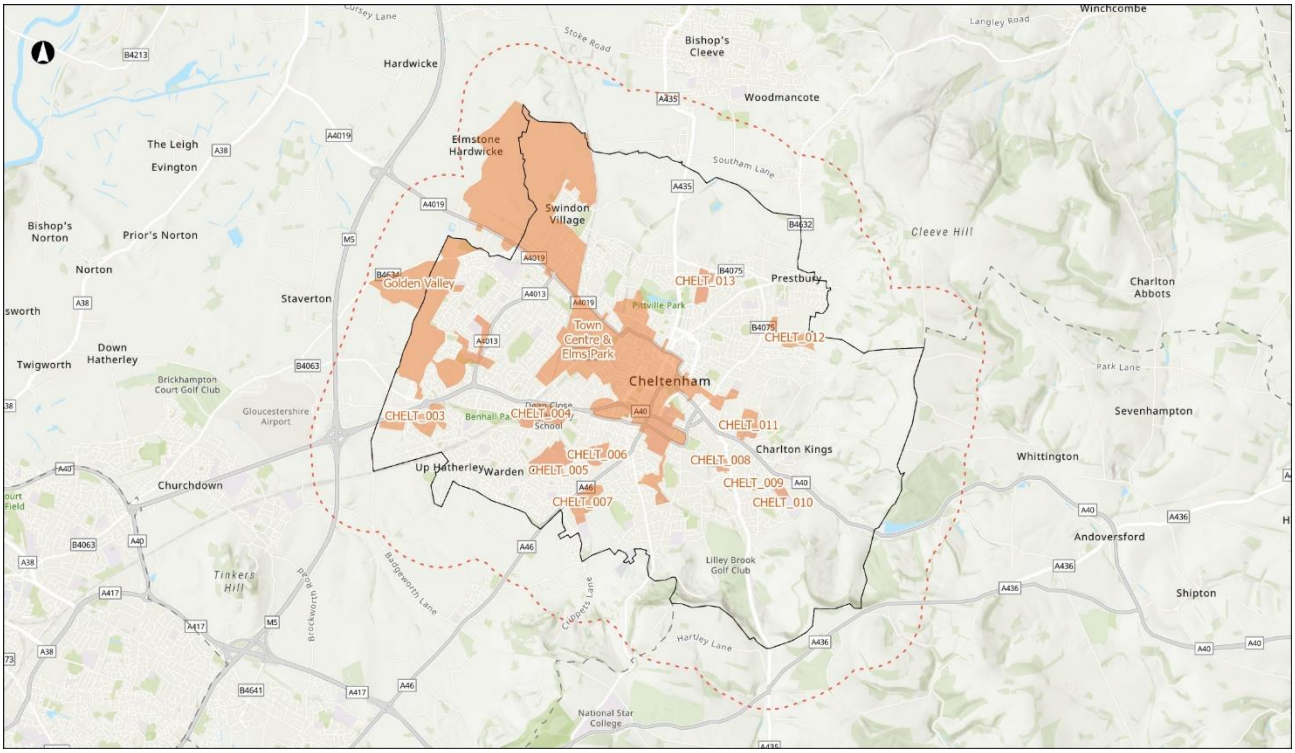
Department for Energy Security & Net Zero

Cheltenham

Heat Network Zoning

Zone Opportunity Report



February 2025

Disclaimer

Please read the following licence conditions thoroughly to understand your responsibility for use of this report and data presented within it.

This report contains outputs from the Heat Network Zoning Pilot Programme. The Pilot was undertaken prior to full details of the Heat Network Zoning policy being available. Therefore, the contents, including data shown in maps, technical and economic data within the report, are likely to change and potentially sensitive information is withheld. No part of this report shall be relied upon for any business decisions.

Acknowledgements

This document was produced by Greenfield Nordic in partnership with Cheltenham Borough Council in a template format provided by DESNZ. We are grateful to all stakeholders who participated in the Pilot programme for their time and assistance.

Any enquiries regarding this publication should be sent to us at:
hnzoning@energysecurity.gov.uk

Contents

Executive Summary

About Cheltenham: Cheltenham is a large town in Gloucestershire in southwest England, with a population of approximately 115,000. It is named after the River Chelt which flows through the town.

Local Energy Policy: In 2019 Cheltenham Borough Council declared a climate emergency and stated an ambition for the town to be carbon neutral by 2030. The local energy policy supports the development of heat networks.

Existing heat networks: Cheltenham currently has limited existing heat network infrastructure but plans to develop new networks to meet future energy demands.

Zones identified: 13 potential heat network zones have been identified for heat network development in Cheltenham, with an overall heat demand for all buildings required to connect within these zones estimated at 200GWh/yr.

Strategic heat network zones: Two strategic zones have been identified with an overall heat demand for all buildings required to connect within these zones estimated at 175GWh/yr.

Key heat demands: The initial zone opportunities have an overall heat demand of 150GWh/yr, with key buildings including the Golden Valley development, GCHQ, and Gloucestershire College.

