Waste Core Strategy

Technical Evidence Paper WCS-Q

Energy from Waste and Combined Heat & Power Potential

December 2010

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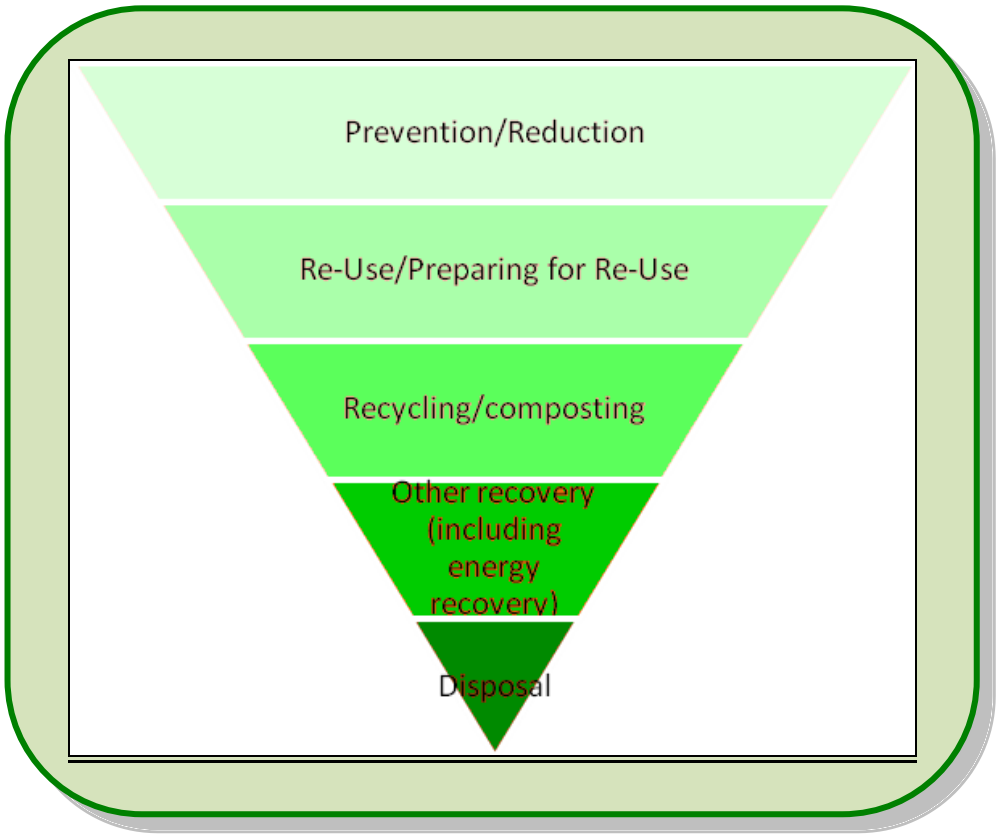
1. Introduction

1.1 This paper is one of a series of evidence papers produced in support of the Waste Core Strategy (WCS). The purpose of the paper is to explore the potential for Energy from Waste (EfW) powered Combined Heat and Power (CHP) at each of the 13 sites identified in the Waste Core Strategy Site Options consultation (October 2009). Therefore it will provide background as to the CHP potential for any sites that are taken forward in the process for inclusion in the WCS or any future DPD.

2. What is Energy from Waste (EfW)?

2.1 One of the Government's key objectives in The Waste Strategy for England (2007) is to maximise environmental benefit from investment in waste infrastructure *"through increased recycling of resources and recovery of energy from residual waste using a mix of technologies"*. The Waste Strategy for England encourages the implementation of the Waste Hierarchy (see the diagram below). EfW falls into the 'other recovery' category helping to move waste up the waste hierarchy away from disposal (landfill).

Figure 1: The Waste Hierarchy



2.2 EfW includes a number of established and emerging technologies which can be defined as both thermal and energy generating technologies. Generally, thermal combustion is the primary technology. Many types of wastes are combustible (e.g. municipal solid waste (MSW)), with relatively high calorific values. The energy released during the combustion of waste cane be recovered for both heat and electricity.

2.3 Annex E of the The Waste Strategy for England (2007) lists various EfW technologies, these are:

- Direct Combustion (Incineration);
- Advanced Thermal Treatment (ATT) - Gasification & Pyrolysis and;
- Anaerobic Digestion (AD)

2.4 The government states that a technology is more beneficial if both heat and electricity can be recovered from the waste recovery process.

Direct Combustion (Incineration)

2.5 Incineration involves the combustion of waste being burnt at temperatures over 850°C. On arrival at the facility the waste (generally MSW and Commercial and Industrial waste (C&I)) is mixed and sometimes shredded to a more homogenous fuel that will combust. It is then moved to a combustion chamber where oxygen is added. Combusting the waste turns most of it into carbon dioxide, other gases and water. The process releases energy which, through use of a boiler system, can be harnessed and turned into electricity and heat energy.

2.6 Any material that won't burn (glass, metal, stones) collects at the bottom of the combustion chamber and is known as bottom ash. Incinerators also create gases which are generally acidic and contain particles. Prior to being released into the atmosphere the gases are cleaned carefully to neutralise the acidity and remove the particles. The particles collected along with the excess cleaning chemicals are known as fly-ash (Air Pollution Control Residues (APC Residues)), which are classed as hazardous waste.

2.7 Modern incinerators generate and capture heat and electricity which may be used on or off-site thereby contributing to renewable energy targets[1]. In some instances, incineration may be used in conjunction with other waste management technologies as part of an integrated facility. For example, using a pre-treatment technology such as mechanical treatment to extract metal, glass or plastics from the waste before it is combusted or using a Mechanical Biological Treatment (MBT) facility to produce a fuel (Refuse Derived Fuel (RDF) or Solid Recovered Fuel (SRF)) to be used in an incinerator of other ATT process

[1] The degree to which 'renewable energy' is generated will depend to a large extent on the nature of the waste being incinerated.

Advanced Thermal Treatment (ATT) - Gasification & Pyrolysis

2.8 ATT is a general term used for two different technologies, pyrolysis and gasification, which can be used as part of a solution separately or together. The main difference between ATT and incineration is the amount of oxygen used and the temperature in the combustion chamber.

2.9 Gasification is a similar process to pyrolysis, but with some oxygen (although not as much as incineration). This means the waste is partially combusted at temperatures above 650°C. The main product from the process is syngas, but ash is also produced. The syngas can then be combusted to generate electricity and heat.

2.10 Pyrolysis involves breaking down the waste at 300-850°C without oxygen. It almost 'melts' the waste, breaking most of it down into gases and the remainder produces a solid char. The solid char can be used like coal and the synthetic gas (called syngas, which is a mixture of gases) has the potential to be used as a liquid fuel or to generate electricity and heat.

Anaerobic Digestion (AD)

2.11 AD is the biological degradation of treated source segregated wastes in the absence of oxygen. It essentially replicates the biological processes which occur in a landfill, but under controlled conditions. The process generates a number of usable products including:

- **Digestate** - a fibrous product, the quality of which is determined by the feedstock. It has a variety of horticultural or agricultural uses as it can be used as a fertiliser; However this is not a product which can currently be produced by residual waste.
- **Liquor** - can be used either to moisten feedstock or as a liquid fertiliser; However this is not a product which can currently be produced by residual waste.
- **Biogas** - rich in methane which can be used as a natural gas substitute, converted into fuel for use in vehicles or burned to generate electricity in a CHP scheme.

2.12 Further information on these various technologies is available at www.defra.gov.uk/environment/waste

3. What is Combined Heat and Power (CHP)?

Introduction

3.1 Putting it simply CHP (or cogeneration as it is sometimes known) is the simultaneous generation of heat and power in a single process by the generation of steam/gas produced by burning a fuel. It makes use of the heat that would normally be wasted in an electricity generation process. It can be powered by a variety of different fuels including MSW. It is a highly efficient process which can make a significant contribution towards reducing carbon emissions.

3.2 CHP does not only have to be a provider of heat, it also has the potential to be used for cooling. This option is only likely to be viable however when there is a high and constant refrigeration demand.

3.3 In 2006 CHP plants (using a variety of fuels) in the UK produced some 28TWh[2] of electricity and 54 TWh of heat. For electricity this equates to approximately 6% of the UK's electricity supplies (Institute of Engineering and Technology 2008). In terms of heat, district heating networks (see below) currently provide 4% of the UK's heat supply, supplying approximately 600,000 dwellings (CHPA. 2010).

3.4 CHP is most effective when there is a constant demand for electricity, heating and/or cooling throughout the day. The ideal scenario therefore is where there is a mix of different users, for example residential, offices, industry and municipal buildings providing constant demand.

European Policy

3.5 At the European level there is the CHP Directive (2004/8/EC). The European Union encourages the use of CHP because it saves energy, avoids network losses, secures energy supply and reduced carbon and greenhouse gas emissions. The directive should have been transposed into Member State law by February 2006. This has not fully happened in the UK but sections of the directive have been included within existing laws.

[2] Terawatt hours - a unit that it used to measure electrical power or electricity consumption

National Policy

3.6 In March 2010, draft Planning Policy Statement 'Planning for a Low Carbon Future in a Changing Climate' (a supplement to PPS1 – Delivering Sustainable Development) was published for consultation and stated that:

> *'Local planning authorities should assess their area for opportunities for decentralised energy. The assessment should focus on opportunities at a scale which could supply more than individual buildings and include up-to-date mapping of heat demand and possible sources of supply. Local planning authorities should in particular look for opportunities to secure:*
>
> *i. decentralised energy to meet the needs of new development;*
> *ii. greater integration of waste management with the provision of decentralised energy;*
> *iii. co-location of potential heat suppliers and users; and,*
> *iv. district heating networks based on renewable energy from waste, surplus heat and biomass, or which could be economically converted to such sources in the future. '*

CHP technologies and fuels

3.7 There are five main **technologies** that can be used for CHP. These are:

- **Gas Engines** – Most often use natural gas to generate heat and electricity. The engine is similar to that used in a motor vehicle which generates electricity and then the heat is recovered.
- **Gas Turbines** – This is the most common way of generating CHP. The turbine produces an exhaust gas which generates steam.
- **Steam Turbines** – This is the oldest form of CHP generation and can use any type of fuel. The fuel is burned and the resulting steam generates electricity and heat.
- **Combined Cycle Gas Turbines** - This is a gas turbine which generates steam at a variety of pressures which then produces the electricity and heat.
- **Absorption Chilling** - This technology is used when there is a cooling demand. It uses the heat generated to produce chilled water. This process is very similar to that taking place in a fridge.

3.8 There are a significant range of **fuels** that can be used for CHP, these include:

- Natural gas
- Landfill and sewage gas e.g. methane
- Fuel and gas oils
- Coal, ignite and coke
- Biomass and biogas e.g. wood.
- Solid waste, e.g. refuse, tyres
- Waste gases, e.g. refinery of gas
- Waste process heat e.g. steam and gases
- MBT produced RDF and SRF

District Heating

3.9 District/community heating schemes allow for a number of buildings to be heated by the heat produced in the CHP process. The heat is transferred to the consumer (homes and businesses) in the form of steam, hot water or chilled liquid through a network of underground insulated pipes. District heating systems are common in Scandinavia, the Netherlands and Germany. There are far fewer schemes in the UK with only a handful of developments incorporating such networks, e.g. Southampton, Sheffield, Nottingham, Lerwick and the City of London.

3.10 Retro-fitting district heating networks within existing developments is possible but this increases the economic cost of the schemes. This is because the existing infrastructure (roads etc.) has to be disrupted to lay the heating pipes. Therefore it is much easier to include a network within a new development before the main infrastructure is put into place.

Examples of District Heating Systems

3.11 Both schemes below developed district heating networks over twenty years ago. Since then these networks have increased in size and are successful examples of using waste to generate heat and power in the UK.

1. **Sheffield** (Veoila Environmental Services) – The network now supplies 140 buildings including public buildings, businesses and dwellings. The underground pipes cover 44km. The heat is now supplied by an Energy Recovery Facility which processes 225 000 tonnes of waste producing 60Mw of thermal energy and 19mw of electrical energy. It is estimated that it saves 21 000 tonnes of CO_2 emissions compared to conventional energy production.

