0.4155	11.6896	0.0855	0.4155
19	0.3957	12.0853	0.0827	0.3957
20	0.3769	12.4622	0.0802	0.3769
21	0.3589	12.8212	0.0780	0.3589
22	0.3418	13.1630	0.0760	0.3418
23	0.3256	13.4886	0.0741	0.3256
24	0.3101	13.7986	0.0725	0.3101
25	0.2953	14.0939	0.0710	0.2953
26	0.2812	14.3752	0.0696	0.2812
27	0.2678	14.6430	0.0683	0.2678
28	0.2551	14.8981	0.0671	0.2551
29	0.2429	15.1411	0.0660	0.2429
30	0.2314	15.3725	0.0651	0.2314

30 Year Costing (excluding Leaseholder Contribution)

Maiden lane

Given figures

Discount Factor	5.00%	Affects the NPV
Commissioning minor changes	5.00%	

Option 6 — PV, Boilers, pipework and HIU

	Percentage Annual Increase	Year 0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Capital cost																																
Energy Centre																																
Boiler Plant		£ 250,000.00																				£ 250,000.00										
part-used																																
Pumps		£ 50,000.00																				£50,000.00										
Pipeworks		£ 150,000.00																									£ 150,000.00					
Controls		£ 200,000.00										£ 200,000.00										£ 200,000.00										£ 200,000.00
Electrical works associated		£ 100,000.00																				£ 100,000.00										
PV		£ 39,000.00																									£ 39,000.00					
Boiler house vent		£ 20,000.00																														£ 20,000.00
Commissioning major changes		£ 27,000.00																				£ 27,000.00										
Commissioning minor changes		£ 40,450.00	£ -	£ -	£ -	£ -	£ -	£ -	£ -	£ -	£ -	£ 10,000.00	£ -	£ -	£ -	£ -	£ -	£ -	£ -	£ -	£ -	£ 30,000.00	£ -	£ -	£ -	£ -	£ 9,450.00	£ -	£ -	£ -	£ -	£ 11,000.00
Distribution network																																
Pipework		£ 500,000.00																				£ 500,000.00										
Pumps		£ 50,000.00																				£ 50,000.00										
Civils		£ 250,000.00																														
Commissioning major changes		£ 24,000.00																				£ 24,000.00										
Commissioning minor changes		£ 27,500.00	£ -	£ -	£ -	£ -	£ -	£ -	£ -	£ -	£ -	£ -	£ -	£ -	£ -	£ -	£ -	£ -	£ -	£ -	£ -	£ 27,500.00	£ -	£ -	£ -	£ -	£ -	£ -	£ -	£ -	£ -	£ -
Apartments works																																
Heat Interface Unit (include metering per dwelling)		£ 1,197,500.00															£ 1,197,500.00															£ 1,197,500.00
Radiator Installation		£ 718,500.00																				£ 718,500.00										
Pipework		£ 958,000.00																									£ 958,000.00					
Controls		£ 479,000.00										£ 479,000.00										£ 479,000.00										£ 479,000.00
Heat metering (per block)		£ 260,700.00										£ 260,700.00										£ 260,700.00										£ 260,700.00
Electrical works associated		£ 479,000.00															£ 479,000.00															£ 479,000.00
Domestic Hot water		£ 718,500.00																									£718,500.00					
Commissioning major changes		£ 136,515.00																				£ 136,515.00										
Commissioning minor changes		£ 240,560.00	£ -	£ -	£ -	£ -	£ -	£ -	£ -	£ -	£ -	£ 36,985.00	£ -	£ -	£ -	£ -	£ 83,825.00	£ -	£ -	£ -	£ -	£ 72,910.00	£ -	£ -	£ -	£ -	£ 83,825.00	£ -	£ -	£ -	£ -	£ 120,810.00
Other																																
Preliminaries	12%	£829,947.00																				£351,135.00					£235,053.00					£332,161.20
Builderworks & minor redecoration	10%	£666,622.50																				£267,612.50					£195,877.50					£276,801.00
Design fees	7%	£524,732.04																				£211,908.20					£153,567.96					£217,011.98
Grants - PV generated electricity (Feed in tariff)		-£393.75	-£403.59	-£413.68	-£424.03	-£434.63	-£445.49	-£456.63	-£468.05	-£479.75	-£491.74	-£504.03	-£516.63	-£529.55	-£542.79	-£556.36	-£570.27	-£584.52	-£599.14	-£614.12	-£629.47	-£645.21	£0.00	£0.00	£0.00	£0.00	£0.00	£0.00	£0.00	£0.00	£0.00	£0.00
Use onsite - PV generated electricity		-£450.00	-£461.25	-£472.78	-£484.60	-£496.72	-£509.13	-£521.86	-£534.91	-£548.28	-£561.99	-£576.04	-£590.44	-£605.20	-£620.33	-£635.84	-£651.73	-£668.03	-£684.73	-£701.85	-£719.39	-£737.38	-£755.81	-£774.71	-£794.07	-£813.93	-£834.27	-£855.13	-£876.51	-£898.42	-£920.88	-£943.91
Use offsite (exported) - PV generated electricity		-£790.20	-£809.96	-£830.20	-£850.96	-£872.23	-£894.04	-£916.39	-£939.30	-£962.78	-£986.85	-£1,011.52	-£1,036.81	-£1,062.73	-£1,089.30	-£1,116.53	-£1,144.45	-£1,173.06	-£1,202.38	-£1,232.44	-£1,263.25	-£1,294.83	-£1,327.21	-£1,360.39	-£1,394.40	-£1,429.26	-£1,464.99	-£1,501.61	-£1,539.15	-£1,577.63	-£1,617.07	-£1,657.50
MCW can be reused	£0.00	£0.00																														
Inflation	2.5%	100.000%	102.500%	105.063%	107.689%	110.381%	113.141%	115.969%	118.869%	121.840%	124.886%	128.008%	131.209%	134.489%	137.851%	141.297%	144.830%	148.451%	152.162%	155.966%	159.865%	163.862%	167.958%	172.157%	176.461%	180.873%	185.394%	190.029%	194.780%	199.650%	204.641%	209.757%
Capital cost inc. Inflation		£ 8,937,526.54	£ -	£ -	£ -	£ -	£ -	£ -	£ -	£ -	£ -	£ 1,263,040.22	£ -	£ -	£ -	£ -	£ 2,549,475.47	£ -	£ -	£ -	£ -	£ 6,155,922.62	£ -	£ -	£ -	£ -	£ 4,715,086.82	£ -	£ -	£ -	£ -	£ 7,538,624.70
Fuel cost		£ 239,654.34	£ 245,603.83	£ 251,699.94	£ 257,946.22	£ 264,346.32	£ 270,903.96	£ 277,622.96	£ 284,507.23	£ 291,560.75	£ 298,787.61	£ 306,192.00	£ 313,778.19	£ 321,550.56	£ 329,513.59	£ 337,671.87	£ 346,030.07	£ 354,593.00	£ 363,365.55	£ 372,352.75	£ 381,559.71	£ 390,991.70	£ 401,764.84	£ 411,719.31	£ 421,918.10	£ 432,367.09	£ 443,072.30	£ 454,039.88	£ 465,276.11	£ 476,787.44	£ 488,580.46	£ 500,661.88
Energy management change	-10.0%	£ -	-£ 24,560.38	-£ 25,169.99	-£ 25,794.62	-£ 26,434.63	-£ 27,090.40	-£ 27,762.30	-£ 28,450.72	-£ 29,156.07	-£ 29,878.76	-£ 30,619.20	-£ 31,377.82	-£ 32,155.06	-£ 32,951.36	-£ 33,767.19	-£ 34,603.01	-£ 35,459.30	-£ 36,336.55	-£ 37,235.27	-£ 38,155.97	-£ 39,099.17	-£ 40,176.48	-£ 41,171.93	-£ 42,191.81	-£ 43,236.71	-£ 44,307.23	-£ 45,403.99	-£ 46,527.61	-£ 47,678.74	-£ 48,858.05	-£ 50,065.19
Maintenance Cost	2.5%	£ 150,000.00	£ 153,750.00	£ 157,593.75	£ 161,533.59	£ 165,571.93	£ 169,711.23	£ 173,954.01	£ 178,302.86	£ 182,760.43	£ 187,329.45	£ 192,012.68	£ 196,813.00	£ 201,733.32	£ 206,776.66	£ 211,946.07	£ 217,244.72	£ 222,675.84	£ 228,242.74	£ 233,948.81	£ 239,797.53	£ 245,792.47	£ 251,937.28	£ 258,235.71	£ 264,691.60	£ 271,308.89	£ 278,091.61	£ 285,043.91	£ 292,170.00	£ 299,474.25	£ 306,961.11	£ 314,635.14
Net annual Cost/Surplus		**£ 9,327,180.88**	**£ 374,793.45**	**£ 384,123.69**	**£ 393,685.19**	**£ 403,483.62**	**£ 413,524.80**	**£ 423,814.68**	**£ 434,359.37**	**£ 445,165.11**	**£ 456,238.29**	**£ 1,730,625.70**	**£ 479,213.37**	**£ 491,128.83**	**£ 503,338.89**	**£ 515,850.75**	**£ 3,078,147.26**	**£ 541,809.54**	**£ 555,271.73**	**£ 569,066.28**	**£ 583,201.27**	**£ 6,753,607.61**	**£ 613,525.63**	**£ 628,783.09**	**£ 644,417.89**	**£ 660,439.28**	**£ 5,391,943.51**	**£ 693,679.79**	**£ 710,918.50**	**£ 728,582.95**	**£ 746,683.52**	**£ 8,303,855.53**
		£ 9,327,180.88	£ 356,946.14	£ 348,411.51	£ 340,080.07	£ 331,946.97	£ 324,007.50	£ 316,257.04	£ 308,691.09	£ 301,305.27	£ 294,095.27	£ 1,062,454.05	£ 280,186.13	£ 273,478.91	£ 266,931.36	£ 260,539.68	£ 1,480,641.46	£ 248,209.19	£ 242,263.22	£ 236,458.79	£ 230,792.55	£ 2,545,363.68	£ 220,220.34	£ 214,949.42	£ 209,803.97	£ 204,781.03	£ 1,592,255.86	£ 195,091.02	£ 190,418.33	£ 185,856.88	£ 181,404.01	£ 1,921,324.91
Net Present Valve		**£ 24,492,346.53**	**Summary**																													