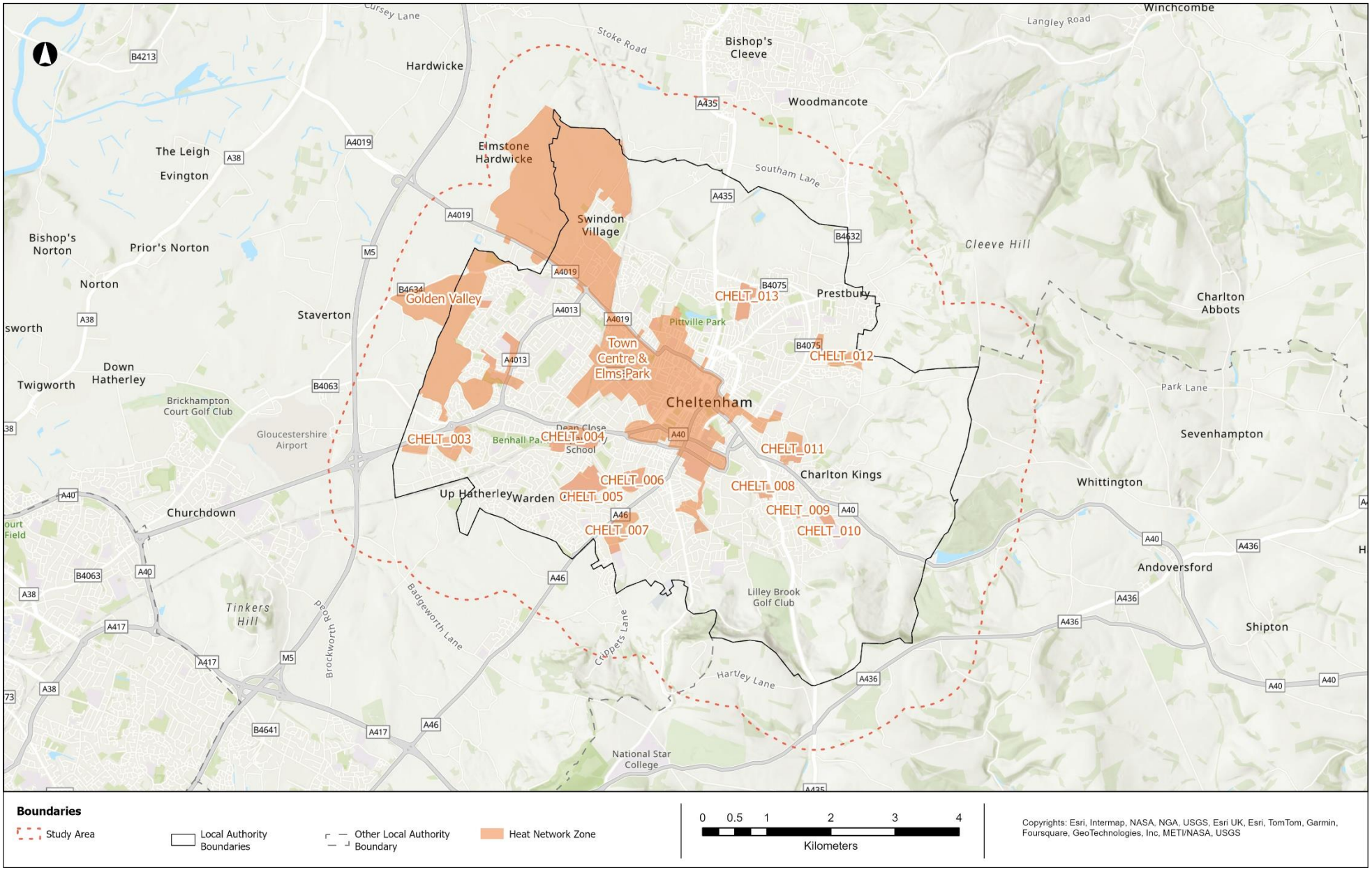
Key heat sources: Potential heat sources include waste heat recovery from the Hayden Sewage Treatment Works, GCHQ, water source heat pumps, and large-scale solar thermal arrays.

Estimated CapEx: The high-level estimate of capital expenditure to network all buildings required to connect in all zones is approximately £225m, of which the initial zone opportunities amount to approximately £175m.

Other heat network zones: Several smaller and more discrete heat network opportunities have been identified around clusters of office, commercial and educational buildings.

Carbon savings: The initial zone opportunities identified could deliver carbon savings of approximately 25ktCO_{2e}/yr.

Figure 1: Overview of Heat Network Zones in Cheltenham



1) Introduction

Heat networks will play a crucial role in decarbonising heat in buildings. Heat networks take heating, cooling or hot water from a central source(s) and deliver it to a variety of premises such as public buildings, shops, offices, hospitals, universities, and homes. They are also an important part of securing the UK's energy independence through local, low carbon heat sources and reducing the cost of living through efficient, affordable heating in densely populated areas. Analysis shows that heat networks could provide about 20% of total heat by 2050. They currently provide about 3%.

The Department for Energy Security and Net Zero (DESNZ) is enabling the development of heat network infrastructure through a range of targeted funding, policy and legislative support to de-risk projects and attract investment. The Energy Act 2023 establishes the regulatory framework for heat networks in Great Britain and provides powers to introduce heat network zoning in England through secondary legislation. A heat network zone (HNZ) is a formally designated geographical area in England where heat networks are expected to provide the lowest-cost solution for decarbonising heating.