2. **Nottingham** (Enviroenergy) – The scheme in Nottingham provides energy to 5,000 homes along with public buildings, schools and Nottingham Trent University. The energy is produced as a result an incinerator which burns 145,000 tonnes of waste. The steam produced as part of the incineration process is exported to an energy centre nearby where it gets turned in to heat and electricity. The heat is then transported using underground pipes to the users and the electricity is fed in to the National Grid.

Advantages/benefits of CHP

- It can be 80-90% efficient unlike power stations which only have an efficiency of 35%. The increase in efficiency results in a decrease in the CO_2 emissions as the waste heat is being used.
- It has the potential to increase energy supply security and reduce dependence on imported fuel.
- It provides an economic saving of between 30-40% over electricity purchased from the National Grid.
- Good quality CHP[3] which has been assessed by the CHPQA (CHP Quality Assurance) and meets a certain criteria can receive 1 Renewable Obligation Certificate (ROC) [4] per MWh[5].

[3] Good quality CHP is when it has been assessed for its energy efficiency and environmental performance.
[4] ROC is a green certificate issued to an accredited generator for eligible renewable electricity generated within the United Kingdom and supplied to customers within the United Kingdom by a licensed electricity supplier.
[5] Megawatt hour – a measure of energy consumption

Limitations of CHP

- The insulated pipe work required to transport heat is very expensive which often means the identification of potential sites for CHP scheme are within a limited radius as it is not cost effective after a certain distance.
- CHP schemes need to be relatively close to heat users, due to the cost of implementing a network and the associated heat loss through the length of the network (1°c per km);
- Retro-fitting is considerably more expensive than new development due to existing infrastructure already being in place;
- There are often issues over the funding of a CHP scheme/district heating network.
- There need to be a 24 hour heat demand and this has to be large enough to make the scheme pay for itself.
- There are often problems with connecting to the National Grid which can increase the cost.
- When both heat and electricity are generated the amount electricity produced decreases compared to when only electricity is created.

4. Assessing the CHP potential of the 13 site options

4.1 This section of the paper contains a basic assessment of the CHP potential of the 13 sites identified in the Waste Core Strategy Site Options Consultation (October 2009).

4.2 Each site has been considered in turn for ease of reference. For each site the following general information is provided in a series of site schedules attached below:

- Site name
- Site area
- Site Plan
- Existing use/designation
- Ownership
- Existing heat users within 1km
- Potential heat users within 2km

4.3 Assuming that any electricity generated at each site will be exported to the National Grid, this paper seeks to identify if there is any scope to use the heat from the process. In particular whether there are any existing or potential heat users on or within 'close proximity' of the site. This includes industrial/employment uses, other commercial uses, residential, public buildings, hotels/catering, retail, education and health facilities.

4.4 Ideal heat users include those with a continuous demand for heat such as certain industrial processes, hospitals etc. Those with variable, possibly seasonal heat demand, such as residential development are less ideal although can still be catered for e.g. through district heating particularly where they form part of a mixed-use development for example housing, offices and leisure facilities where there is variable heat demand throughout the day.

4.5 It is understood that modern technology means the heat from an 'energy from waste' facility can be transferred up to 15km from where it is generated. However it is preferable for the heat client to be closer to the source of the heat as heat is lost at a rate of 1°c per km. To provide a basis for assessing the potential for CHP in Gloucestershire the locations of all existing heat users within 1km of each of the 13 potential waste sites identified in the site options consultation (2009) have been investigated and reported. This is because going beyond 1km for existing properties would have led to an unmanageable number of sites being identified. Identifying existing properties (housing, public buildings, industry etc) was

carried out using GIS[6]. The locations of 'potential' heat users within 2km of the each of the sites was also investigated and recorded. This includes future developments that have not yet been built but could come forward in the future such as sites that have been identified in a Local Plan or Strategic Housing Land Availability Assessments (SHLAA) but have not yet implemented. The site schedules for each of the thirteen site options are set out below.

4.6 There are currently investigations taking place as to the possibility of biogas produced through the Anaerobic Digestion (AD) process being piped in to the national gas pipelines. This is being supported by the National Grid. As such, the site schedules include information on the distance of the site to a gas pipeline. The data was provided by Wales and West Utilities and did not include pipelines owned by other gas transporters or private owners. The information was given without obligation, or warranty, the accuracy thereof cannot be guaranteed.

4.7 For each of the sites we have **estimated** the heat demand within the surrounding area. The data used to estimate the heat demand was taken from an independent renewable energy study produced by consultants ENTEC on behalf of Gloucestershire County Council in June 2010[7]. From this report it was calculated that the average heat demand for a typical office/industrial unit was 92,682 kWh[8] (derived using an average of the heat demand and floor area of all of the office and industrial types set out in the ENTEC report). The average heat demand (an average for flats and houses) for an average dwelling[9] (with a floor area of 80m²) was calculated to be 7,280 kWh.

4.8 It is important to note that these figures provide an **indication** of the potential only. It is a desktop assessment based on an assumed average floorspace and heat demand. If a developer wanted to create a district heating network it would be their responsibility to establish accurate figures. It should also be noted that the estimated figures are for heat demand only. We have not investigated the cost or infrastructure practicalities of implementing a district heating network.

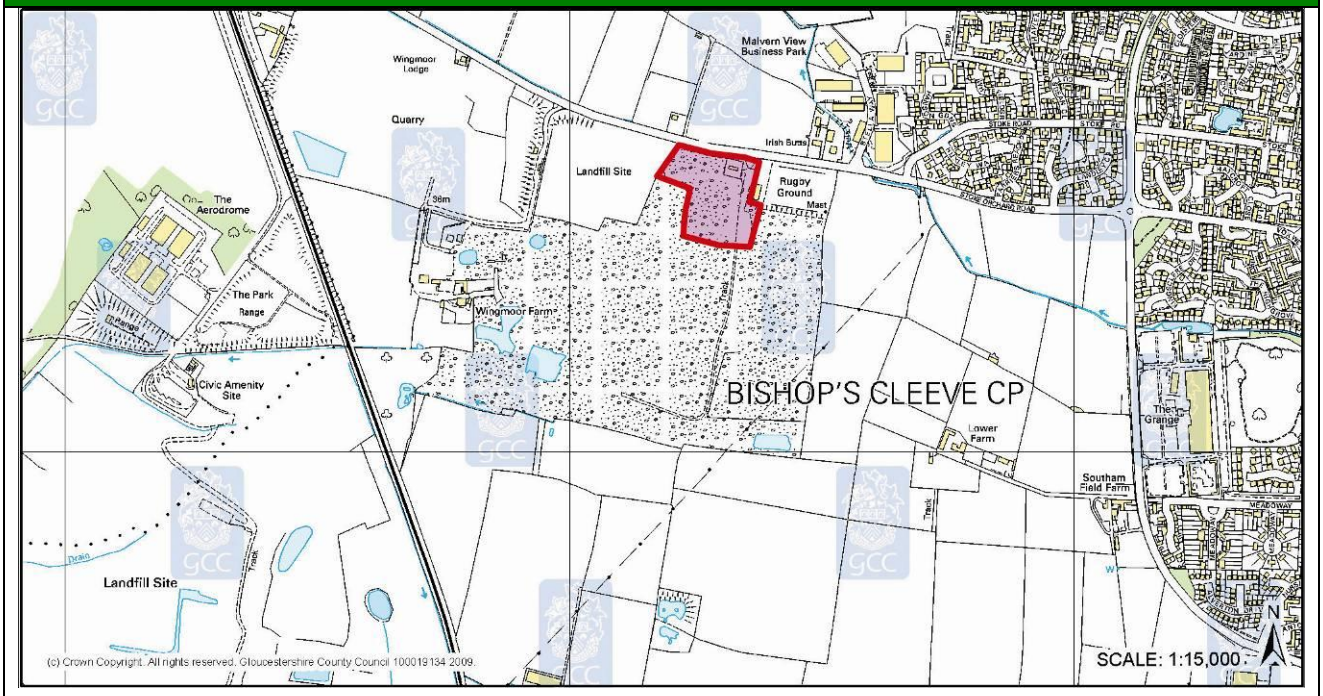
4.9 It should be noted that this desk top assessment does not take into account any of the practical limitations outlined in Section 3, which would have to be considered fully prior to implementation of a CHP/District Heating scheme.

[6] Geographical Information System
[7] 'Gloucestershire County Council Renewable Energy Study Final Report 14 June 2010'
[8] Kilowatt Hour – a measure of energy consumption
[9] Roys, M. 2008, 03: Housing Space Standards: a national perspective. RIBA

Site 1a: Area A at Wingmoor Farm East

Site Area (ha)	c. 2.5

Site Plan



Existing use/designation	
Open land and buildings including Materials Recovery Facility (MRF)	
Site ownership	Grundon Waste Management Ltd
Approximate distance to nearest gas pipeline	0.9km - High pressure pipeline

Existing heat users within 0-1km of site	
Nearby uses	**ESTIMATED Heat Demand (kWh per annum)**
Business properties: There are 22 nearby businesses,	2,039,004
Residential properties: There are approximately 1127 nearby residential properties.	8,204,560
Public buildings/other properties: Cheltenham North Rugby Club and Cheltenham & District Clay Club.	Data not available

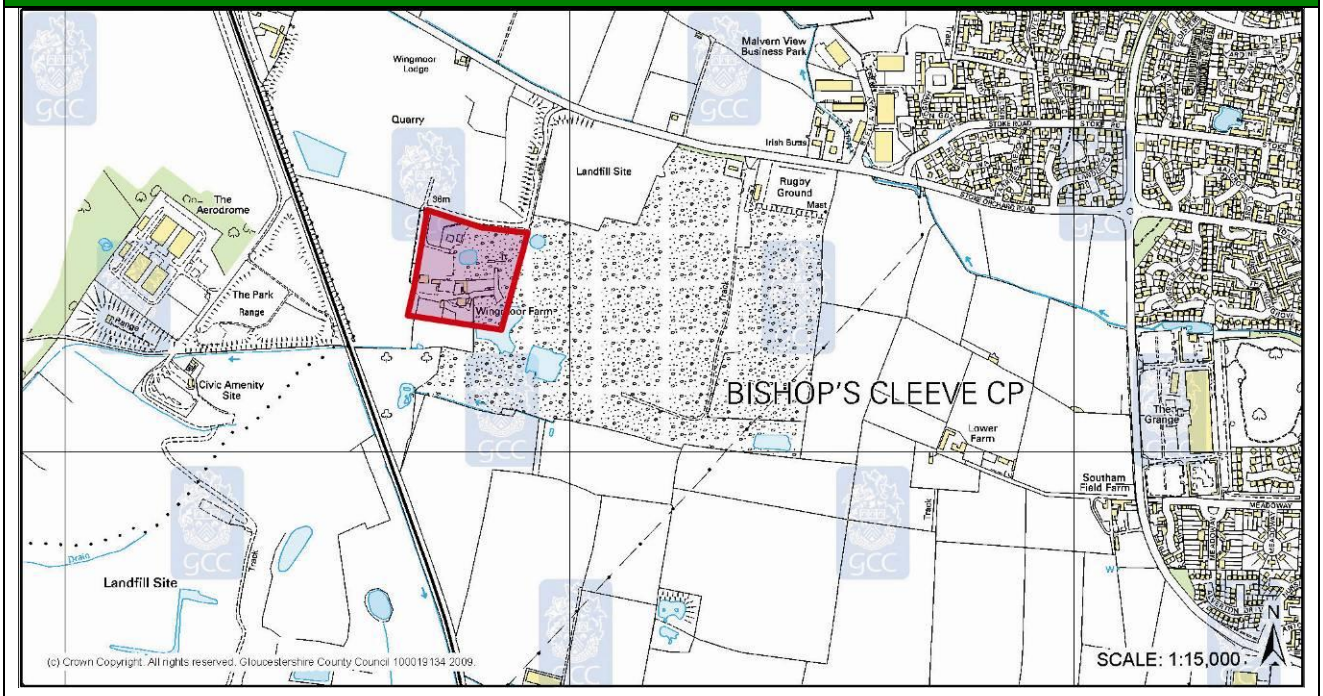
Potential heat users within 0-2km of site	
Site	**ESTIMATED Heat Demand (kWh per annum)**
Local Plan - Extension to Malvern View (2.5 ha)	Data not available

SHLAA site – Dean Farm, Bishops Cleeve – 2359 dwellings	17,173,520
SHLAA site – Land to north west of Cheltenham - 5000 dwellings	36,400,000
SHLAA site – Land at Homelands Farm (west of railway), Bishops Cleeve – 550 dwellings	4,004,000
Recommendation	
The initial assessment work indicates that there would be a potential demand for a heat network within nearby existing development. However the heat network would have to be retrofitted. There is good potential for a heat network to be included within any future development due to the possible number of new dwellings associated with major potential development nearby.	