Summary

Camden Economic options appraisal		Year 0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Installation cost	**Included in the capital costs**																															
Maintenance cost	**£ 3,315,221.52**	£ 150,000.00	£ 146,428.57	£ 142,942.18	£ 139,538.79	£ 136,216.44	£ 132,973.19	£ 129,807.16	£ 126,716.52	£ 123,699.46	£ 120,754.23	£ 117,879.13	£ 115,072.48	£ 112,332.66	£ 109,658.08	£ 107,047.17	£ 104,498.43	£ 102,010.37	£ 99,581.55	£ 97,210.56	£ 94,896.02	£ 92,636.60	£ 90,430.96	£ 88,277.84	£ 86,175.99	£ 84,124.18	£ 82,121.22	£ 80,165.96	£ 78,257.24	£ 76,393.98	£ 74,575.07	£ 72,799.48
Plant replacement cost	**£ 16,396,013.41**	£ 8,937,526.54	£ -	£ -	£ -	£ -	£ -	£ -	£ -	£ -	£ -	£ 775,397.13	£ -	£ -	£ -	£ -	£ 1,226,341.29	£ -	£ -	£ -	£ -	£ 2,320,102.49	£ -	£ -	£ -	£ -	£ 1,392,378.21	£ -	£ -	£ -	£ 1,744,267.75
Fuel and other standing charges	**£ 5,285,717.96**	£ 239,654.34	£ 233,908.41	£ 228,299.26	£ 222,823.64	£ 217,478.37	£ 212,260.34	£ 207,166.53	£ 202,193.97	£ 197,339.79	£ 192,601.16	£ 187,975.32	£ 183,459.61	£ 179,051.38	£ 174,748.09	£ 170,547.24	£ 166,446.38	£ 162,443.14	£ 158,535.19	£ 154,720.26	£ 150,996.14	£ 147,360.66	£ 144,210.42	£ 140,746.19	£ 137,364.43	£ 134,063.16	£ 130,840.48	£ 127,694.51	£ 124,623.42	£ 121,625.44	£ 118,698.82	£ 115,841.87
Energy management change	-£ 504,606.36	£ -	-£ 23,390.84	-£ 22,829.93	-£ 22,282.36	-£ 21,747.84	-£ 21,226.03	-£ 20,716.65	-£ 20,219.40	-£ 19,733.98	-£ 19,260.12	-£ 18,797.53	-£ 18,345.96	-£ 17,905.14	-£ 17,474.81	-£ 17,054.72	-£ 16,644.64	-£ 16,244.31	-£ 15,853.52	-£ 15,472.03	-£ 15,099.61	-£ 14,736.07	-£ 14,421.04	-£ 14,074.62	-£ 13,736.44	-£ 13,406.32	-£ 13,084.05	-£ 12,769.45	-£ 12,462.34	-£ 12,162.54	-£ 11,869.88	-£ 11,584.19
Summary	**£ 24,492,346.53**																															

Assumptions

Number of dwellings		**479**
Number of blocks of apartments		**33**
Cost for one HIU (each dwelling)	£	**2,500.00**
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Cost for pipework (each dwelling)	£	**2,000.00**
Cost for control (each dwelling)	£	**1,000.00**
Cost for Electrical works associated (each dwe	£	**1,000.00**
Cost for domestic hot water (each dwelling)	£	**1,500.00**
Cost for commissioning (each dwelling)	£	**285.00**
Cost heat meter eack block	£	**7,900.00**
Cost installaton of PV £/m²	£	**1,300.00**

Grants

PV

Grants, Solar PV per kWh	£	**0.0175**	Based on "Tariffs payable per kWh of electricity produced" on Feed-in-tariffs homepage 11/10/2016
Panel area PV m²		**210**	Based on PV array installed on Block 10 which has a total roof area of approximately 462m2 and estimated 30kW electrical baseload for the energy centre
Capacity of the PV kW		**30**	Panel area divided by 7kW/m² source previous projects McBainsCooper.
Capacity of the PV kWh		**22500**	Based on 750kWh/kW Source: BSRIA Illustrated Guide to renewables
Use onsite - PV generated electricity		**4500**	Based on 20% of total Capacity kWh
Grant Use onsite - PV generated electricity	£	**0.100**	per kW
Use offsite (exported) - PV generated electricity		**18000**	Based on 80% of total Capacity kWh
Grant Use offsite (exported) - PV generated ele	£	**0.04390**	per kW