Under heat network zoning, central and local government will work with industry and local stakeholders to identify and designate areas of England where heat networks are expected to be the lowest-cost solution to decarbonising heat. Heat network zoning will be essential to speeding up the development of new heat networks and we hope to catalyse growth where it's most needed.

Heat network zoning will significantly increase private sector investment in the sector by removing the barriers which currently limit the pace of developing large scale heat networks. It will also give local communities the tools to accelerate the development of heat networks in their own areas and ensure that more homes and businesses can have access to greener, cheaper heat. It also has the potential to create tens of thousands of jobs across the country.

This report shows the Pilot programme outputs for Cheltenham and is intended to showcase potential heat network zones in the city. The report indicates the heat network investment opportunity at a city scale, the potential location of heat network zones, and key opportunities for initial heat network development within those potential zones

Please note that all information presented in this report, including the location of identified heat network zones, is subject to change. These are the findings of Pilot programme that were developed alongside the emerging Heat Network Zoning policy and therefore reflect our understanding at a moment in time. As the methodology improves, we will update these reports to improve our understanding of how heat network zoning may be rolled out in each area. Any potential zones that are identified fully, or partly, in an adjacent local authority area will need to be discussed further once local zone co-ordinators are established.

Heat Network Zoning Pilot Methodology

Heat network zones will be identified using a standardised national zoning methodology. The Heat Network Zoning Pilot Programme (hereafter Pilot programme) set out to develop a process to identify potential zones in a consistent and standardised manner across a range of towns and cities in England. The programme was fully funded and led by DESNZ, working alongside 28 Local Authorities, and multiple consultancy firms, to develop and test this approach at a local level. As such the final outputs are supported by each Local Authority but do not reflect an approved, endorsed, or adopted position on how zones may be delivered.

Lessons from the Pilot have been used to inform the development of the Heat Network Zoning policy. This includes improvements to the identification approach itself, but also wider policy design relating to the number and size of potential zones; existing heat networks; and the impacts of the policy on a range of stakeholders. Once the response to the heat network zoning consultation is published, we will update the methodology to reflect the final policy position.

The key concepts, definitions and complementary workstreams relevant to this report are introduced below. For a fuller description of the Heat Network Zoning policy, and up to date information regarding its implementation, please visit https://www.gov.uk/government/collections/heat-network-zoning.

Heat Network Zone Identification

Heat network zones will be identified using a standardised national zoning methodology. The December 2023 consultation on Heat Network Zoning proposes that the methodology will consist of two stages:

1. a national mapping exercise (using a data-led spatial energy model – the National Zoning Model, (or NZM), to identify indicative heat network zones across England;
2. a refinement stage where relevant local stakeholders will input to the review and refinement of potential heat network zones prior to formal designation.

For the purposes of this study, indicative heat network zones have been identified using a prototype version of the NZM. These indicative zones were then refined by technical consultants with input from local stakeholders. The NZM outputs are already of considerably higher quality than those shared for this work and therefore these reports will improve over time.

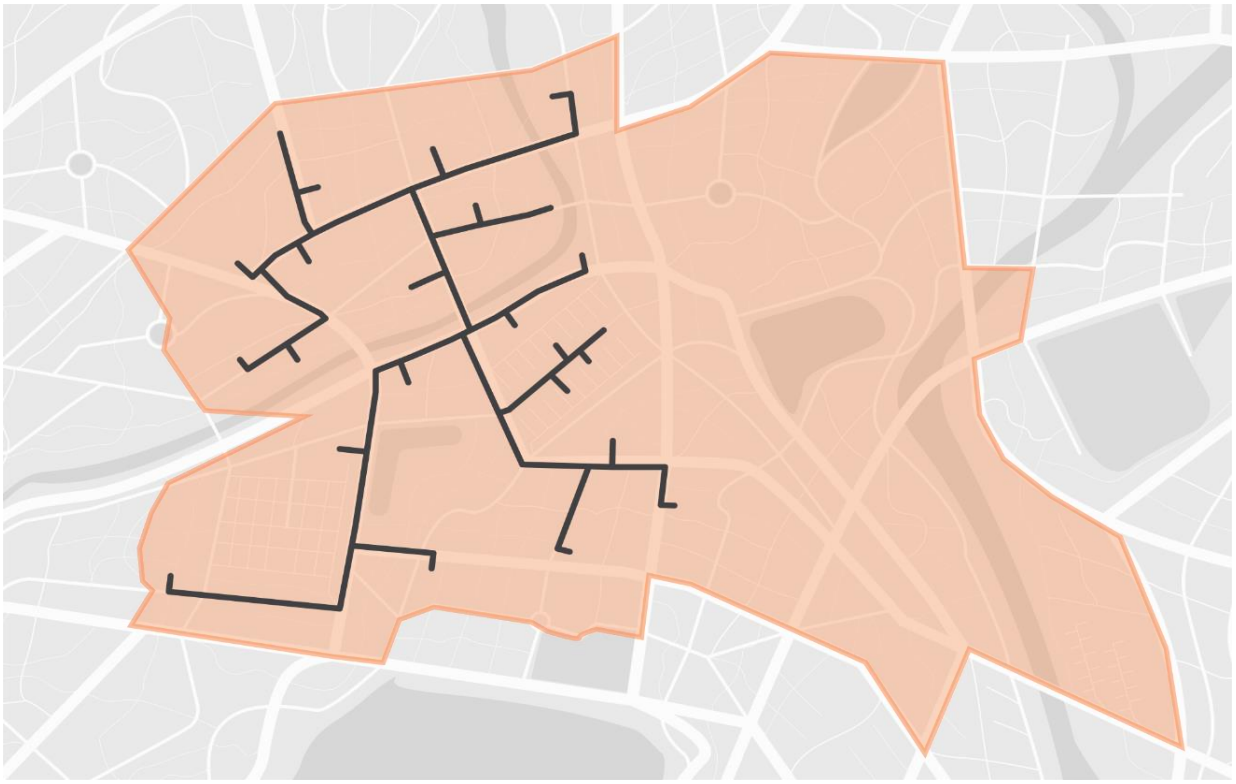
This study split heat network zones into two different categories. These are **'strategic'** zones – the largest zones which are generally seen as strategically significant to developing heat networks in an area; and **'other'** zones – which are generally smaller and discrete. These are terms that specific to the Pilot programme, and the reporting focuses primarily on the strategic zones.