Site 1b: Area B at Wingmoor Farm East

Site Area (ha)	c. 3.3

Site Plan



Existing use/designation	
Central non-landfilled area containing hard standing, silos, buildings and plant	
Site ownership	Grundon Waste Management Ltd
Approximate distance to nearest gas pipeline	0.6km - High pressure pipeline

Existing heat users within 0-1km of site

Nearby users	**ESTIMATED Heat Demand (kWh per annum)**
Business properties: There are 29 nearby businesses	2,687,778
Residential properties: There are approximately 193 nearby residential properties.	1,405,040
Public buildings/other properties: Cheltenham North Rugby Club and Cheltenham & District Clay Club.	Data not available

Potential heat users within 0-2km of site

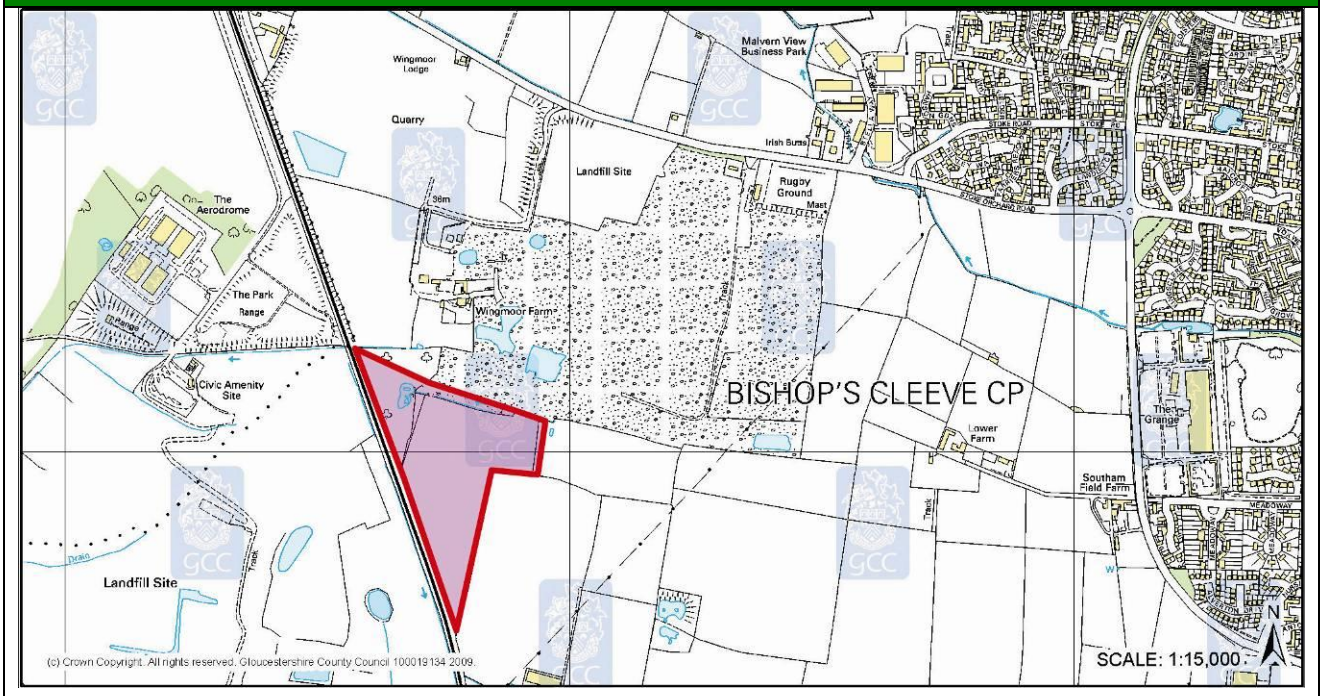
Site	**ESTIMATED Heat Demand (kWh per annum)**
Local Plan - Extension to Malvern View (2.5 ha)	Data not available

SHLAA site – Dean Farm, Bishops Cleeve – 2359 dwellings	17,173,520
SHLAA site – Land to north west of Cheltenham - 5000 dwellings	36,400,000
Recommendation	
The initial assessment work indicates that there would be a potential demand for a heat network within nearby existing development. However the heat network would have to be retrofitted. There is good potential for a heat network to be included within any future development due to the possible number of new dwellings associated with major potential development nearby.	

Site 1c: Area C at Wingmoor Farm East

Site Area (ha)	c. 2.8

Site Plan



Existing use/designation	
Southern area with long boundary adjacent to railway line.	
Site ownership	Grundon Waste Management Ltd
Approximate distance to nearest gas pipeline	0.5km - High pressure pipeline

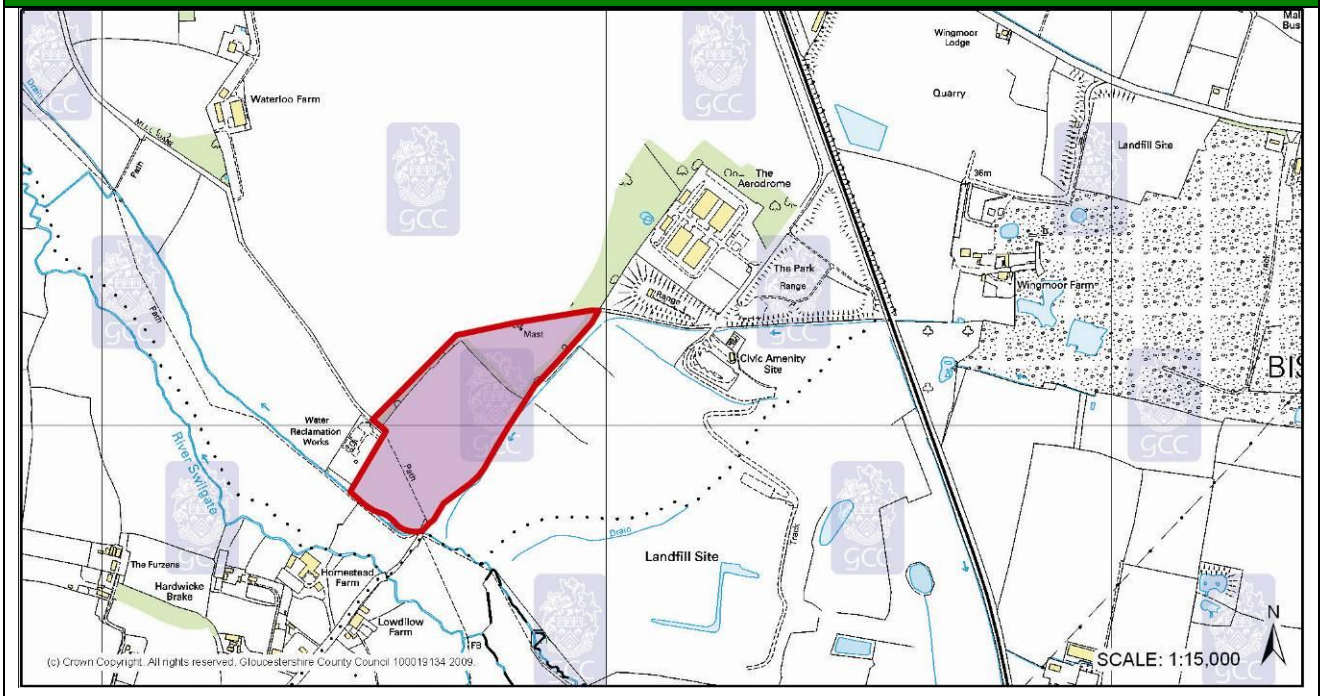
Existing heat users within 0-1km of site

Nearby users	**ESTIMATED Heat Demand (kWh per annum)**
Business properties: There are 36 nearby businesses	3,336,552
Residential properties: There are approximately 67 nearby residential properties.	487,760
Public buildings/other properties: Cheltenham North Rugby Club and Cheltenham & District Clay Club.	Data not available

Potential heat users within 0-2km of site	
Site	**ESTIMATED Heat Demand (kWh per annum)**
Local Plan - Extension to Malvern View (2.5 ha)	Data not available
SHLAA site – Dean Farm, Bishops Cleeve – 2359 dwellings	17,173,520
SHLAA site – Land to north west of Cheltenham - 5000 dwellings	36,400,000
Recommendation	
The initial assessment work indicates that there would be a potential demand for a heat network within nearby existing development. However the heat network would have to be retrofitted. There is good potential for a heat network to be included within any future development due to the possible number of new dwellings associated with major potential development nearby.	

Site 2a: Area A at Wingmoor Farm West

Site Area (ha)	c. 9
Site Plan	



Existing use/designation	
Flat agricultural land and scrubby areas.	
Site ownership	William Gilder
Approximate distance to nearest gas pipeline	Running along site boundary – High pressure pipeline

Existing heat users within 0-1km of site	
Nearby users	**ESTIMATED Heat Demand (kWh per annum)**
Business properties: There are 11 nearby businesses	1,019,502
Residential properties: There are approximately 42 nearby residential properties.	305,760
Public buildings/other properties: Cheltenham & District Clay Club.	Data not available

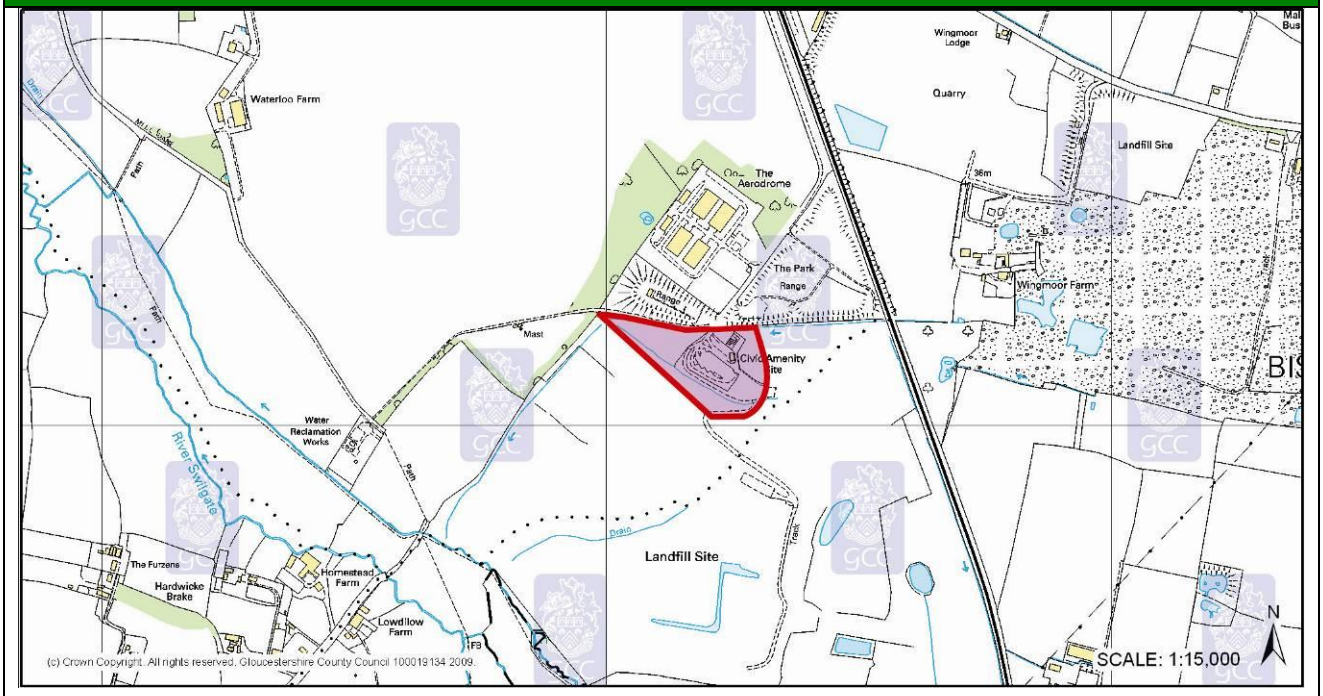
Potential heat users within 0-2km of site	
Potential nearby users	**ESTIMATED Heat Demand (kWh per annum)**
Local Plan - Extension to Malvern View (2.5 ha)	Data not available

SHLAA site Deans Farm, Bishops Cleeve – 2000 dwellings	14,560,000
SHLAA site Land to the north west of Cheltenham - 5000 dwellings	36,400,000
Recommendation	
The initial assessment work indicates that there would be a potential demand for a heat network within nearby existing development. However the heat network would have to be retrofitted. There is good potential for a heat network to be included within any future development due to the possible number of new dwellings associated with major potential development nearby.	