Homepages

http://www.fitariffs.co.uk/eligible/levels/

GSHP

Grants GSHP, per kWh	£	**0.0895**	Based on "Tariffs and payments:Non Domestic RHI" from Ofgem's homepage 11/10/2016
GSHP, kW		**600**	Based on information from Genius Energy Lab - 2016
GSHP, hours per year		**1200**	Based on 5 months per (30 days) per year, 8 hours a day
GSHP kWh per year		**720000**	
Use onsite - GSHP generated heat		**720000**	Based on 100% of total Capacity kWh
Grant Use onsite - GSHP generated heat	£	**-**	per kWh
Use offsite (exported) - GSHP generated heat		**0**	Based on 0% of total Capacity kWh
Grant Use offsite (exported) - GSHP generated	£	**0.04390**	per kWh
Cost for GSHP/kW	£	**1,500**	Source: Report "Heat pumps in Distict Heating" 2016

https://www.ofgem.gov.uk/environmental-programmes/non-domestic-rhi/contacts-guidance-and-resources/tariffs-and-payments-non-domestic-rhi

http://www.geniusenergylab.com/

Please note that the PV Feed in tariffs only lasts 25 years

NPV — Future valve x $\frac{1}{(1+r)^n}$

Year	PV of £1 (p6)	PV of £1 pa (p6)	EAC of £1 (p6)	$1/(1+i)^t$
0	1.0000			1.0000
1	0.9524	0.9524	1.0500	0.9524
2	0.9070	1.8594	0.5378	0.9070
3	0.8638	2.7232	0.3672	0.8638
4	0.8227	3.5460	0.2820	0.8227
5	0.7835	4.3295	0.2310	0.7835
6	0.7462	5.0757	0.1970	0.7462
7	0.7107	5.7864	0.1728	0.7107
8	0.6768	6.4632	0.1547	0.6768
9	0.6446	7.1078	0.1407	0.6446
10	0.6139	7.7217	0.1295	0.6139
11	0.5847	8.3064	0.1204	0.5847
12	0.5568	8.8633	0.1128	0.5568
13	0.5303	9.3936	0.1065	0.5303
14	0.5051	9.8986	0.1010	0.5051
15	0.4810	10.3797	0.0963	0.4810
16	0.4581	10.8378	0.0923	0.4581
17	0.4363	11.2741	0.0887	0.4363
18	0.4155	11.6896	0.0855	0.4155
19	0.3957	12.0853	0.0827	0.3957
20	0.3769	12.4622	0.0802	0.3769
21	0.3589	12.8212	0.0780	0.3589
22	0.3418	13.1630	0.0760	0.3418
23	0.3256	13.4886	0.0741	0.3256
24	0.3101	13.7986	0.0725	0.3101
25	0.2953	14.0939	0.0710	0.2953
26	0.2812	14.3752	0.0696	0.2812
27	0.2678	14.6430	0.0683	0.2678
28	0.2551	14.8981	0.0671	0.2551
29	0.2429	15.1411	0.0660	0.2429
30	0.2314	15.3725	0.0651	0.2314

30 Year Costing (excluding Leaseholder Contribution)

Maiden lane

Given figures

Discount Factor	5.00%	Affects the NPV
Commissioning minor changes	5.00%	

Option 3a — Boilers, pipework, HIU including Add ons

	Persentage Annual Increase	Year 0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Capital cost																																
Energy Centre																																
Boiler Plant		£ 250,000.00																				£ 250,000.00										
pipework																																
Pumps		£ 50,000.00																				£50,000.00										
Pipeworks		£ 150,000.00																									£ 150,000.00					
Controls		£ 200,000.00										£ 200,000.00										£ 200,000.00										£ 200,000.00
Electrical works associated		£ 100,000.00																				£ 100,000.00										
cladding																																
Boiler house vent		£ 20,000.00																														£ 20,000.00
Commissioning major changes		£ 27,000.00																				£ 27,000.00										
Commissioning minor changes		£ 38,500.00	£ -	£ -	£ -	£ -	£ -	£ -	£ -	£ -	£ -	£ 10,000.00	£ -	£ -	£ -	£ -	£ -	£ -	£ -	£ -	£ -	£ 30,000.00	£ -	£ -	£ -	£ -	£ 7,500.00	£ -	£ -	£ -	£ -	£ 11,000.00
Distribution network																																
Pipework		£ 500,000.00																				£ 500,000.00										
Pumps		£ 50,000.00																				£ 50,000.00										
Civils		£ 250,000.00																														
Commissioning major changes		£ 24,000.00																				£ 24,000.00										
Commissioning minor changes		£ 27,500.00	£ -	£ -	£ -	£ -	£ -	£ -	£ -	£ -	£ -	£ -	£ -	£ -	£ -	£ -	£ -	£ -	£ -	£ -	£ -	£ 27,500.00	£ -	£ -	£ -	£ -	£ -	£ -	£ -	£ -	£ -	£ -
Apartments works																																
Heat Interface Unit (include metering per dwelling)		£ 1,197,500.00															£ 1,197,500.00															£ 1,197,500.00
Radiator Installation		£ 718,500.00																				£ 718,500.00										
Pipework		£ 958,000.00																									£ 958,000.00					
Controls		£ 479,000.00										£ 479,000.00										£ 479,000.00										£ 479,000.00
Heat metering (per block)		£ 260,700.00										£ 260,700.00										£ 260,700.00										£ 260,700.00
Electrical works associated		£ 479,000.00															£ 479,000.00															£ 479,000.00
Domestic Hot water		£ 718,500.00																									£718,500.00					
Commissioning major changes		£ 136,515.00																				£ 136,515.00										
Commissioning minor changes		£ 240,560.00	£ -	£ -	£ -	£ -	£ -	£ -	£ -	£ -	£ -	£ 36,985.00	£ -	£ -	£ -	£ -	£ -	£ -	£ 83,825.00	£ -	£ -	£ 72,910.00	£ -	£ -	£ -	£ -	£ 83,825.00	£ -	£ -	£ -	£ -	£ 120,810.00
Add-ons																																
Pressure valves on incoming water		£ 239,500.00																				£ 239,500.00										
Replacement Mains cold water supply		£ 94,800.00																														
Additional pipework and valves for link between Phase 2 and Phase 1		£ 100,000.00																														
Other																																
Preliminaries	12%	£877,125.00																				£379,875.00					£230,139.00					£332,161.20
Builderworks & minor redecoration	10%	£705,937.50																				£291,562.50					£191,782.50					£276,801.00
Design fees	7%	£555,555.00																				£230,685.00					£150,357.48					£217,071.98
Gassite																																
MCW can be reused	£0.00	£0.00																														
Inflation	2.5%	100.000%	102.500%	105.063%	107.689%	110.381%	113.141%	115.969%	118.869%	121.840%	124.886%	128.008%	131.209%	134.489%	137.851%	141.297%	144.830%	148.451%	152.162%	155.966%	159.865%	163.862%	167.958%	172.157%	176.461%	180.873%	185.394%	190.029%	194.780%	199.650%	204.641%	209.757%
Capital cost inc. Inflation		£ 9,447,992.50	£ -	£ -	£ -	£ -	£ -	£ -	£ -	£ -	£ -	£ 1,263,040.22	£ -	£ -	£ -	£ -	£ 2,549,475.47	£ -	£ -	£ -	£ -	£ 6,665,477.93	£ -	£ -	£ -	£ -	£ 4,616,513.58	£ -	£ -	£ -	£ -	£ 7,538,624.70
Fuel cost		£ 241,288.29	£ 247,320.50	£ 253,503.51	£ 259,841.10	£ 266,337.13	£ 272,995.55	£ 279,820.44	£ 286,815.95	£ 293,986.35	£ 301,336.01	£ 308,869.41	£ 316,591.15	£ 324,505.93	£ 332,618.57	£ 340,934.04	£ 349,457.39	£ 358,193.82	£ 367,148.67	£ 376,327.39	£ 385,735.57	£ 395,378.96	£ 405,263.44	£ 415,395.02	£ 425,779.90	£ 436,424.39	£ 447,335.00	£ 458,518.38	£ 469,981.34	£ 481,730.87	£ 493,774.14	£ 506,118.50
Energy management change	-10.0%	£ -	£ 24,732.05	£ 25,350.35	£ 25,984.11	£ 26,633.71	£ 27,299.56	£ 27,982.04	£ 28,681.60	£ 29,398.64	£ 30,133.60	£ 30,886.94	£ 31,659.11	£ 32,450.59	£ 33,261.86	£ 34,093.40	£ 34,945.74	£ 35,819.38	£ 36,714.87	£ 37,632.74	£ 38,573.56	£ 39,537.90	£ 40,526.34	£ 41,539.50	£ 42,577.99	£ 43,642.44	£ 44,733.50	£ 45,851.84	£ 46,998.13	£ 48,173.09	£ 49,377.41	£ 50,611.85
Maintenance Cost	2.5%	£ 150,000.00	£ 153,750.00	£ 157,593.75	£ 161,533.59	£ 165,571.93	£ 169,711.23	£ 173,954.01	£ 178,302.86	£ 182,760.43	£ 187,329.45	£ 192,012.68	£ 196,813.00	£ 201,733.32	£ 206,776.66	£ 211,946.07	£ 217,244.72	£ 222,675.84	£ 228,242.74	£ 233,948.81	£ 239,797.53	£ 245,792.47	£ 251,937.28	£ 258,235.71	£ 264,691.60	£ 271,308.89	£ 278,091.61	£ 285,043.91	£ 292,170.00	£ 299,474.25	£ 306,961.11	£ 314,635.14
Net annual Cost/Surplus		**£ 9,839,280.79**	**£ 376,338.45**	**£ 385,746.91**	**£ 395,390.58**	**£ 405,275.35**	**£ 415,407.23**	**£ 425,792.41**	**£ 436,437.22**	**£ 447,348.15**	**£ 458,531.86**	**£ 1,753,035.37**	**£ 481,745.03**	**£ 493,788.66**	**£ 506,133.37**	**£ 518,786.71**	**£ 3,081,231.85**	**£ 545,050.29**	**£ 558,676.54**	**£ 572,643.46**	**£ 586,959.54**	**£ 7,267,111.46**	**£ 616,874.37**	**£ 632,091.23**	**£ 647,893.51**	**£ 664,090.85**	**£ 5,297,206.79**	**£ 697,710.45**	**£ 715,153.21**	**£ 733,032.04**	**£ 751,357.84**	**£ 8,308,766.49**
		£ 9,839,280.79	£ 358,417.57	£ 349,883.82	£ 341,553.25	£ 333,421.03	£ 325,482.44	£ 317,732.85	£ 310,167.79	£ 302,782.84	£ 295,573.72	£ 1,063,933.38	£ 281,666.34	£ 274,960.00	£ 268,413.33	£ 262,022.54	£ 1,482,125.20	£ 249,693.82	£ 243,748.72	£ 237,945.18	£ 232,279.82	£ 2,738,897.88	£ 221,350.56	£ 216,080.31	£ 210,935.54	£ 205,913.26	£ 1,564,279.82	£ 196,224.60	£ 191,552.58	£ 186,991.81	£ 182,539.62	£ 1,922,461.19
Net Present Valve		**£ 25,208,311.61**	**Summary**																													