Initial Zone Opportunities

Alongside the identification of potential heat network zones, the Pilot programme has attempted to define areas within zones where the most attractive heat network development opportunities might exist. For the purposes of this programme *only* these are called an "initial zone opportunity" (or IZO). The approach considered economic viability, investment scale and returns, decarbonisation impact and deliverability. They were developed solely around buildings which could be required to connect[1] under the proposed Heat Network Zoning policy and did not consider potential voluntary connections.

Initial zone opportunity design targeted a linear heat density (LHD) of 4MWh/m/yr, for the existing built environment. This is considered a relatively low proxy for economic viability with the heat network sector in England. A more flexible approach was used for new development sites, where different economic success criteria are likely to be applied. To standardise the way opportunities were assessed, the IZOs presented in this report may differ from, or overlap with, existing or planned heat network infrastructure. Campus style heat networks (e.g. in hospitals or university campuses) were considered as potential heat loads with a single point connection. Figure 2 below shows an example of a heat network zone and an IZO.

Figure 2: Illustration of a Heat Network Zone (HNZ) and an Initial Zone Opportunity (IZO)



[1] The building categories being considered as required to connect include new developments, large non-domestic buildings, and communally heated residential blocks as described in Heat Network Zoning Consultation (2023)

Study Scope

This document is presented as a zone opportunity report as it was developed in advance of the final policy design. As such, the report does not include:

- references to the **central authority** or **zoning co-ordinator** roles;
- assumptions about rights of **existing heat networks,** or **zone delivery areas**;
- an options appraisal on which **routes to market** may be taken;
- calculations on the **cost of heat** (connection/tariffs) to specific buildings**;**
- any inferences as the suitability for **public/private sector delivery** unless it's matter of fact (existing network or Heat Network Investment Project/Green Heat Network Fund project);
- references to **local community benefit** or **consumer protection** (subject to a live consultation).

In the future, it is intended that a document, similar in style, will be produced to incorporate these policy design aspects and be used as a Zone Market Prospectus (ZMP) to market heat network zoning opportunities in an area. Further detail on the methodology and initial zone opportunity criteria is provided in Appendix 4 and Appendix 5.

2) Cheltenham Heat Networks Context

2.1) Cheltenham Town Overview

Cheltenham is a large town in Gloucestershire in southwest England, with a population of approximately 115,000. Cheltenham is in the Cotswolds, and is named after the River Chelt which flows through the town. The land area of Cheltenham is approximately 47km^2.

Cheltenham Borough Council (CBC) is one of the district borough councils in the two-tier Gloucestershire County Council area. Exploration of options for restructuring of the current administrative arrangements within the county is understood to be underway.

There are 30 communal heat networks in Cheltenham registered under the Heat Network Metering and Billing Regulations. These primarily serve small social housing schemes. There are approximately 9,000 registered social houses in Cheltenham.

There are currently no operational district heat network systems in Cheltenham. However, a heat mapping study was completed in 2019 and a feasibility study is ongoing for district-scale heat network opportunities within the town centre and Golden Valley areas.