Site 2b: Area B at Wingmoor Farm West

Site Area (ha)	c. 4

Site Plan



Existing use/designation

HRC area. Area of hard standing, temporary buildings and Household Recycling Centre skips, containers etc.

Site ownership	Cory Environmental Limited
Approximate distance to nearest gas pipeline	Running alongside the site boundary – High pressure pipeline

Existing heat users within 0-1km of site

Nearby users	**ESTIMATED Heat Demand (kWh per annum)**
Business properties: There are 9 nearby businesses.	834,138
Residential properties: There are approximately 12 nearby residential properties.	87,360
Public buildings/other properties: Cheltenham & District Clay Club.	Data not available

Potential heat users within 0-2km of site

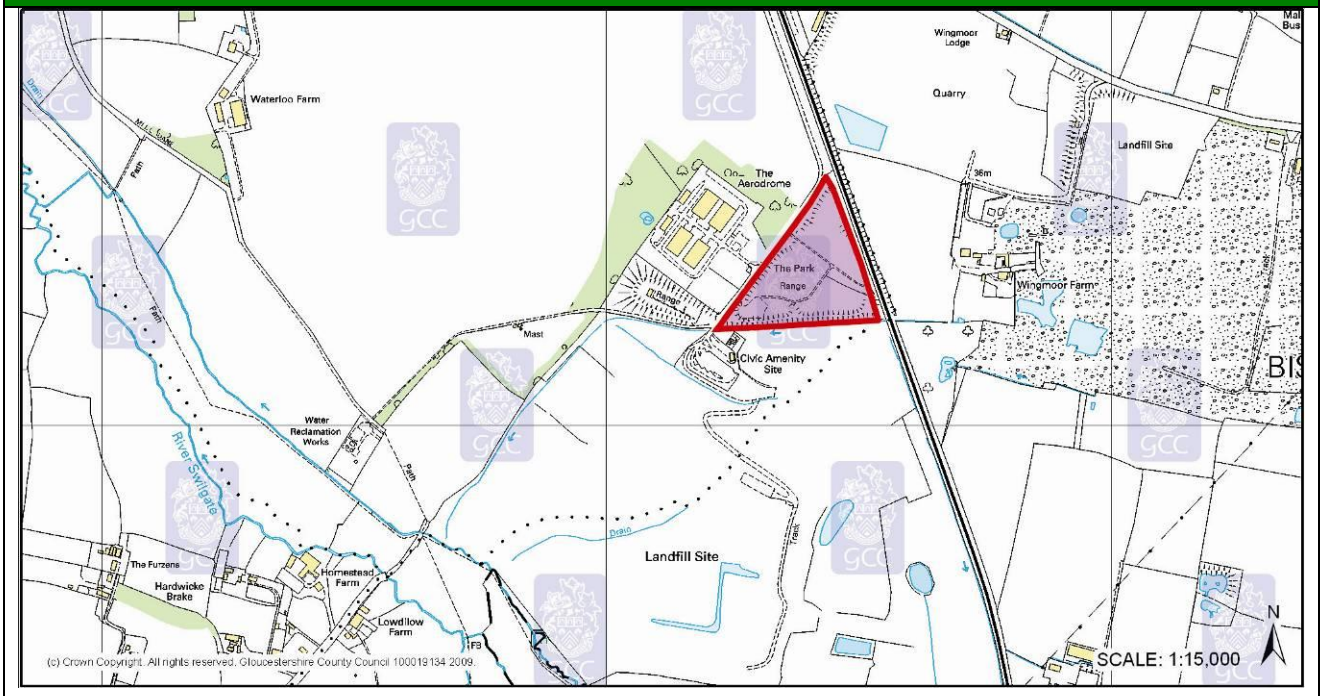
Potential nearby users	**ESTIMATED Heat Demand (kWh per annum)**
Local Plan - Extension to Malvern View (2.5 ha)	Data not available

SHLAA site Deans Farm, Bishops Cleeve – 2000 dwellings	14,560,000
SHLAA site Land to the north west of Cheltenham – 5000 dwellings	36,400,000
Recommendation	
The initial assessment work indicates that there would be a potential demand for a heat network within nearby existing development. However the heat network would have to be retrofitted. There is good potential for a heat network to be included within any future development due to the possible number of new dwellings associated with major potential development nearby.	

Site 2c: Area C at Wingmoor Farm West

Site Area (ha)	c. 5.5

Site Plan



Existing use/designation

Gun range. Open green or rough areas interspersed with trees, thick shrubs/hedges and a few low buildings.

Site ownership	Tewkesbury Borough Council
Approximate distance to nearest gas pipeline	0.2km – High pressure pipeline

Existing heat users within 0-1km of site

Nearby users	**ESTIMATED Heat Demand (kWh per annum)**
Business properties: There are 9 nearby businesses.	834,138
Residential properties: There are approximately 9 nearby residential properties.	65,520
Public buildings/other properties: Cheltenham North Rugby Club and the Cheltenham & District Clay Club.	Data not available

Potential heat users within 0-2km of site

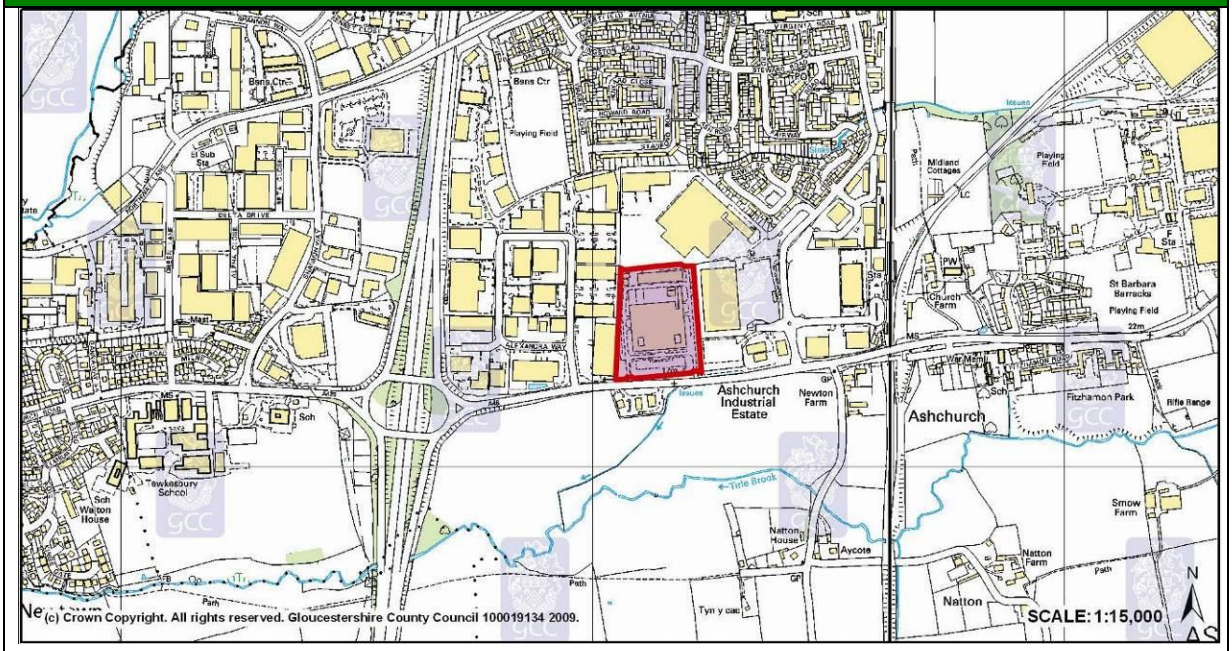
Potential nearby users	**ESTIMATED Heat Demand (kWh per annum)**
Local Plan - Extension to Malvern View (2.5 ha)	Data not available

SHLAA site Deans Farm, Bishops Cleeve - 2000 dwellings	14,560,000
SHLAA site Land to the north west of Cheltenham - 5000 dwellings	36,400,000
Recommendation	
The initial assessment work indicates that there would be a potential demand for a heat network within nearby existing development. However the heat network would have to be retrofitted. There is good potential for a heat network to be included within any future development due to the possible number of new dwellings associated with major potential development nearby.	

Site 3: Easter Park, Ashchurch/Tewkesbury Industrial Est.

Site Area (ha)	c. 3.5

Site Plan



Existing use/designation	
Substantially cleared site in centre of business/industrial park.	
Site ownership	Easter Group
Approximate distance to nearest gas pipeline	Running through the site – Medium pressure pipeline

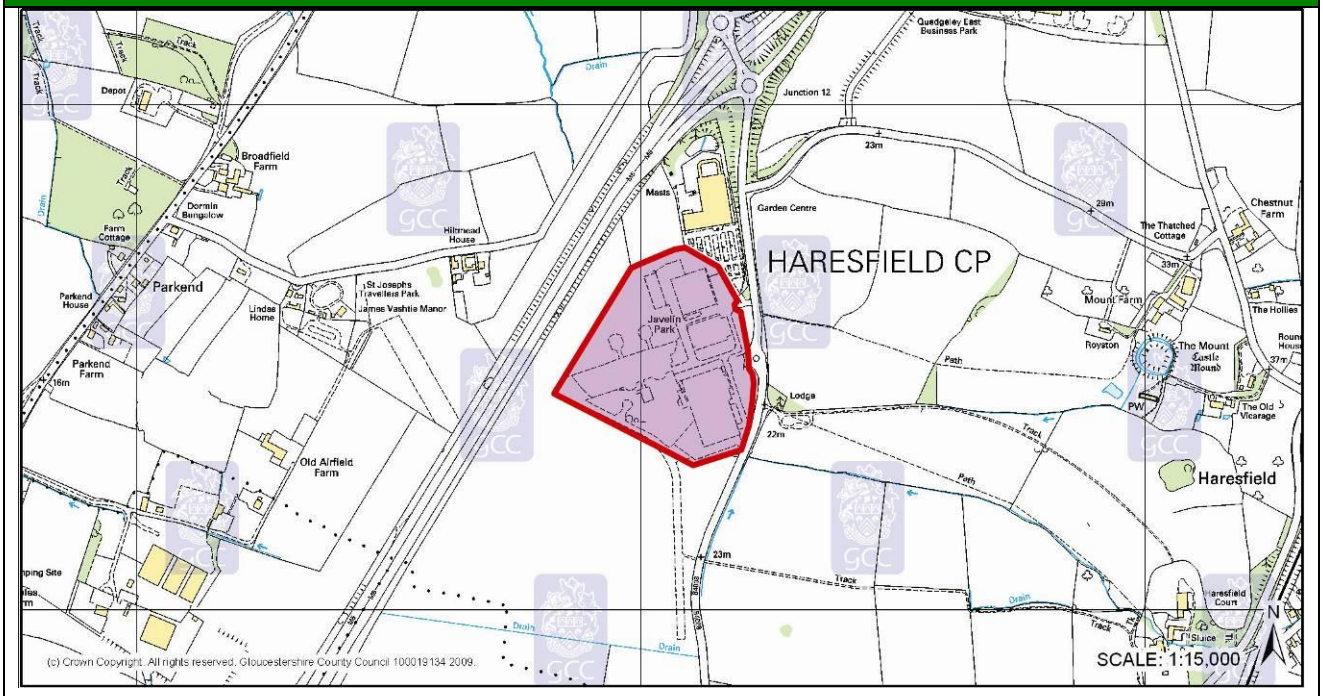
Existing heat users within 0-1km of site	
Nearby users	**ESTIMATED Heat Demand (kWh per annum)**
Business properties: There are 274 nearby businesses.	25,394,868
Residential properties: There are approximately 2119 nearby residential properties.	15,426,320
Public buildings/other properties: 5 nearby schools (4 junior, 1 senior) and 1 church	Data not available

Potential heat users within 0-2km of site	
Potential nearby users	**ESTIMATED Heat Demand (kWh per annum)**
Local Plan - Housing allocation AC1 – 20 dwellings	145,600
SHLAA site Land to the north and north west of DSDC Ashchurch - 1000 dwellings	7,280,000

SHLAA site Land surrounding Homedowns – North of Fiddington - 2000 dwellings	14,560,000
SHLAA site Land at Northway Lane, Northway - 5 dwellings	36,400
SHLAA site Land at Northway County Infants School, Northway - 10 dwellings	72,800
Recommendation	
The initial assessment work indicates that there would be a potential demand for a heat network within nearby existing development. However the heat network would have to be retrofitted. There is potential for a heat network to be incorporated within any future development due to the number of possible new dwellings associated with major potential development nearby.	