Summary

Camden Economic options apparisal		Year 0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Installation cost	**Included in the capital costs**																															
Maintenance cost	**£ 3,315,221.52**	£ 150,000.00	£ 146,428.57	£ 142,942.18	£ 139,538.79	£ 136,216.44	£ 132,973.19	£ 129,807.16	£ 126,716.52	£ 123,699.46	£ 120,754.23	£ 117,879.13	£ 115,072.48	£ 112,332.66	£ 109,658.08	£ 107,047.17	£ 104,498.43	£ 102,010.37	£ 99,581.55	£ 97,210.56	£ 94,896.02	£ 92,636.60	£ 90,430.96	£ 88,277.84	£ 86,175.99	£ 84,124.18	£ 82,121.22	£ 80,165.96	£ 78,257.24	£ 76,393.98	£ 74,575.07	£ 72,799.48
Plant replacement cost	**£ 17,069,416.46**	£ 9,447,992.50	£ -	£ -	£ -	£ -	£ -	£ -	£ -	£ -	£ -	£ 775,397.13	£ -	£ -	£ -	£ -	£ 1,226,341.29	£ -	£ -	£ -	£ -	£ 2,512,148.53	£ -	£ -	£ -	£ -	£ 1,363,269.26	£ -	£ -	£ -	£ 1,744,267.75
Fuel and other standing charges	**£ 5,332,827.57**	£ 241,288.29	£ 235,543.33	£ 229,935.16	£ 224,460.51	£ 219,116.21	£ 213,899.16	£ 208,806.32	£ 203,834.74	£ 198,981.54	£ 194,243.88	£ 189,619.03	£ 185,104.29	£ 180,697.04	£ 176,394.73	£ 172,194.86	£ 168,094.98	£ 164,092.72	£ 160,185.75	£ 156,371.80	£ 152,648.66	£ 149,014.17	£ 145,466.22	£ 142,002.73	£ 138,621.72	£ 135,321.20	£ 132,099.27	£ 128,954.05	£ 125,883.71	£ 122,886.48	£ 119,960.61	£ 117,104.41
Energy management change	-£ 509,153.93	£ -	-£ 23,554.33	-£ 22,993.52	-£ 22,446.05	-£ 21,911.62	-£ 21,389.92	-£ 20,880.63	-£ 20,383.47	-£ 19,898.15	-£ 19,424.39	-£ 18,961.90	-£ 18,510.43	-£ 18,069.70	-£ 17,639.47	-£ 17,219.49	-£ 16,809.50	-£ 16,409.27	-£ 16,018.57	-£ 15,637.18	-£ 15,264.87	-£ 14,901.42	-£ 14,546.62	-£ 14,200.27	-£ 13,862.17	-£ 13,532.12	-£ 13,209.93	-£ 12,895.40	-£ 12,588.37	-£ 12,288.65	-£ 11,996.06	-£ 11,710.44
Summary	**£ 25,208,311.61**																															

Assumptions

Number of dwellings		**479**
Number of blocks of apartments		**33**
Cost for one HIU (each dwelling)	**£**	**2,500.00**
Cost for Radiator installation (each dwelling)	**£**	**1,500.00**
Cost for pipework (each dwelling)	**£**	**2,000.00**
Cost for control (each dwelling)	**£**	**1,000.00**
Cost for Electrical works associated (each dwe	**£**	**1,000.00**
Cost for domestic hot water (each dwelling)	**£**	**1,500.00**
Cost for commissioning (each dwelling)	**£**	**285.00**
Cost heat meter eack block	**£**	**7,900.00**
Cost pressure valve (per valve)	**£**	**500.00**