2.2) Cheltenham Net zero targets and commitments

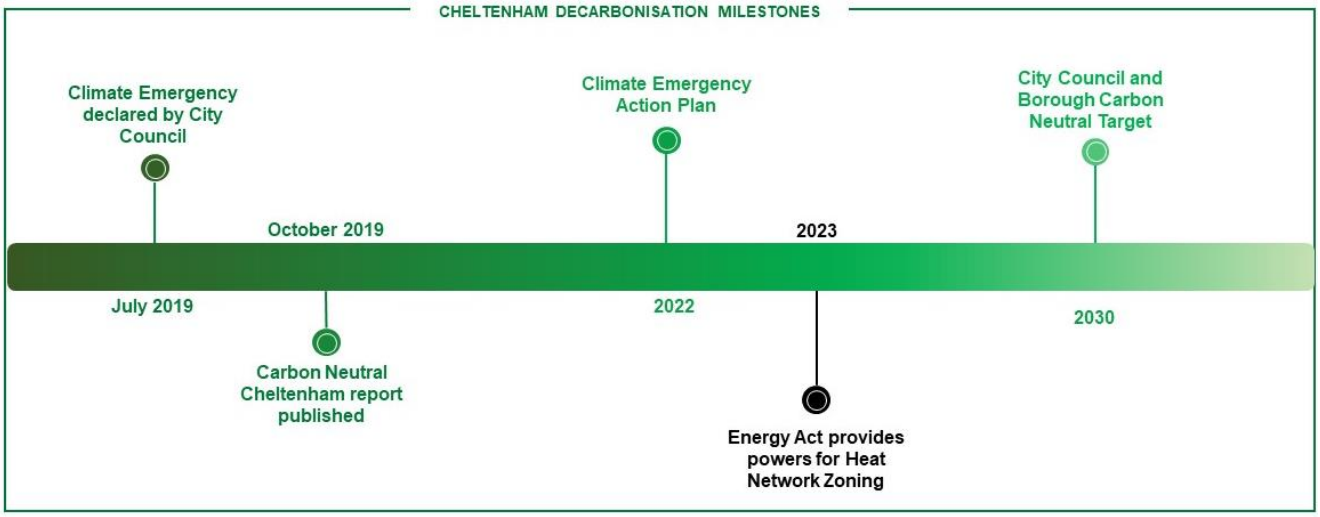
In 2019 CBC declared a climate emergency and stated an ambition for the town to be carbon neutral by 2030. A Climate Emergency Action Plan: Pathway to Net Zero[2] was subsequently published in 2022 and has been updated in 2024. The Action Plan supports the development of heat networks in Cheltenham, and states that low carbon heat networks should be explored to help reduce borough-wide emissions. In addition, the Action Plan contains activities to support emissions reduction. These include:

- New responsibility for net zero within Cabinet and the Senior Management Team.
- A climate-focused Supplementary Planning Document which prioritises low carbon heat and encourages heat network solutions within new developments.
- Embedding climate change decision making in all new projects and key decisions.
- Creation of a Climate Investment Strategy for the local authority estate.
- New funding to support a county-wide Climate Change coordination function.
- Commitment to explore low carbon heat networks.

Figure 3, summarises key dates in CBC's plans for decarbonisation and demonstrates their progress towards decarbonisation targets announced in the Climate Emergency Action Plan.

[2] Cheltenham Climate Emergency Action plan (2024). Available at: https://www.cheltenham.gov.uk/downloads/file/10116/pathway_to_net_zero_-_2024_update

Figure 3: Cheltenham Decarbonisation Milestones



2.3) Delivering Heat Networks in Cheltenham

As well as leading feasibility studies on potential heat networks in Cheltenham, CBC is identified as a key stakeholder with the ability to unlock further opportunities for heat network development through its various roles and powers.

In the Golden Valley redevelopment scheme, CBC is a landholder and participant in the development. This includes ownership of land that may be suitable for an energy centre. CBC can also act as a facilitator in Golden Valley, bringing together building owners to connect to a network.

Please refer to Appendix 2 for further information about the evidence compiled for heat network opportunities in Cheltenham. This includes a stakeholder directory and records of interactions with those stakeholders as well key studies and reports.

2.4) Cheltenham Heat Network Zones

A total of 13 potential HNZs were identified in Cheltenham, with two considered Strategic HNZs. Figure 4 shows the study area boundary as well as the boundaries of all HNZs identified in Cheltenham. Strategic HNZs have been allocated a meaningful name agreed as relevant from a local perspective whilst Other HNZs have a reference number allocated instead. In both cases, these names/references are shown on the map.