Site 4: Javelin Park

Site Area (ha)	c. 11
Site Plan	



Existing use/designation	
Vacant, previously developed airfield land. Benefits from planning permission for employment use.	
Site ownership	Gloucestershire County Council/Consi
Approximate distance to nearest gas pipeline	Running along the site boundary – Low pressure pipeline

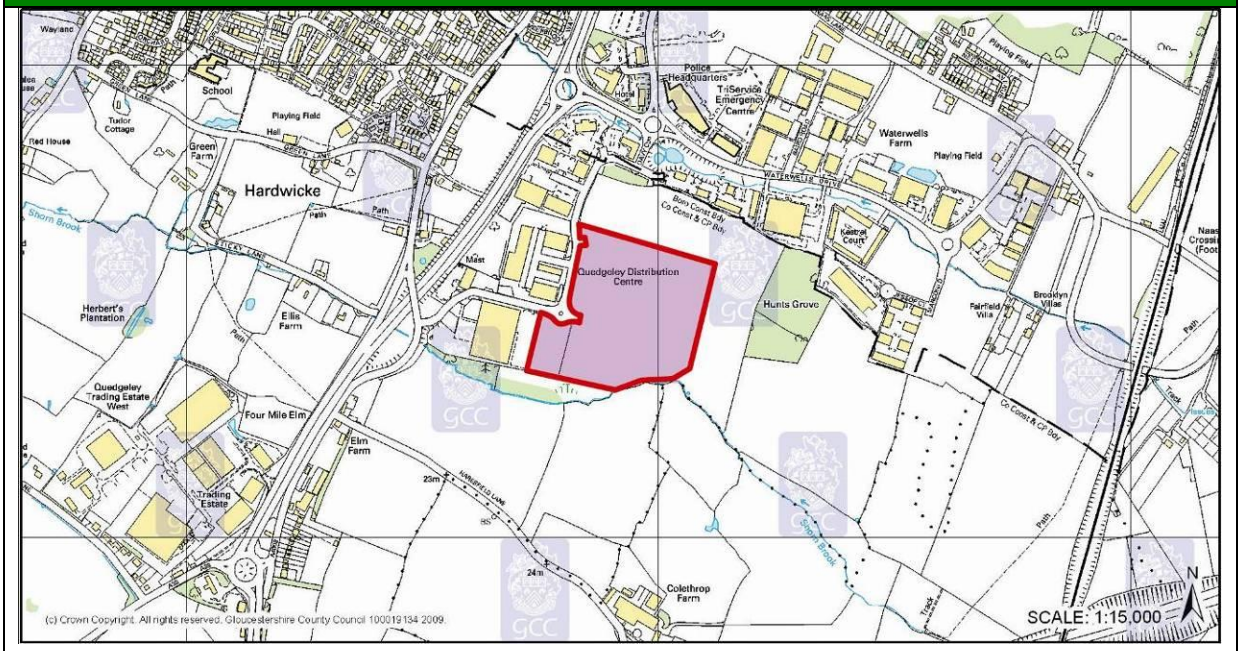
Existing heat users within 0-1km of site	
Nearby users	**ESTIMATED Heat Demand (kWh per annum)**
Business properties: There are 32 nearby businesses.	2,965,824
Residential properties: There are approximately 46 nearby residential properties.	334,880
Public buildings/other properties: 1 church	Data not available

Potential heat users within 0-2km of site	
Potential nearby users	**ESTIMATED Heat Demand (kWh per annum)**
Local Plan - EK36 Hardwicke Former MoD Site 6	Data not available

Local Plan - EK35 Hardwicke Former MoD Site 2	Data not available
SHLAA site - Hardwicke Green, Hardwicke – 2068 dwellings	15,055,040
SHLAA site - Green Farm, Green Lane, Hardwicke – 213 dwellings	1,550,640
SHLAA site - Summerhill Equestrian Centre, Hardwicke – 266 dwellings	1,936,480
SHLAA site - Land south of Haresfield Lane, Hardwicke – 994 dwellings	7,236,320
SHLAA site - Parkend Farm Lane, Moreton Valence – 246 dwellings	1,790,880
SHLAA site - Land surrounding Broadfield Farm, off A38, Moreton Valence – 345 dwellings	2,511,600
SHLAA site - Land adjacent to M5 at Moreton Valence – Plot C – 62 dwellings	451,360
SHLAA site - Land adjacent to M5 at Moreton Valence – Plot B – 246 dwellings	1,790,880
Existing planning permission – Hunts Grove – 1750 dwellings, neighbourhood centre (including a primary school) and 5.75ha employment	Data not available
Recommendation	
The initial assessment work indicates that there would be a limited demand for a retrofitted heat network within existing nearby development. There is potential for a heat network to be incorporated within any future development due to the number of possible new dwellings associated with potential development nearby.	

Site 5: Land adjacent to Quadrant Business Centre

Site Area (ha)	c. 9
Site Plan	



Existing use/designation	
Flat overgrown previously developed land	
Site ownership	Ashtenne
Approximate distance to nearest gas pipeline	Running along the site boundary – Low pressure pipeline

Existing heat users within 0-1km of site	
Nearby users	**ESTIMATED Heat Demand (kWh per annum)**
Business properties: There are 155 nearby businesses.	14,365,710
Residential properties: There are approximately 1854 nearby residential properties.	13,497,120
Public buildings/other properties: 1 church, 1 school, 3 units for the emergency centre and The Royal British Legion,	Data not available

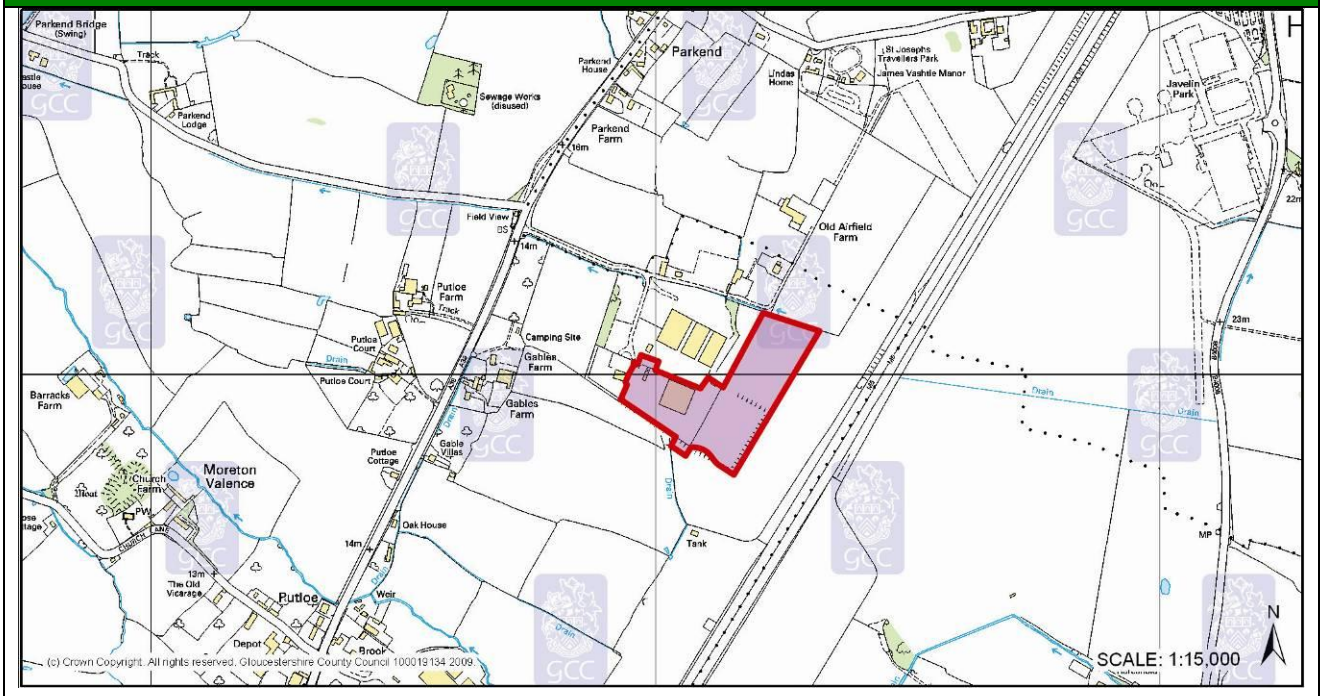
Potential heat users within 0-1km of site	
Potential nearby users	**ESTIMATED Heat Demand (kWh per annum)**
Local Plan - EK35 Hardwicke Former MoD Site 2	Data not available

SHLAA site - RAF Quedgeley, Kingsway – 3300 dwellings	24,024,000
SHLAA site - Mayo's Land, Quedgeley – 70 dwellings	509,600
SHLAA site - IM Distribution Centre, Naas Lane – 180 dwellings	1,310,400
SHLAA site - Lynton Fields and land to rear of – 57 dwellings	414,960
SHLAA site - Land east of Waterwells – 50 dwellings	364,000
SHLAA site - Land south of Grange Road – 220 dwellings	1,601,600
SHLAA site - Education site, Clearwell Drive, Quedgeley – 30 dwellings	218,400
SHLAA site - Land south of Gloucester, at Whaddon - 4,422 dwellings	32,192,160
SHLAA site - Sellars Farm, Hardwicke – 348 dwellings	2,533,440
SHLAA site - Mayo's Land, Hardwick – 80 dwellings	582,400
SHLAA site - Hardwicke Green, Hardwicke – 2068 dwellings	15,055,040
SHLAA site - Green Farm, Green Lane, Hardwicke – 213 dwellings	1,550,640
SHLAA site - Summerhill Equestrian Centre – 266 dwellings	1,936,480
SHLAA site - Land at Shorn Brook Hardwicke – 86 dwellings	626,080
SHLAA site - Land south of Haresfield Lane, Hardwicke – 994 dwellings	7,236,320
SHLAA site - Land surrounding Broadfield Farm, off A38, Moreton Valence – 345 dwellings	2,511,600
Existing planning permission – Hunts Grove – 1750 dwellings, neighbourhood centre (including a primary school) and 5.75ha employment	Data not available
Recommendation	
The initial assessment work indicates that there would is significant potential demand for a heat network within existing nearby development. However the heat network would have to be retrofitted. There is also good potential for a heat network to be incorporated within any future development due to the number of possible new dwellings associated with major potential development nearby.	