NPV Future valve x $\frac{1}{(1+r)^n}$

Year	PV of £1 (pfi)	PV of £1 pa (pfi)	EAC of £1 (pfi)	$1/(1+i)^t$
0	1.0000			1.0000
1	0.9524	0.9524	1.0500	0.9524
2	0.9070	1.8594	0.5378	0.9070
3	0.8638	2.7232	0.3672	0.8638
4	0.8227	3.5460	0.2820	0.8227
5	0.7835	4.3295	0.2310	0.7835
6	0.7462	5.0757	0.1970	0.7462
7	0.7107	5.7864	0.1728	0.7107
8	0.6768	6.4632	0.1547	0.6768
9	0.6446	7.1078	0.1407	0.6446
10	0.6139	7.7217	0.1295	0.6139
11	0.5847	8.3064	0.1204	0.5847
12	0.5568	8.8633	0.1128	0.5568
13	0.5303	9.3936	0.1065	0.5303
14	0.5051	9.8986	0.1010	0.5051
15	0.4810	10.3797	0.0963	0.4810
16	0.4581	10.8378	0.0923	0.4581
17	0.4363	11.2741	0.0887	0.4363
18	0.4155	11.6896	0.0855	0.4155
19	0.3957	12.0853	0.0827	0.3957
20	0.3769	12.4622	0.0802	0.3769
21	0.3589	12.8212	0.0780	0.3589
22	0.3418	13.1630	0.0760	0.3418
23	0.3256	13.4886	0.0741	0.3256
24	0.3101	13.7986	0.0725	0.3101
25	0.2953	14.0939	0.0710	0.2953
26	0.2812	14.3752	0.0696	0.2812
27	0.2678	14.6430	0.0683	0.2678
28	0.2551	14.8981	0.0671	0.2551
29	0.2429	15.1411	0.0660	0.2429
30	0.2314	15.3725	0.0651	0.2314

30 Year Costing (excluding Leaseholder Contribution)

Maiden lane

Given figures

Discount Factor	5.00%	Affects the NPV
Commissioning minor changes	5.00%	

Option 5a — GSHP, Boilers, pipework, HIU including Add ons

	Persentage Annual Increase	Year 0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Capital cost																																
Energy Centre																																
Boiler Plant		£ 250,000.00																				£ 250,000.00										
pipework																																
Pumps		£ 50,000.00																				£50,000.00										
Pipeworks		£ 150,000.00																									£ 150,000.00					
Controls		£ 200,000.00										£ 200,000.00										£ 200,000.00										£ 200,000.00
Electrical works associated		£ 100,000.00																				£ 100,000.00										
GSHP		£ 900,000.00																				£ 900,000.00										
Boiler house vent		£ 20,000.00																														£ 20,000.00
Commissioning major changes		£ 27,000.00																				£ 27,000.00										
Commissioning minor changes		£ 83,500.00	£ -	£ -	£ -	£ -	£ -	£ -	£ -	£ -	£ -	£ 10,000.00	£ -	£ -	£ -	£ -	£ -	£ -	£ -	£ -	£ -	£ 75,000.00	£ -	£ -	£ -	£ -	£ 7,500.00	£ -	£ -	£ -	£ -	£ 11,000.00
Distribution network																																
Pipework		£ 500,000.00																				£ 500,000.00										
Pumps		£ 50,000.00																				£ 50,000.00										
Civils		£ 250,000.00																														
Commissioning major changes		£ 24,000.00																				£ 24,000.00										
Commissioning minor changes		£ 27,500.00	£ -	£ -	£ -	£ -	£ -	£ -	£ -	£ -	£ -	£ -	£ -	£ -	£ -	£ -	£ -	£ -	£ -	£ -	£ -	£ 27,500.00	£ -	£ -	£ -	£ -	£ -	£ -	£ -	£ -	£ -	£ -
Apartments works																																
Heat Interface Unit (include metering per dwelling)		£ 1,197,500.00															£ 1,197,500.00															£ 1,197,500.00
Radiator Installation		£ 718,500.00																				£ 718,500.00										
Pipework		£ 958,000.00																									£ 958,000.00					
Controls		£ 479,000.00										£ 479,000.00										£ 479,000.00										£ 479,000.00
Heat metering (per block)		£ 260,700.00										£ 260,700.00										£ 260,700.00										£ 260,700.00
Electrical works associated		£ 479,000.00															£ 479,000.00															£ 479,000.00
Domestic Hot water		£ 718,500.00																									£718,500.00					
Commissioning major changes		£ 136,515.00																				£ 136,515.00										
Commissioning minor changes		£ 240,560.00	£ -	£ -	£ -	£ -	£ -	£ -	£ -	£ -	£ -	£ 36,985.00	£ -	£ -	£ -	£ -	£ -	£ -	£ 83,825.00	£ -	£ -	£ -	£ -	£ -	£ -	£ -	£ -	£ 72,910.00	£ -	£ -	£ -	£ -	£ 120,810.00
Add-ons																																
Pressure valves on incoming water		£ 239,500.00																				£ 239,500.00										
Replacement Mains cold water supply		£ 94,600.00																														
Additional pipework and valves for link between Phase 2 and Phase 1		£ 100,000.00																														
Other																																
Preliminaries	12%	£990,525.00																				£493,275.00					£230,139.00					£332,161.20
Builderworks & minor redecoration	10%	£800,437.50																				£386,062.50					£191,782.50					£276,801.00
Design fees	7%	£629,643.00																				£304,773.00					£150,357.48					£217,011.98
Grants for the GSHP		-£64,440.00	-£66,051.00	-£67,702.28	-£69,394.83	-£71,129.70	-£72,907.95	-£74,730.64	-£76,598.91	-£78,513.88	-£80,476.73	-£82,488.65	-£84,550.86	-£86,664.64	-£88,831.25	-£91,052.03	-£93,328.33	-£95,661.54	-£98,053.08	-£100,504.41	-£103,017.02	-£105,592.44	£0.00	£0.00	£0.00	£0.00	£0.00	£0.00	£0.00	£0.00	£0.00	£0.00	£0.00
Use onsite - GSHP generated heat		£0.00	£0.00	£0.00	£0.00	£0.00	£0.00	£0.00	£0.00	£0.00	£0.00	£0.00	£0.00	£0.00	£0.00	£0.00	£0.00	£0.00	£0.00	£0.00	£0.00	£0.00	£0.00	£0.00	£0.00	£0.00	£0.00	£0.00	£0.00	£0.00	£0.00	£0.00
Use offsite (exported) - GSHP generated heat		£0.00	£0.00	£0.00	£0.00	£0.00	£0.00	£0.00	£0.00	£0.00	£0.00	£0.00	£0.00	£0.00	£0.00	£0.00	£0.00	£0.00	£0.00	£0.00	£0.00	£0.00	£0.00	£0.00	£0.00	£0.00	£0.00	£0.00	£0.00	£0.00	£0.00	£0.00
MCW can be reused	£0.00	£0.00																														
Inflation	2.5%	100.000%	102.500%	105.063%	107.689%	110.381%	113.141%	115.969%	118.869%	121.840%	124.886%	128.008%	131.209%	134.489%	137.851%	141.297%	144.830%	148.451%	152.162%	155.966%	159.865%	163.862%	167.958%	172.157%	176.461%	180.873%	185.394%	190.029%	194.780%	199.650%	204.641%	209.757%
Capital cost inc. Inflation		£ 10,674,980.50	£ -	£ -	£ -	£ -	£ -	£ -	£ -	£ -	£ -	£ 1,263,040.22	£ -	£ -	£ -	£ -	£ 2,549,475.47	£ -	£ -	£ -	£ -	£ 8,676,040.64	£ -	£ -	£ -	£ -	£ 4,616,513.58	£ -	£ -	£ -	£ -	£ 7,538,624.70
Fuel cost		£ 176,848.29	£ 179,618.22	£ 182,373.81	£ 185,110.46	£ 187,823.24	£ 190,506.91	£ 193,155.81	£ 195,763.92	£ 198,324.81	£ 200,831.60	£ 203,276.97	£ 205,653.09	£ 207,951.63	£ 210,163.71	£ 212,279.90	£ 214,290.14	£ 216,183.73	£ 217,949.31	£ 219,574.81	£ 221,047.40	£ 222,353.45	£ 405,263.44	£ 415,395.02	£ 425,779.90	£ 436,424.39	£ 447,335.00	£ 458,518.38	£ 469,981.34	£ 481,730.87	£ 493,774.14	£ 506,118.50
Energy management change	-10.0%	£ -	-£ 17,961.82	-£ 18,237.38	-£ 18,511.05	-£ 18,782.32	-£ 19,050.69	-£ 19,315.58	-£ 19,576.39	-£ 19,832.48	-£ 20,083.16	-£ 20,327.70	-£ 20,565.31	-£ 20,795.16	-£ 21,016.37	-£ 21,227.99	-£ 21,429.01	-£ 21,618.37	-£ 21,794.93	-£ 21,957.48	-£ 22,104.74	-£ 22,235.34	-£ 40,526.34	-£ 41,539.50	-£ 42,577.99	-£ 43,642.44	-£ 44,733.50	-£ 45,851.84	-£ 46,998.13	-£ 48,173.09	-£ 49,377.41	-£ 50,611.85
Maintenance Cost	2.5%	£ 160,000.00	£ 164,000.00	£ 168,100.00	£ 172,302.50	£ 176,610.06	£ 181,025.31	£ 185,550.95	£ 190,189.72	£ 194,944.46	£ 199,818.08	£ 204,813.53	£ 209,933.87	£ 215,182.21	£ 220,561.77	£ 226,075.81	£ 231,727.71	£ 237,520.90	£ 243,458.92	£ 249,545.39	£ 255,784.03	£ 262,178.63	£ 268,733.10	£ 275,451.42	£ 282,337.71	£ 289,396.15	£ 296,631.06	£ 304,046.83	£ 311,648.00	£ 319,439.20	£ 327,425.18	£ 335,610.81
Net annual Cost/Surplus		**£ 11,011,828.79**	**£ 325,656.40**	**£ 332,236.43**	**£ 338,901.91**	**£ 345,650.98**	**£ 352,481.53**	**£ 359,391.17**	**£ 366,377.25**	**£ 373,436.79**	**£ 380,566.52**	**£ 1,650,803.02**	**£ 395,021.64**	**£ 402,238.68**	**£ 409,709.11**	**£ 417,127.72**	**£ 2,974,064.30**	**£ 432,086.25**	**£ 439,613.30**	**£ 447,162.73**	**£ 454,726.69**	**£ 9,138,337.37**	**£ 633,470.19**	**£ 649,306.94**	**£ 665,539.62**	**£ 682,178.11**	**£ 5,315,746.14**	**£ 716,713.37**	**£ 734,631.21**	**£ 752,996.99**	**£ 771,821.91**	**£ 8,329,742.16**
		£ 11,011,828.79	£ 310,148.95	£ 301,348.23	£ 292,756.21	£ 284,367.92	£ 276,178.50	£ 268,183.23	£ 260,377.47	£ 252,756.72	£ 245,316.57	£ 1,013,449.85	£ 230,960.97	£ 224,037.23	£ 217,277.49	£ 210,677.84	£ 1,430,575.78	£ 197,943.69	£ 191,801.83	£ 185,805.35	£ 179,950.79	£ 3,444,143.25	£ 227,379.29	£ 221,965.49	£ 216,680.60	£ 211,521.54	£ 1,569,754.57	£ 201,569.00	£ 196,769.73	£ 192,084.74	£ 187,511.29	£ 1,927,314.49
Net Present Valve		**£ 26,182,437.42**	**Summary**																													