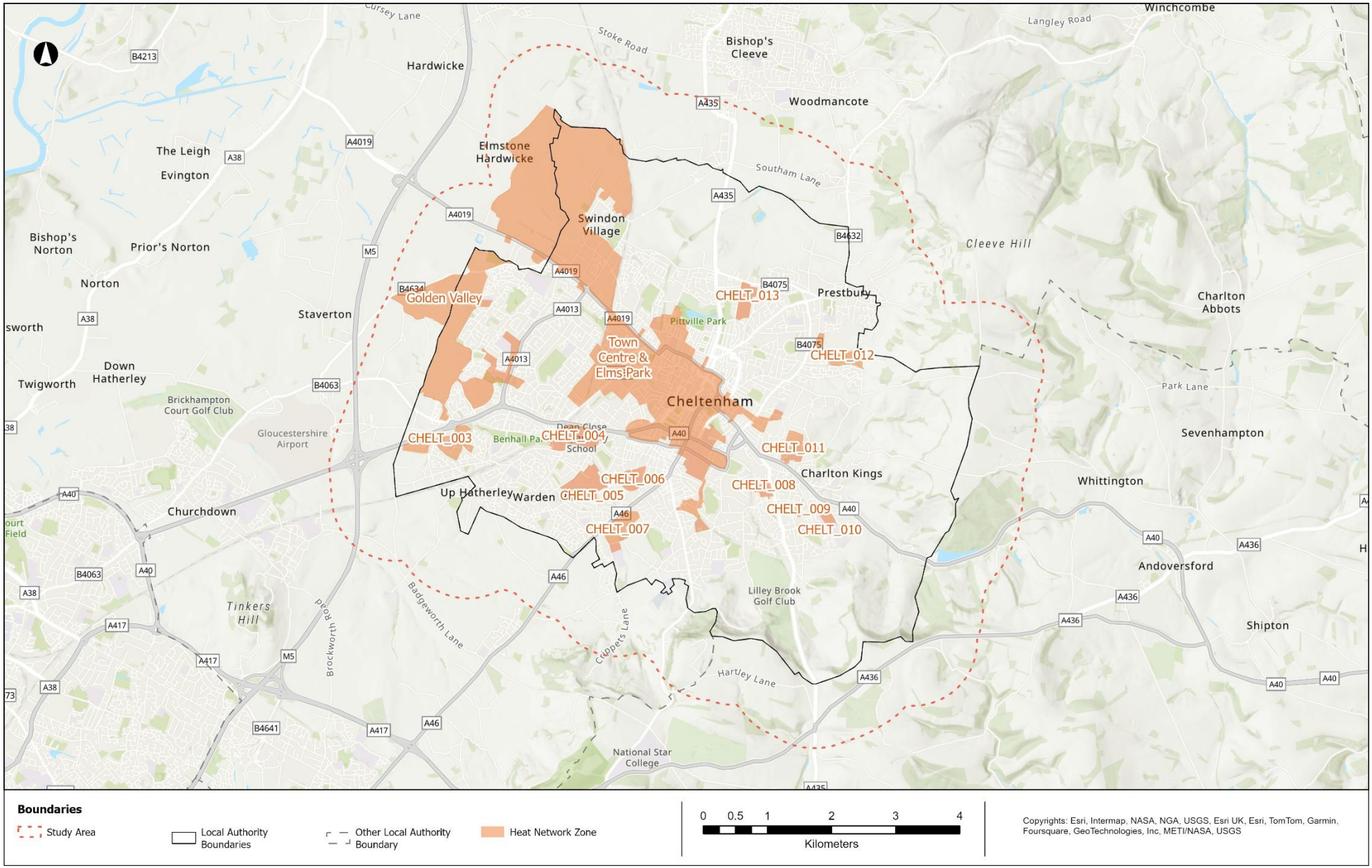
The mapping and data in Appendix 1 demonstrate high heat demand density in the two Strategic HNZs which could support heat network development beyond the central town centre area and connect key loads such as the General Hospital and various leisure and education loads. It also demonstrates heat network opportunities in the Golden Valley and Elms Park areas, driven by major urban expansions and various existing consumers including Government Communications Headquarters (GCHQ). The other 11 HNZs identified are

smaller focused around individual anchor loads such as education campuses and planned new developments.

Please see Appendix 1 for the following maps giving more detail:

- A: City Typology Map – shows building typologies which dominate by area.
- B: Key Heat Loads Map – highlights key buildings required to connect by heat demand.
- C: Key Heat Sources Map – highlights key heat sources by type and potential energy centre locations as well as any existing district heat network energy centres.
- D: Existing / Planned Heat Networks Map – shows existing heat networks, planned extensions, and planned networks at an advanced development stage.
- E: Key Constraints Map – shows key topographical constraints identified.
- F: Off-gas Grid Areas – presents areas with differing levels of properties off the gas grid within the study area.

Figure 4: Heat Network Zones Identified within the Cheltenham Study Area



3) Strategic Heat Network Zones

Strategic HNZs in Cheltenham

This section examines the two strategic HNZs and the IZOs identified within each. This covers the key heat demands, heat sources, energy centre locations and potential constraints for each IZO identified. Heat network distribution routes are conceptual and designed to illustrate the potential size and scale of the heat network opportunity that may be realised as part of the upcoming Heat Network Zoning policy. Other heat network zones are listed in Section 4.

Table 1 below presents a high-level estimate of the scale of opportunities across Cheltenham. Please refer to Appendix 4 for more detail.

Table 1: Annual Heat Demand for Buildings in All Zones, Strategic Zones and IZOs

Scope	Annual heat demand (GWh/yr)
All buildings required to connect in all zones[3]	200
All buildings required to connect in strategic zones	175
All buildings connected to the IZOs	150

Existing/planned heat networks that overlap with IZOs are described, though their locations may vary due to different approaches. The Pilot programme applied a standard set of technical and economic assumptions across each of the 28 areas that participated in the programme and uses a proxy for economic viability (see Section 1 and Appendix 4 for more detail). Existing and planned networks will often be based on more detailed design work and have taken account of strategic and commercial considerations that were relevant at the time of their development. Future iterations of this report will consider how to better align local studies whilst retaining a nationally consistent approach.