Site 6: Land at Moreton Valence

Site Area (ha)	c. 5.6

Site Plan



Existing use/designation	
Former airfield land. Busy C&D and C&I waste facility. The extension area is currently farm land.	
Site ownership	Smiths Gloucester
Approximate Distance to nearest gas pipeline	Running through the site – High pressure pipeline

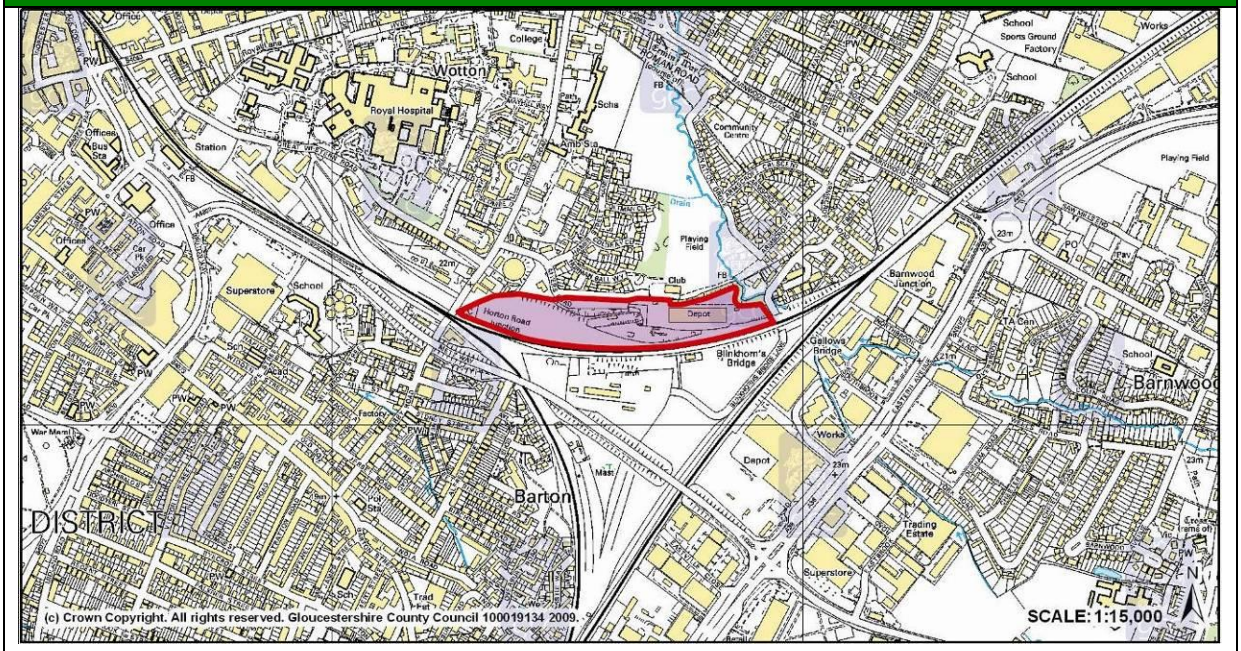
Existing heat users within 0-1km of site	
Nearby users	**ESTIMATED Heat Demand (kWh per annum)**
Business properties: There are 23 nearby businesses.	2,131,686
Residential properties: There are approximately 54 nearby residential properties.	393,120
Public buildings/other properties: 1 church	Data not available

Potential heat users within 0-2km of site	
Potential nearby users	**ESTIMATED Heat Demand (kWh per annum)**
Local Plan - EK36 Hardwicke Former MoD Site 6	Data not available

SHLAA site - Land north west of Whitminster (only some of this site falls within the 2KM buffer zone) – 1455 dwellings	10,592,400
SHLAA site - Summerhill Equestrian Centre, Hardwicke – 266 dwellings	1,936,480
SHLAA site - Hardwick Green, Hardwicke – 2068 dwellings	15,055,040
SHLAA site - Land south of Haresfield Lane, Hardwicke – 994 dwellings	5,238,380
SHLAA site - Parkend Farm Land, Moreton Valence – 246 dwellings	1,790,880
SHLAA site - Land surrounding Broadfield Farm, off A38, Moreton Valence – 345 dwellings	2,511,600
SHLAA site - Land adjacent to M5 at Moreton Valence – Plot C – 62 dwellings	451,360
SHLAA site - Land adjacent to M5 at Moreton Valence – Plot B – 246 dwellings	1,790,880
Recommendation	
The initial assessment work indicates that there would be a limited demand for a retrofitted heat network within existing nearby development. There is potential for a heat network to be incorporated within any future development due to the number of possible new dwellings associated with potential development nearby.	

Site 7: Land north of Railway Triangle, Gloucester

Site Area (ha)	c. 5.5
Site Plan	



Existing use/designation	
Existing waste transfer site/aggregate business. The site also includes an area containing other small businesses as well as redundant railway land and sidings	
Site ownership	Allstone Sand and Gravel Ltd
Approximate distance to nearest gas pipeline	Running along the site boundary – Low pressure pipeline

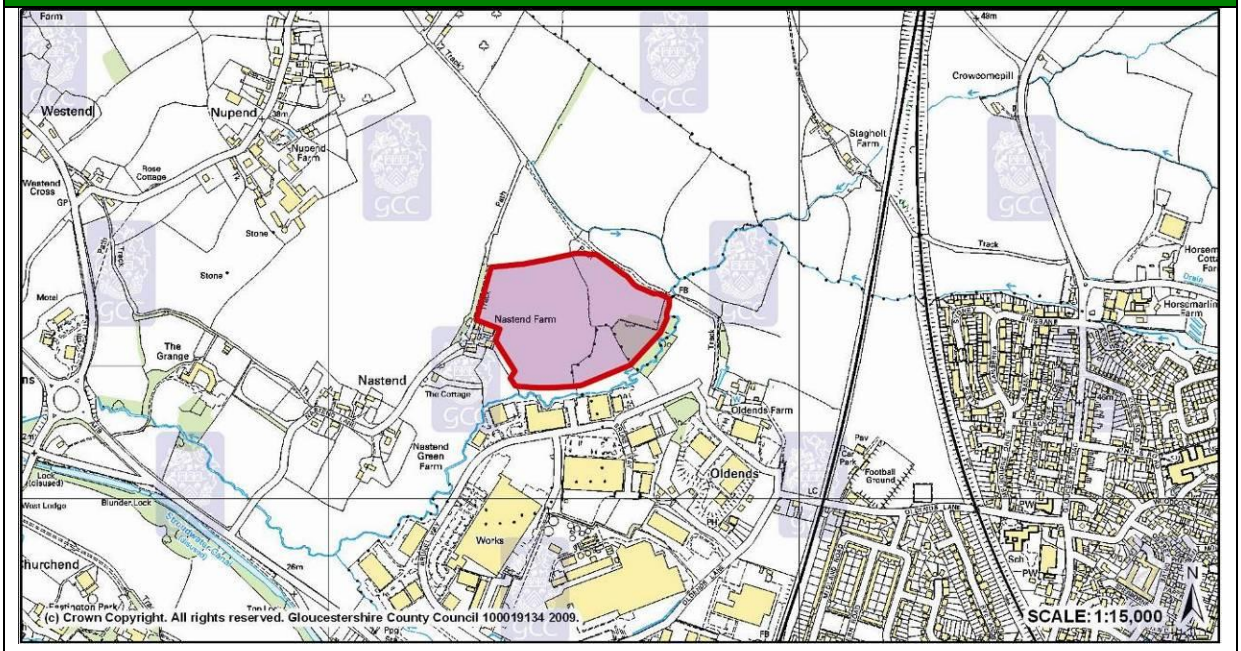
Existing heat users within 0-1km of site	
Nearby users	**ESTIMATED Heat Demand (KWh per annum)**
Business properties: There are approximately 602 nearby businesses.	55,794,564
Residential properties: There are approximately 8027 nearby residential properties.	58,436,560
Public buildings/other properties: These include approximately 1 hospital, 1 ambulance station, 9 schools, 4 churches, 1 police station, 1 fire station, 2 sports/leisure centres and the TA Centre. There are approximately 30 nearby public building/other properties in total.	Data not available

Potential heat users within 0-2km of site	
Potential nearby users	**ESTIMATED Heat Demand (kWh per annum)**
Local Plan –H 2.6 Bus Depot, London Rd -35 dwellings	254,800
Local Plan – H 2.1 Part of St Michael's Square facing Brunswick Road – 35 dwellings	254,800
Local Plan – H 2.3 Thomas Rich's car park – 30 dwellings	218,400
Local Plan – HC 18 Bakers Quay – 118 dwellings	859,040
Local Plan – MU 3 Bus Station and Market Parade (bus station, offices, retail and housing) 25 dwellings	182,000
SHLAA site - Railway triangle (North) – 334 dwellings	2,431,520
SHLAA site - Fire Station – Eastern Avenue – 38 dwellings	276,640
SHLAA site - Former B&Q – 40 dwellings	291,200
SHLAA site - Bohanam House and adj Elmscroft Community Centre site – 38 dwellings	276,640
SHLAA site - Hellipebs, Sisson Road – 70 dwellings	509,600
SHLAA site - Paygrove West – land off Paygrove Lane – 15 dwellings	109,200
SHLAA site - Clifton Road triangle – 65 dwellings	473,200
SHLAA site - Land at the corner of Southgate Street and Trier Way – 12 dwellings	87,360
SHLAA site - former GWRSA social club – 20 dwellings	145,600
SHLAA site - Bus Station and Market Parade – 200 dwellings	1,456,000
SHLAA site - former Telecom House, Great Western Road – 25 dwellings	182,000
SHLAA site - Hampden Way car park – 75 dwellings	546,000
SHLAA site - Heathfields, 30 Denmark Road – 4 dwellings	29,120
SHLAA site - Land at Posy Lane, Lansdown Road and Denmark Road – 10 dwellings	72,800
Gloucestershire Heritage Urban Regeneration Corporation site – Railway Triangle	Data not available
Recommendation	
This site has significant potential heat demand from existing nearby development including businesses, dwellings and Gloucester Royal Hospital. However to meet this demand a	

significant heat network would have to be retrofitted. There is potential for a heat network to be included within any future development in particular the prospective redevelopment of the railway triangle area.

Site 8: Nastend Farm, Stroudwater Industrial Estate

Site Area (ha)	c. 8.5
Site Plan	



Existing use/designation	
Grazing farmland. This is a Greenfield site but is allocated for future employment use in the Stroud Local Plan	
Site ownership	Gloucestershire County Council
Approximate distance to nearest gas pipeline	0.6km – Medium pressure pipeline

Existing heat users within 0-1km of site	
Nearby users	**ESTIMATED Heat Demand (kWh per annum)**
Business properties: There are 134 nearby businesses.	12,419,388
Residential properties: There are approximately 1133 nearby residential properties.	8,248,240
Public buildings/other properties: 3 schools and 1 library, there are also other properties to include 1 nursing home.	Data not available

Potential heat users within 0-2km of site	
Potential heat users	**ESTIMATED Heat Demand (kWh per annum)**
Local Plan - EA9 Stonehouse North of Stroudwater Industrial	Data not available