Summary

Camden Economic options apparisal	Year 0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Installation cost	**Included in the capital costs**																														
Maintenance cost	**£ 3,536,236.28**	£ 160,000.00	£ 156,190.48	£ 152,471.66	£ 148,841.38	£ 145,297.54	£ 141,838.07	£ 138,460.97	£ 135,164.28	£ 131,946.09	£ 128,804.51	£ 125,737.74	£ 122,743.98	£ 119,821.51	£ 116,968.61	£ 114,183.65	£ 111,464.99	£ 108,811.06	£ 106,220.32	£ 103,691.27	£ 101,222.43	£ 98,812.37	£ 96,459.69	£ 94,163.03	£ 91,921.06	£ 89,732.46	£ 87,595.97	£ 85,510.35	£ 83,474.39	£ 81,486.91	£ 79,546.74	£ 77,652.77
Plant replacement cost	**£ 19,054,164.40**	£ 10,674,980.50	£ -	£ -	£ -	£ -	£ -	£ -	£ -	£ -	£ -	£ 775,397.13	£ -	£ -	£ -	£ -	£ 1,226,341.29	£ -	£ -	£ -	£ -	£ 3,269,908.47	£ -	£ -	£ -	£ -	£ 1,363,269.26	£ -	£ -	£ -	£ 1,744,267.75
Fuel and other standing charges	**£ 3,971,502.12**	£ 176,848.29	£ 171,064.97	£ 165,418.42	£ 159,905.37	£ 154,522.65	£ 149,267.15	£ 144,135.84	£ 139,125.76	£ 134,234.04	£ 129,457.84	£ 124,794.43	£ 120,241.10	£ 115,795.25	£ 111,454.30	£ 107,215.77	£ 103,077.22	£ 99,036.26	£ 95,090.56	£ 91,237.87	£ 87,475.96	£ 83,802.68	£ 145,466.22	£ 142,002.73	£ 138,621.72	£ 135,321.20	£ 132,099.27	£ 128,954.05	£ 125,883.71	£ 122,886.48	£ 119,960.61	£ 117,104.41
Energy management change	-£ 379,465.38	£ -	-£ 17,086.50	-£ 16,541.84	-£ 15,990.54	-£ 15,452.26	-£ 14,926.71	-£ 14,413.58	-£ 13,912.56	-£ 13,423.40	-£ 12,945.78	-£ 12,479.44	-£ 12,024.11	-£ 11,579.52	-£ 11,145.43	-£ 10,721.58	-£ 10,307.72	-£ 9,903.63	-£ 9,509.06	-£ 9,123.79	-£ 8,747.60	-£ 8,380.27	-£ 14,546.62	-£ 14,200.27	-£ 13,862.17	-£ 13,532.12	-£ 13,209.93	-£ 12,895.40	-£ 12,588.37	-£ 12,288.65	-£ 11,996.06	-£ 11,710.44
Summary	**£ 26,182,437.42**																														

Assumptions

Number of dwellings		**479**
Number of blocks of apartments		**33**
Cost for one HIU (each dwelling)	£	**2,500.00**
Cost for Radiator installation (each dwelling)	£	**1,500.00**
Cost for pipework (each dwelling)	£	**2,000.00**
Cost for control (each dwelling)	£	**1,000.00**
Cost for Electrical works associated (each dwell	£	**1,000.00**
Cost for domestic hot water (each dwelling)	£	**1,500.00**
Cost for commissioning (each dwelling)	£	**285.00**
Cost heat meter eack block	£	**7,900.00**
Cost pressure valve (per valve)	£	**500.00**

Grants

PV

				Homepages
Grants, Solar PV per kWh	£	**0.0175**	Based on "Tariffs payable per kWh of electricity produced" on Feed-in-tariffs homepage 11/10/2016	http://www.fitariffs.co.uk/eligible/levels/
Panel area PV m^2		**210**	Based on PV array installed on Block 10 which has a total roof area of approximately 462m2 and estimated 30kW electrical baseload for the energy centre	
Capacity of the PV kW		**30**	Panel area divided by 7kW/m^2 source previous projects McBainsCooper.	
Capacity of the PV kWh/year		**22500**	Based on 750kWh/kW Source: BSRIA Illustrated Guide to renewables	
Use onsite - PV generated electricity		**4500**	Based on 20% of total kWh	
Grant Use onsite - PV generated electricity	£	**0.100**	per kWh	
Use offsite (exported) - PV generated electricity		**18000**	Based on 80% of total kWh	
Used offsite (exported) - PV generated electricity	£	**0.04390**	per kWh	