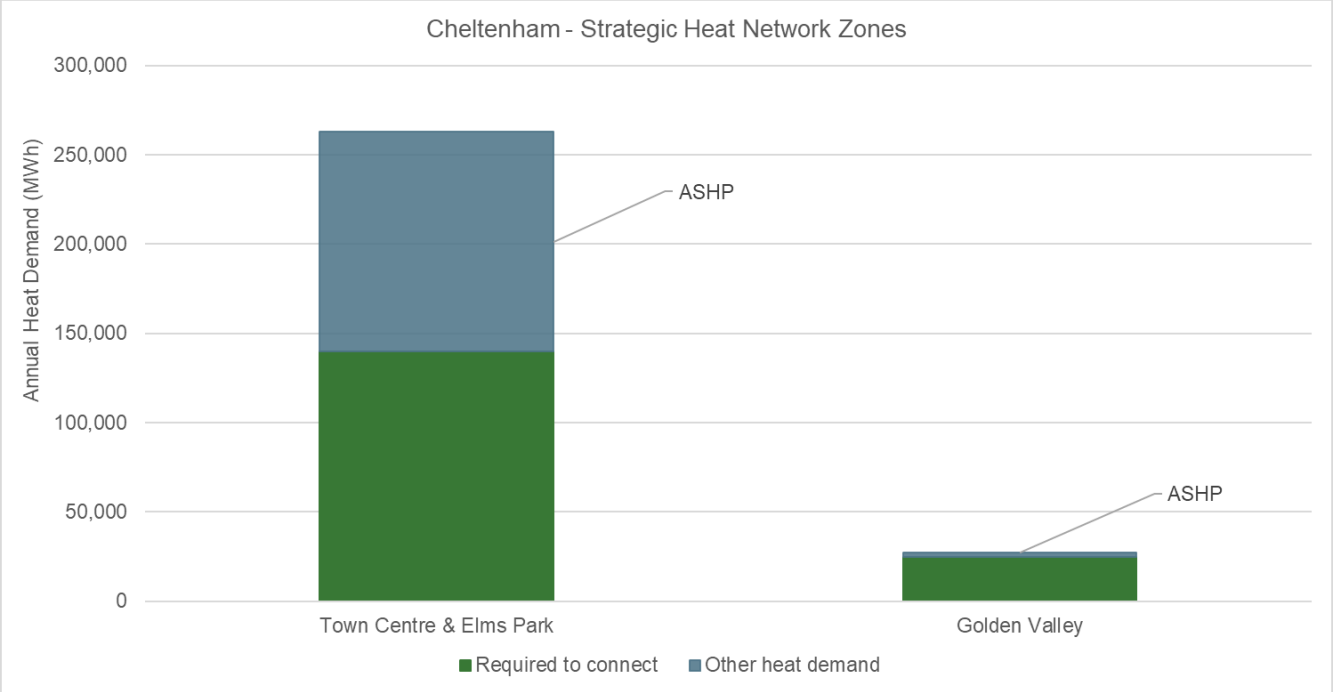
The two strategic zones are summarised below. Figure 5 illustrates the size of each, alongside the key potential heat source and the proportion of buildings that may be required to connect.

Town Centre and Elms Park encompasses two distinct areas connected by the A4019, the town centre and Elms Park in the northwestern part of the borough. Elms Park covers a large industrial and commercial estate as well as a significant planned low-density residential development area. For more information, please see Section 3.1.

[3] Row 1 is an estimate of heat demand across buildings required to connect in all zones identified. Row 2 is as per row 1, but only within strategic zones. Row 3 includes buildings connected to the IZOs described and largely comprise of buildings potentially required to connect. Figures are generally rounded up to the nearest 25 or 50GWh/yr.

Golden Valley is in west Cheltenham and includes GCHQ and a large area of planned mixed-use development. For more information, please see Section 3.2.

Figure 5: Summary of Heat Demands in all Strategic HNZs Identified



3.1) Town Centre and Elms Park

3.1.1) Town Centre and Elms Park – HNZ Summary

The Town Centre and Elms Park HNZ (shown in Figure 6) covers two distinct areas of Cheltenham; the town centre and the Elms Park urban expansion located on the northwestern area of the zone. The town centre has the highest density of buildings that may be required to connect in Cheltenham. The two areas are connected along the A4019 corridor with an area of lower heat density between them. They are included in a single zone as it is considered plausible that the heat network expansion over time could lead to interconnection of the two areas. Prior to further examination of other options, a centralised ASHP solution is the proposed primary low carbon heat supply technology. There are a range of other potential heat sources available within or close to the zone, including waste heat from the Marle Hill power substation owned and operated by National Grid, a mid-sized data centre called Safe Hosts and cooling plant at Cheltenham General Hospital.

3.1.2) Town Centre and Elms Park - Existing Heat Networks

No existing district-scale heat networks have been identified in the zone, however it is understood that the developer of the Elms Park urban expansion is considering a heat network solution. Details of any plans are currently unavailable.

3.1.3) Town Centre and Elms Park - Initial Zone Opportunities

Two discrete IZOs were identified in the Town Centre and Elms Park zone. Potential routing[4] for the IZOs is shown in Figure 6 and summary statistics provided in Table 2.

Table 2: Town Centre and Elms Park - Summary Statistics for Initial Zone Opportunities[5]

CapEx	Heat	Network	CO_{2e} savings	Linear Heat Density	Heat Sources
~£150m	~120GWh/yr	50km	20ktCO_{2e}/yr	5.0MWh/m	ASHPs

The **Town Centre IZO** is a significant opportunity connecting to approximately 80GWh/yr of heat demand in the town centre. Key heat loads include Cheltenham General Hospital, Cheltenham College, and two University of Gloucestershire campuses. The heat density of larger anchor consumers is a key driver for this IZO. A centralised ASHP solution is proposed to supply the IZO at this stage, prior to further examination of other options.