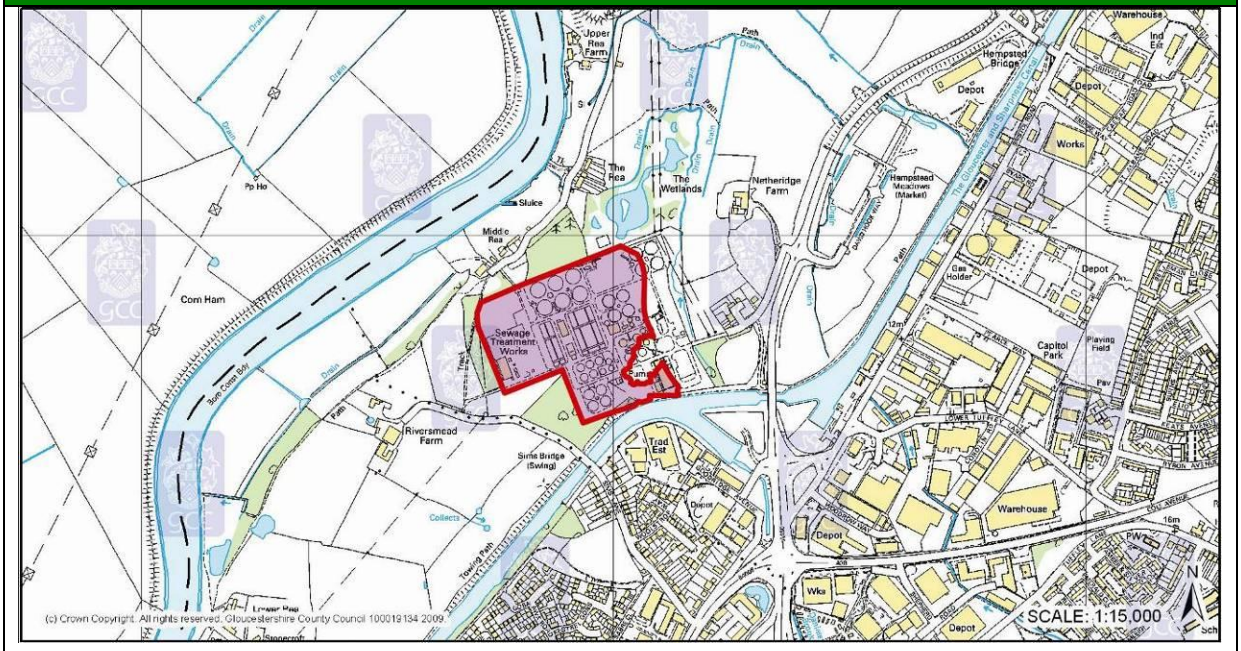
Estate 15.7ha	
Local Plan - EA2 Eastington Meadow Mill, Eastington 2.2ha	Data not available
Local Plan - EK2 Eastington Meadow Mill Industrial Estate	Data not available
Local Plan - EK4 Stonehouse Bonds Mill Industrial Estate, Bristol Road	Data not available
Local Plan - EK5 Stonehouse Upper Mills Industrial Estate, Bristol Road	Data not available
Local Plan - Hg15C Garage and plumbers' yard, Gloucester Road - 20 dwellings	145,600
SHLAA site - Land west of Stonehouse – 3805 dwellings	27,700,400
SHLAA site - Land north of Eastington – 1567 dwellings	11,407,760
SHLAA site - Land to the rear of Regent Street, Stonehouse – 28 dwellings	203,840
SHLAA site - Pearcroft Road, Stonehouse – 18 dwellings	131,040
SHLAA site - Pearcroft Road, Stonehouse – 85 dwellings	618,800
SHLAA site - Paper Mill, Lower Mills, Stonehouse – 55 dwellings	400,400
SHLAA site - Cotswold Green, Stonehouse – 28 dwellings	203,840
SHLAA site - Former goods yard and branch line, Stonehouse – 71 dwellings	516,880
SHLAA site - Willow Farm, Bristol Road, Stonehouse – 95 dwellings	691,600
SHLAA site - Land to the east of Bramble Lane, Stonehouse 54 dwellings	393,120
SHLAA site - Land between Millend Lane and Bath Road, Eastington – 306 dwellings	2,227,680
SHLAA site - Site of former Ship Inn, Stonehouse – 12 dwellings	87,360
SHLAA site - The Shubberies School, Oldends Lane, Stonehouse – 44 dwellings	320,320
SHLAA site - Land at Kimmins Road, Stonehouse – 10 dwellings	72,800
SHLAA site - Land opposite Avenue Terrace, Stonehouse – 226 dwellings	164,280
SHLAA site - Land west of Bridgend House, Bridgend, Stonehouse – 62 dwellings	451,360

SHLAA site - Land at former hospital, Standish – 184 dwellings	1,339,520
SHLAA site - Chipmans Platt, Oldbury, Stonehouse – 52 dwellings	378,560
SHLAA site - Horsemarling Farm, Stonehouse – 82 dwellings	596,960
SHLAA site - Land to the north of Millend Lane, Eastington – 29 dwellings	211,120
SHLAA site - Land off Cotswold Avenue, Eastington – 49 dwellings	356,720
SHLAA site - Land North of Broadfield Road – 206 dwellings	1,499,680
SHLAA site - Land to the rear of Nupend Farm, Nupend – 131 dwellings	953,680
Recommendation	
The initial assessment work indicates that there would be significant potential demand for a heat network within existing nearby development, specifically from industrial uses such as the dairy. However the heat network would have to be retrofitted. There would also be potential for a heat network to be incorporated within any future development due to the number of possible new dwellings associated with potential future development in the local area.	

Site 9: Netheridge Sewage Treatment Works, Gloucester

Site Area (ha)	Entire site 11.9ha. Available area (outside of part of site vulnerable to flooding) 8.5ha

Site Plan



Existing use/designation

Large sewage treatment works utilising Combined Heat and Power on site. Therefore the assessment below is based on additional facilities being developed for an increase in capacity based on it potentially being allocated as a strategic waste site within the WCS.

Site ownership	Severn Trent Water
Approximate distance to nearest gas pipeline	Running along site boundary – Medium pressure pipeline

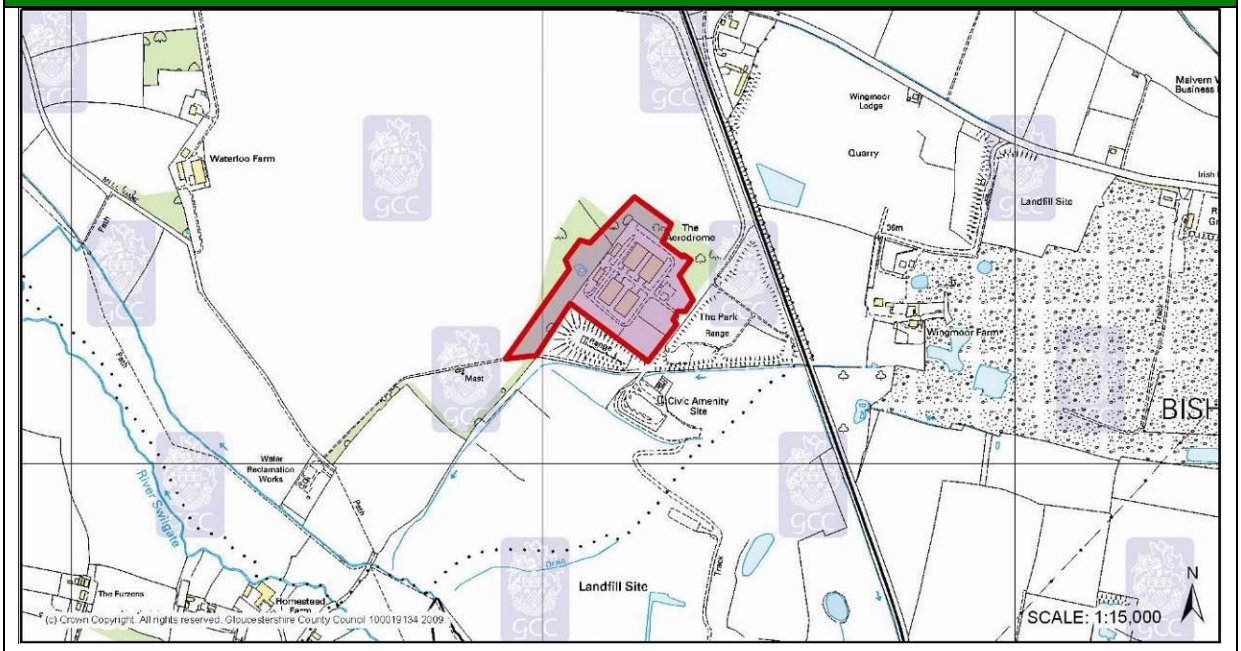
Existing heat users within 0-1km of site

Nearby heat users	**ESTIMATED Heat Demand (kWh per annum)**
Business properties: There are 247 nearby businesses.	22,892,454
Residential properties: There are approximately 1717 nearby residential properties in total.	12,499,760
Public buildings/other properties: 1 primary school.	Data not available

Potential heat users within 0-2km of site	
Potential heat users	**ESTIMATED Heat Demand (kWh per annum)**
SHLAA site - former oil storage depot, Hempsted – 100 dwellings	728,000
SHLAA site - Industrial estate, Secunda Way – 12 dwellings	87,360
SHLAA site - Travis Perkins, Secunda Way – 142 dwellings	1,033,760
SHLAA site - Griggs Timber, Bristol Road – 12 dwellings	87,360
SHLAA site - Rear of 67-75 Milton Avenue, Podsmead – 45 dwellings	327,600
SHLAA site - Former Hempsted gas works – 225 dwellings	1,638,000
SHLAA site - Education site, Clearwell Drive, Quedgeley – 30 dwellings	218,400
SHLAA site - Blackbridge Allotments & playing field, Stroud Road – 220 dwellings	1,601,600
SHLAA site - RAF Quedgeley, Kingsway – 3300 dwellings	24,024,000
SHLAA site - Land between Canal & Bristol Road – 200 dwellings	1,456,000
Recommendation	
The initial assessment work indicates that there is would be significant potential demand for a heat network within existing nearby development. However the heat network would have to be retrofitted. There is potential for a heat network to be included within any future development due to the possible number of new dwellings associated with potential future development in the local area.	

Site 10: The Park, Wingmoor Farm West

Site Area (ha)	c. 6.8
Site Plan	



Existing use/designation	
An industrial estate with existing waste management uses. In the centre of the site there are 4 former RAF buildings/hangers.	
Site ownership	Wellington Park Properties
Approximate distance to nearest gas pipeline	Running through the site – High pressure pipeline

Existing heat users within 0-1km of site	
Nearby heat users	**ESTIMATED Heat Demand (kWh per annum)**
Business properties: There are 13 businesses	1,204,866
Residential properties: There are approximately 23 nearby residential properties in total.	167,440
Public buildings/other properties: There are no nearby public buildings	Data not available

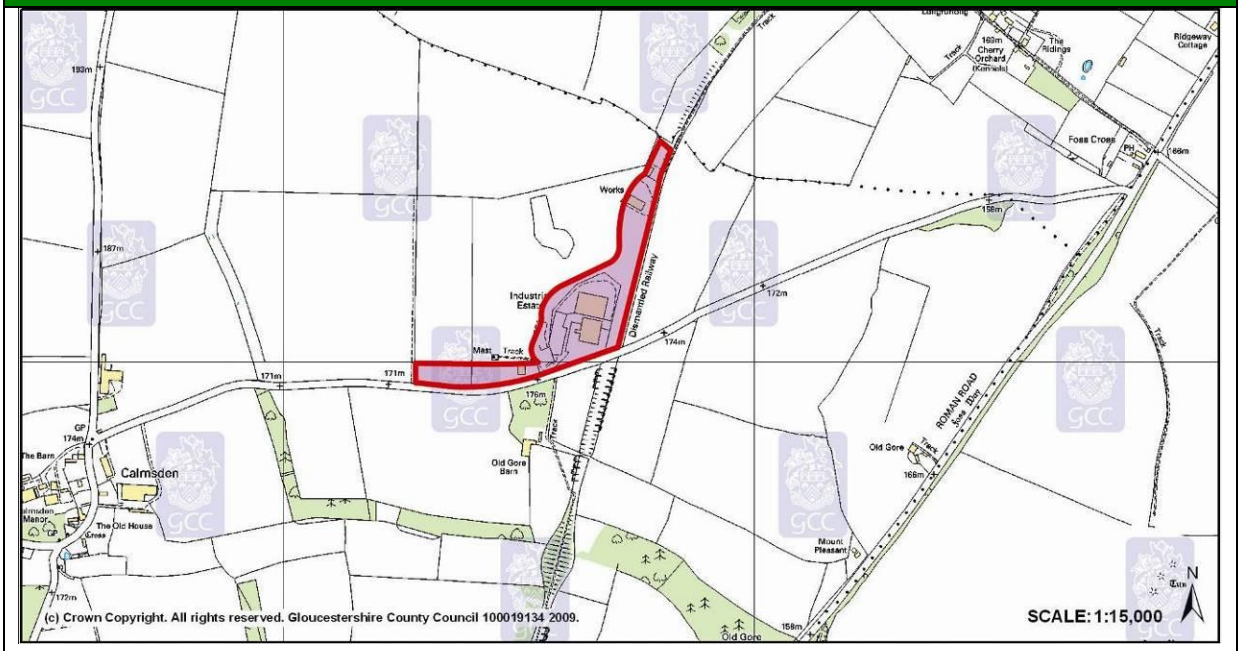
Potential heat users within 0-2km of site	
Potential nearby users	**ESTIMATED Heat Demand (kWh per annum)**
Local Plan - Extension to Malvern View (2.5 ha)	Data not available

SHLAA site Deans Farm, Bishops Cleeve - 2000 dwellings	14,560,000
SHLAA site Land to north west of Cheltenham - 5000 dwellings	36,400,000
Recommendation	
The initial assessment work indicates that there would be a demand for a heat network within the existing development. However the heat network would have to be retrofitted. There is good potential for a heat network to be included within any future development due to the possible number of new dwellings associated with major potential development nearby.	