GSHP

Grants GSHP, per kWh	£	**0.0895**	Based on "Tariffs and payments:Non Domestic RHI" from Ofgem's homepage 11/10/2016	https://www.ofgem.gov.uk/environmental-programmes/non-domestic-rhi/contacts-guidance-and-resources/tariffs-and-payments-non-domestic-rhi
GSHP, kW		**600**	Based on information from Genius Energy Lab - 2016	http://www.geniusenergylab.com/
GSHP, hours per year		**1200**	Based on 5 months per (30 days) per year, 8 hours a day	
GSHP kWh per year		**720000**		
Use onsite - GSHP generated heat		**720000**	Based on 100% of total kWh	
Grant Use onsite - GSHP generated heat	£	**-**	per kWh	
Use offsite (exported) - GSHP generated heat		**0**	Based on 0% of total kWh	
Used offsite (exported) - GSHP generated heat	£	**0.04390**	per kWh	
Cost for GSHP/kW	£	**1,500**	Source: Report "Heat pumps in Distict Heating" 2016	
			Source: Report "Heat pumps in Distict Heating" 2016	

Please note that the RHI only lasts 20 years

It is our understanding that the system will be classed as "Non Domestic" system given that it serves multiple dwellings and not a single private house.

NPV — Future valve x $\frac{1}{(1+r)^n}$

Year	PV of £1 (p8)	PV of £1 pa (p8)	EAC of £1 (p8)	$1/(1+r)^t$
0	1.0000			1.0000
1	0.9524	0.9524	1.0500	0.9524
2	0.9070	1.8594	0.5378	0.9070
3	0.8638	2.7232	0.3672	0.8638
4	0.8227	3.5460	0.2820	0.8227
5	0.7835	4.3295	0.2310	0.7835
6	0.7462	5.0757	0.1970	0.7462
7	0.7107	5.7864	0.1728	0.7107
8	0.6768	6.4632	0.1547	0.6768
9	0.6446	7.1078	0.1407	0.6446
10	0.6139	7.7217	0.1295	0.6139
11	0.5847	8.3064	0.1204	0.5847
12	0.5568	8.8633	0.1128	0.5568
13	0.5303	9.3936	0.1065	0.5303
14	0.5051	9.8986	0.1010	0.5051
15	0.4810	10.3797	0.0963	0.4810
16	0.4581	10.8378	0.0923	0.4581
17	0.4363	11.2741	0.0887	0.4363
18	0.4155	11.6896	0.0855	0.4155
19	0.3957	12.0853	0.0827	0.3957
20	0.3769	12.4622	0.0802	0.3769
21	0.3589	12.8212	0.0780	0.3589
22	0.3418	13.1630	0.0760	0.3418
23	0.3256	13.4886	0.0741	0.3256
24	0.3101	13.7986	0.0725	0.3101
25	0.2953	14.0939	0.0710	0.2953
26	0.2812	14.3752	0.0696	0.2812
27	0.2678	14.6430	0.0683	0.2678
28	0.2551	14.8981	0.0671	0.2551
29	0.2429	15.1411	0.0660	0.2429
30	0.2314	15.3725	0.0651	0.2314

Fuel Costs

Cost for gas the three last years:	
10,738,341	kWh/yr - Apr 13 - Mar14
11,108,292	kWh/yr - Apr 14 - Mar15
10,147,388	kWh/yr - Apr 15 - Mar16

Fuel cost	
10,664,673	average kWh/yr
£ 262,351	Option 1
£ 39,259	standing charge
£ 301,610	**Average annual Total Cost**

Source: Email from Nick Goodes, Principal Accountant Camden, to Tim Pegg. Sent on: Friday 07/10/2016, 15:48

From: Goodes, Nick <Nick.Goodes@camden.gov.uk> Sent: Fri 07/10/2016 15:48
To: Tim Pegg; Garner, Harold
Cc: Coster, Louise; Wells, Derek; Layhe, Michael; Rolfe Jackson; Sara Tauberman
Subject: RE: existing Maiden Lane Estate - Heating replacement works - Costs appraisal

Hi Tim,

For the GAS the kWh for the last 3 years have been as follows

Apr 2013 to Mar 2014	Apr 2014 to Mar 2015	Apr 2015 to Mar 2016
10,738,340.57	11,108,291.96	10,147,387.51

The Oct 15- Sep16 contract has had a £2.046 unit price and a standing charge of £107.56 per day

We are expecting contract changes for the Oct 16 – Sep 17 period of an approximately ***20% decrease*** overall but we won't have the individual site details until the end of the month.

Issues: A new meter went in July 14 and the readings have been infrequent with only one read since January 15.
Also, 36 of the 480 units linked to the system have now been demolished so we would expect 1516 to reduce because of this

I have understood the new builds at Maiden Lane will come off a distinct and separate CHP system, I assume this is still the case

Note also there are two separate cooking gas supplies.

I'm working through our budget setting for all sites over the next weeks. Does the above give you enough information?

I will look into the electricity supplies asap.
regards

Nick Goodes
Principal Accountant

Telephone: 020 7974 5802

Economic Life of Plant

Sources of information as per right hand column.