Site 11: Foss Cross Industrial Estate, Calmsden

Site Area (ha)	c. 6.4

Site Plan



Existing use/designation

Small irregular shaped industrial estate containing HRC, storage, equine and pet services and other uses.

Site ownership	Gloucestershire County Council, Equine & Pet Services Ltd and Cirencester Self Storage Ltd
Approximate distance to nearest gas pipeline	No data

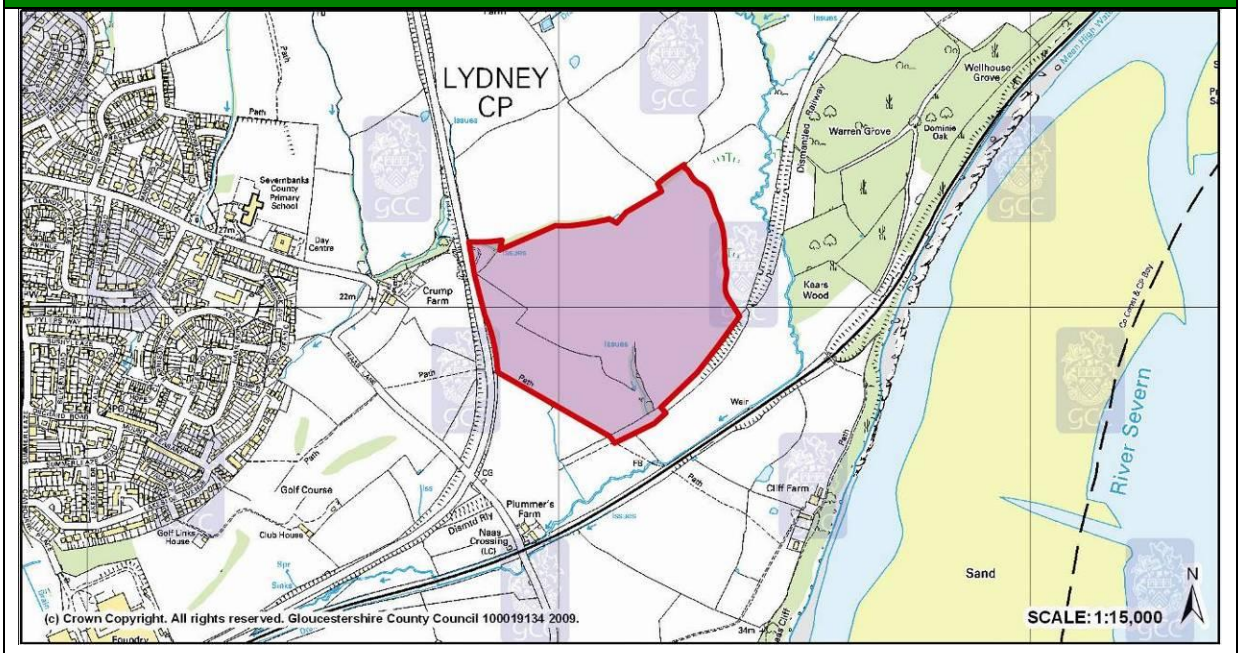
Existing heat users within 0-1km of site

Nearby users	ESTIMATED Heat Demand (KWh per annum)
Business properties: There are 12 nearby businesses	1,112,184
Residential properties: There are approximately 22 nearby residential properties in total.	160,160
Public buildings/other properties: There are no other properties or public buildings nearby.	Data not available

Potential heat users within 0-2km of site	
Potential nearby users	**ESTIMATED Heat Demand (kWh per annum)**
N/A	N/A
Recommendation	
This site would only be suitable for a small scale CHP/district heating network due to the limited number of existing properties in the vicinity of the site and the lack of planned development nearby. Any scheme would have to be retrofitted.	

Site 12: Hurst Farm. Lydney

Site Area (ha)	c. 20
Site Plan	



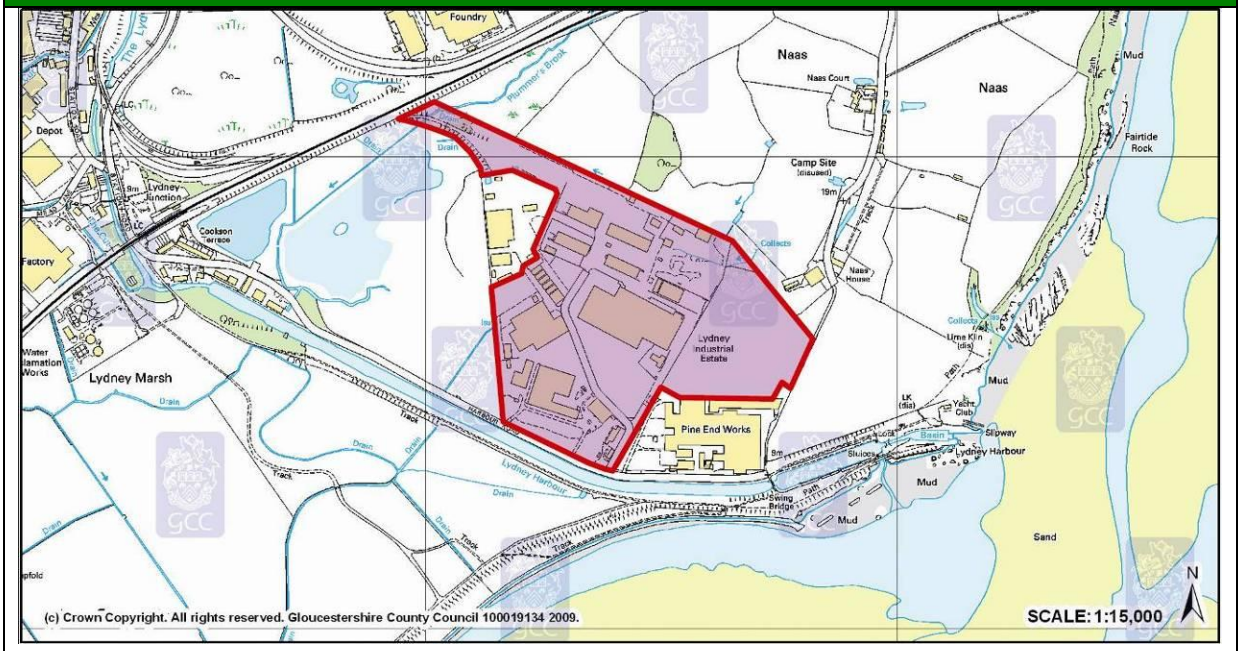
Existing use/designation	
Mixed use allocation site, open fields	
Site ownership	Robert Hitchins Ltd
Approximate distance to nearest gas pipeline	1km – Low pressure pipeline

Existing heat users within 0-1km of site	
Nearby users	**ESTIMATED Heat Demand (KWh per annum)**
Business properties: There 18 nearby businesses in total.	1,668,276
Residential properties: There are approximately 1272 nearby residential properties in total.	9,260,160
Public buildings/other properties: 1 primary school	Data not available

Potential heat users within 0-2km of site	
Potential nearby users	**ESTIMATED Heat Demand (kWh per annum)**
Local Plan - Lydney 1 – Mixed use – 1250 dwellings and 9ha employment	Data not available
Local Plan - Lydney 5 – Housing – Kings Building (Mill St South) – 18 dwellings	131,040
Local Plan - Lydney 6 – Housing – Hill Street – 10 dwellings	72,800
Local Plan - Lydney 8 – Mead Lane – B1, B2, B8	Data not available
Local Plan - Lydney 9 – rear of Pine End Works, Harbour Lane – B1, B2, B8	Data not available
SHLAA site – Cambourne Place - 33 dwellings	240,240
SHLAA site – Former Council Offices, High Street -14 dwellings	101,920
SHLAA site – Severnbanks School – 74 dwellings	538,720
SHLAA site – Highfield Road – 47 dwellings	342,160
SHLAA site – Land at Primrose Hill, Springfield Road – 8 dwellings	58,240
SHLAA site – Augustus Way, Court Road, Allaston – 196 dwellings	1,426,880
SHLAA site – Allaston Road – 9 dwellings	65,520
Recommendation	
The initial assessment work indicates that there would be a potential demand for a heat network within existing nearby development. However the heat network would have to be retrofitted. There is limited potential for a heat network to be included within any future development due to the relatively small number of possible new dwellings associated with future development in the local area.	

Site 13: Land at Lydney Industrial Estate

Site Area (ha)	c. 28
Site Plan	



Existing use/designation	
Industrial estate and other land.	
Site ownership	Beachley Property Ltd
Approximate distance to nearest gas pipeline	Running through the site – Low pressure pipeline

Existing heat users within 0-1km of site	
Nearby users	**ESTIMATED Heat Demand (kWh per annum)**
Business properties: There are approximately 39 nearby businesses in total.	3,614,598
Residential properties: There are approximately 1156 nearby residential properties in total.	8,415,680
Public buildings/other properties: 1 church	Data not available

Potential heat users within 0-2km of site	
Potential nearby users	**ESTIMATED Heat Demand (KWh per annum)**
Local Plan - Lydney 1 – Mixed use – 1250 dwellings and 9ha employment	Data not available

Local Plan - Lydney 5 – Housing – Kings Building (Mill St South) – 18 dwellings	Data not available
Local Plan - Lydney 6 – Housing – Hill Street – 10 dwellings	72,800
Local Plan - Lydney 8 – Mead Lane – B1, B2, B8	Data not available
Local Plan - Lydney 9 – rear of Pine End Works, Harbour Lane – B1, B2, B8	Data not available
SHLAA site – Cambourne Place - 33 dwellings	240,240
SHLAA site – Former Council Offices, High Street - 14 dwellings	101,920
SHLAA site – Severnbanks School – 74 dwellings	538,720
SHLAA site – Highfield Road – 47 dwellings	342,160
SHLAA site – Land at Primrose Hill, Springfield Road – 8 dwellings	58,240
Recommendation	
The initial assessment work indicates that there would be a potential demand for a heat network within the existing development. However the heat network would have to be retrofitted. There is limited potential for a heat network to be included within any future development due to the relatively small number of possible new dwellings associated with future development in the local area.	

Appendix 1

Sources of Further Information

Publications

Energy Act 2008
Integrated Energy – The role of CHP and district heating in our energy future – CHPA (2010)
Meeting the Energy Challenge – A White Paper on Energy (2007)
PPS1 – Delivering Sustainable Development (2005)
PPS22 – Renewable Energy (2004)
Review of PPS22 (2010)
Draft PPS: Planning for a Low Carbon Future in a Changing Climate (2010)
The UK Renewable Energy Strategy (July 2009)
Warm Homes, Greener Homes – A Strategy for Household Energy Management (March 2010)
Waste Strategy for England (May 2007)

Websites

CHP focus – www.chp.decc.gov.uk/cms
Combined Heat and Power Association - www.chpa.co.uk
DEFRA - www.defra.gov.uk/environment/waste
The official information portal on Anaerobic Digestion - www.biogas-info.co.uk
UK heat map – www.chp.decc.gov.uk/heatmap/

recycle for Gloucestershire

Gloucestershire
COUNTY COUNCIL

Minerals & Waste Planning Policy
Environment Directorate
Gloucestershire County Council
Shire Hall
Gloucester
GL1 2TH

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December 2010