Energy Centre	Economic life/years	Comment	Ref:	Source:
Boiler Plant	20		5.5.1.1 Heat source: — 05-01 and 05-02 5.5.1.1.1 Biomass fuel boiler plant and ancillary items — 20 — 05-38	Maintenance engineering and management - CIBSE Guide M
CHP Unit	15		5.5.1.1.7 Central (combined) heat and power (CHP) boiler plant — 15 — Other power generation included in NRM3.8 — 43-07	Maintenance engineering and management - CIBSE Guide M
Pumps	20		12-32 Maintenance engineering and management Equipment item — Economic life/years — Remarks — SFG20 reference **Pumps** Pumps: general — 20 — 45-01 Circulating pumps — 20 — 45-02 Centrifugal pumps — 20 — 45-03	Maintenance engineering and management - CIBSE Guide M
Pipeworks	25	Steel	5.4.3.1.1 Pipelines and fittings: — See other items in 5.4.4.1.1 5.4.3.1.1.2 — Unvented hot water systems — 25 — 32-10	Maintenance engineering and management - CIBSE Guide M
Controls	Option 1		12-30 Maintenance engineering and management Equipment item — Economic life/years — Remarks — SFG20 reference **Controllers and seasors** Multiple boilers: sequence control — 10 — 05-15 Boiler controls: single boiler on/off — 10 — 05-16 Boiler protection controls — 10 — 05-17 Boilers: space temperature controls — 10 — 05-18 Boilers: fire and safety circuits — 10 — 05-24 and 25 Control panels: electrical services — 20 — 14-01 and 02 Control panels: lamps, meters, alarms — 10 — Electronic controls — 14-03 Control optimiser — 10 — 14-04 Heating control: compensator type — 10 — 14-05	Maintenance engineering and management - CIBSE Guide M
Electrical works associated	10 (CIBSE Guide M)	Changed to 20 years to coincide with Boiler plant replacement	12-30 Maintenance engineering and management Equipment item — Economic life/years — Remarks — SFG20 reference **Controllers and seasors** Multiple boilers: sequence control — 10 — 05-15 Boiler controls: single boiler on/off — 10 — 05-16 Boiler protection controls — 10 — 05-17 Boilers: space temperature controls — 10 — 05-18 Boilers: fire and safety circuits — 10 — 05-24 and 25 Control panels: electrical services — 20 — 14-01 and 02 Control panels: lamps, meters, alarms — 10 — Electronic controls — 14-03 Control optimiser — 10 — 14-04 Heating control: compensator type — 10 — 14-05 Controller single input type — 10 — 14-06 Controller unit and sensor type — 10 — 14-07 Controller: timer type — 10 — 14-08 Step controllers — 10 — 14-09 Time switches — 10 — Electro-mechanical — 14-10 (part) Time switches — 10 — Electronic — 14-10 (part) Multi input controllers — 10 — 14-11 Indicator and displays — 10 — 14-12 Alarm modules — 10 — 14-13 Level controllers — 10 — 14-14	McBains Cooper assumption
GSHP	20		5.5.1.1.9 Ground source heating (GSH) including boreholes and all ancillary components (including closed and open loop systems) — 20 — 05-31 — 05-32	Maintenance engineering and management - CIBSE Guide M
PV	25		5.8.5.5 Photovoltaic devices: 5.8.5.5.1 Photovoltaic devices, including cells, panels, modules, etc — 25 — 43-06 5.8.5.5.3 Solar collectors, devices, etc — 25 — 53-01 5.8.5.6 Other transformation devices: — Depends on fuel source and type — Excluded	Maintenance engineering and management - CIBSE Guide M
Boiler house vent	30		5.7.1.1.3 Extract units/terminal units — 40 — 20-02 5.7.1.1.4 Fan units — 15 — See supplementary fans list — T/E (fans) 5.7.1.1.6 Grilles, fans, filters and other ancillary components — 10 — See also supplementary list of fans — 26-01	Maintenance engineering and management - CIBSE Guide M
				Maintenance engineering and management - CIBSE Guide M
Distribution network				Maintenance engineering and management - CIBSE Guide M
Pipework	20	Plastic	5.6.1.1.2 Heat distribution pipelines from heat source to heat emitter or other equipment: — 40-01 — Pipework systems: general — Depends on the material type. — Copper — 45 — Consider tube thickness and quality of copper — Steel galvanised: closed — 35 — Including mountings and supports — Steel galvanised: open — 25 — Plastic — 20	Maintenance engineering and management - CIBSE Guide M
Pumps	20		12-32 Maintenance engineering and management Equipment item — Economic life/years — Remarks — SFG20 reference **Pumps** Pumps: general — 20 — 45-01 Circulating pumps — 20 — 45-02 Centrifugal pumps — 20 — 45-03	Maintenance engineering and management - CIBSE Guide M
Civils	60			Maintenance engineering and management - CIBSE Guide M
Commissioning	-			Maintenance engineering and management - CIBSE Guide M
				Maintenance engineering and management - CIBSE Guide M
Apartments works				Maintenance engineering and management - CIBSE Guide M
Heat Interface Unit (include metering per dwelling)	15		5.4.3.1.7 Storage cylinders, calorifiers: — Depends on the material type, e.g. consider tube thickness and quality of copper — 32-03 and 04, 05, 06 and 15 — Copper — 20 — Steel, galvanised — 15	Maintenance engineering and management - CIBSE Guide M
Radiator Installation	20		5.6.1.1.3.4 Radiant strip heater systems: — 28-01 (part) — Steam and hot water — 20 — Electric — 10 5.6.1.1.3.5 — Radiant panel systems — Depends on the material type — 28-01 5.6.1.1.3.6 — Radiators: aluminium — 20 — Water condition/materials in system, important — 28-01 5.6.1.1.3.7 — Radiators: cast iron — 25 — 28-01 5.6.1.1.3.8 — Radiators: steel — 20 — Water condition is important — 28-01	Maintenance engineering and management - CIBSE Guide M
Pipework	25	Steel	5.6.1.1.2 Heat distribution pipelines from heat source to heat emitter or other equipment: — 40-01 — Pipework systems: general — Depends on the material type. — Copper — 45 — Consider tube thickness and quality of copper — Steel galvanised: closed — 35 — Including mountings and supports — Steel galvanised: open — 25 — Plastic — 20	Maintenance engineering and management - CIBSE Guide M
Controls	10		12-30 Maintenance engineering and management Equipment item — Economic life/years — Remarks — SFG20 reference **Controllers and seasors** Multiple boilers: sequence control — 10 — 05-15 Boiler controls: single boiler on/off — 10 — 05-16 Boiler protection controls — 10 — 05-17 Boilers: space temperature controls — 10 — 05-18 Boilers: fire and safety circuits — 10 — 05-24 and 25 Control panels: electrical services — 20 — 14-01 and 02 Control panels: lamps, meters, alarms — 10 — Electronic controls — 14-03 Control optimiser — 10 — 14-04 Heating control: compensator type — 10 — 14-05	Maintenance engineering and management - CIBSE Guide M
Heat metering	10		12-30 Maintenance engineering and management Equipment item — Economic life/years — Remarks — SFG20 reference **Controllers and seasors** Multiple boilers: sequence control — 10 — 05-15 Boiler controls: single boiler on/off — 10 — 05-16 Boiler protection controls — 10 — 05-17 Boilers: space temperature controls — 10 — 05-18 Boilers: fire and safety circuits — 10 — 05-24 and 25 Control panels: electrical services — 20 — 14-01 and 02 Control panels: lamps, meters, alarms — 10 — Electronic controls — 14-03 Control optimiser — 10 — 14-04 Heating control: compensator type — 10 — 14-05	Maintenance engineering and management - CIBSE Guide M
Electrical works associates	10 (CIBSE Guide M)	Changed to 15 years to coincide with HIU replacement	12-30 Maintenance engineering and management Equipment item — Economic life/years — Remarks — SFG20 reference **Controllers and seasors** Multiple boilers: sequence control — 10 — 05-15 Boiler controls: single boiler on/off — 10 — 05-16 Boiler protection controls — 10 — 05-17 Boilers: space temperature controls — 10 — 05-18 Boilers: fire and safety circuits — 10 — 05-24 and 25 Control panels: electrical services — 20 — 14-01 and 02 Control panels: lamps, meters, alarms — 10 — Electronic controls — 14-03 Control optimiser — 10 — 14-04 Heating control: compensator type — 10 — 14-05 Controller single input type — 10 — 14-06 Controller unit and sensor type — 10 — 14-07 Controller: timer type — 10 — 14-08 Step controllers — 10 — 14-09 Time switches — 10 — Electro-mechanical — 14-10 (part) Time switches — 10 — Electronic — 14-10 (part) Multi input controllers — 10 — 14-11 Indicator and displays — 10 — 14-12 Alarm modules — 10 — 14-13 Level controllers — 10 — 14-14	McBains Cooper assumption
Domestic Hot water	25		5.4.3.1.1.4 Hot water distribution pipelines: — Depends on the material type — Copper — 45 — Consider tube thickness and quality of copper — 40-01 and 02 — Steel galvanised (closed) — 35 — Steel galvanised (open) — 25 — Plastic relatively new unproven life	Maintenance engineering and management - CIBSE Guide M
Commissioning	-			
Add-ons				
Pressure valves on incoming water	20		5.4.2.1.6 Pressurisation expansion units — 20 — 32-12	
Replacement Mains cold water supply	45	Copper	5.4 Water installations (WI) 5.4.1 Mains water supply 5.4.1.1 Mains water supply: 5.4.1.1.1 Pipelines and pipeline fittings — Depends on the material type. — Copper — 45 — 40-01 and 02 — Steel: galvanised — 35 — Plastic or non-metallic — 20 — Lead could be found, but it is recommended that it is replaced (not with lead)	
Additional pipework and valves for link between Phase 2 and Phase 1	45	Copper	5.4.2 Cold water distribution (CWD) 5.4.2.1 Cold water distribution: 5.4.2.1.1 Pipelines and fittings — 45/35/20 — See 5.4.1.1.1 — 31-01 40-01 and 02	