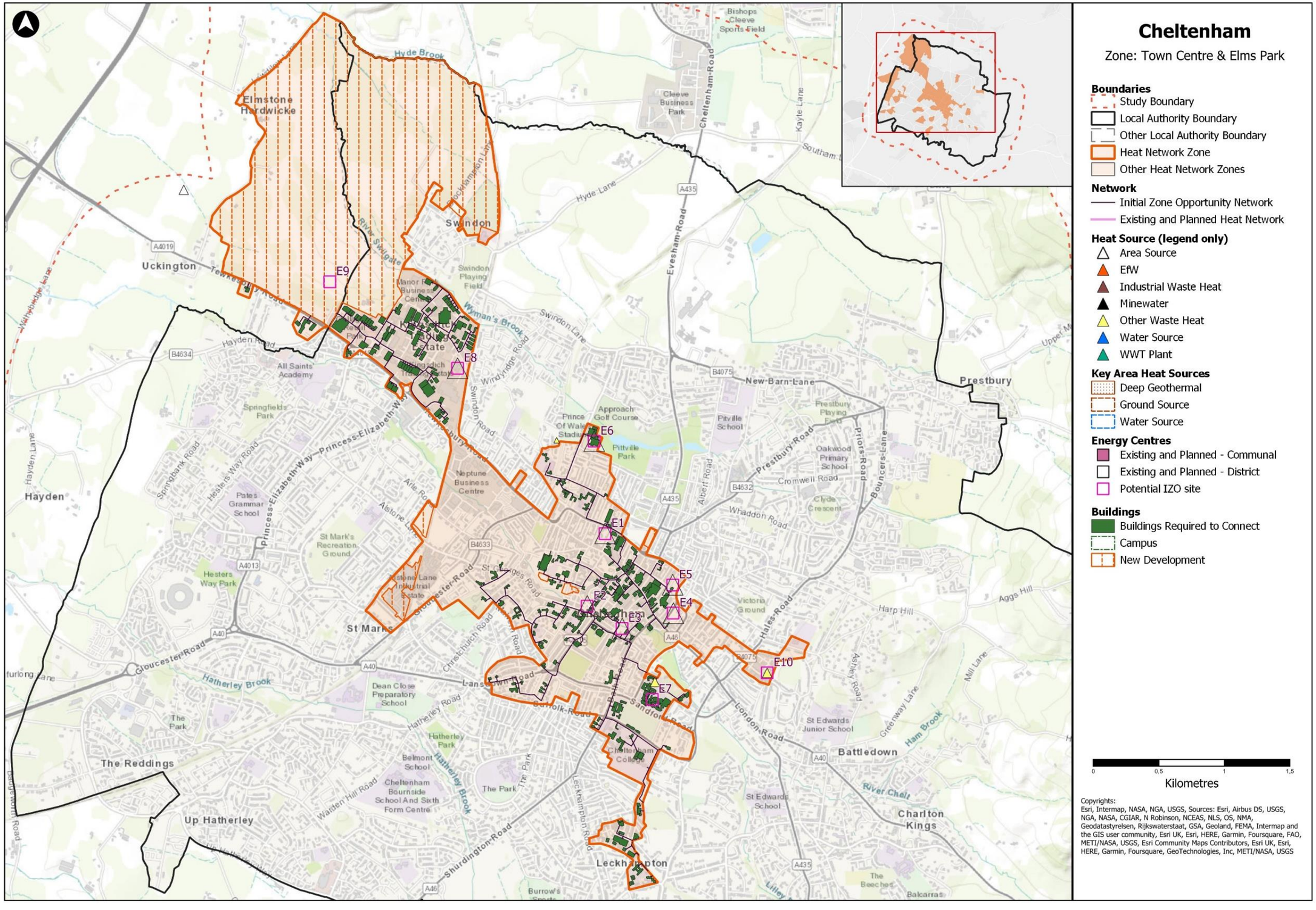
In 2019 a DESNZ-funded Heat Mapping and Masterplanning identified Cheltenham Town Centre as suitable for heat network development. This area falls within the Town Centre IZO. The 2019 study identified potential large consumer connections, network routes, and energy centre locations. The masterplan predates heat network zoning proposals and therefore did not fully capture all buildings that would be potentially required to connect. At the time of the study the primary heat source solution was gas fired combined heat and power (CHP) which would now be unlikely to meet heat network zoning performance standards.

The **Elms Park IZO** is an opportunity shaped by a major planned housing development consisting of around 3,600 homes and associated non-domestic community service buildings. In addition, the IZO connects to existing non-domestic buildings on Kingsditch Trading Estate. The estimated heat demand is approximately 40GWh/yr. A centralised ASHP solution is proposed, at this stage, prior to further examination of other options.

Part of the Elms Park IZO area was considered in the 2019 Heat Mapping and Masterplanning study. However, at that time, the study did not account for the major new housing development which was proposed after the study was concluded.

[4] Routes can be expected to change as a better understanding of local constraints is developed through design.
[5] Please see Appendix 3 – Glossary, “Specific definitions” of the main report for definitions related to Table 2.

Figure 6: Initial Zone opportunities in Town Centre and Elms Park



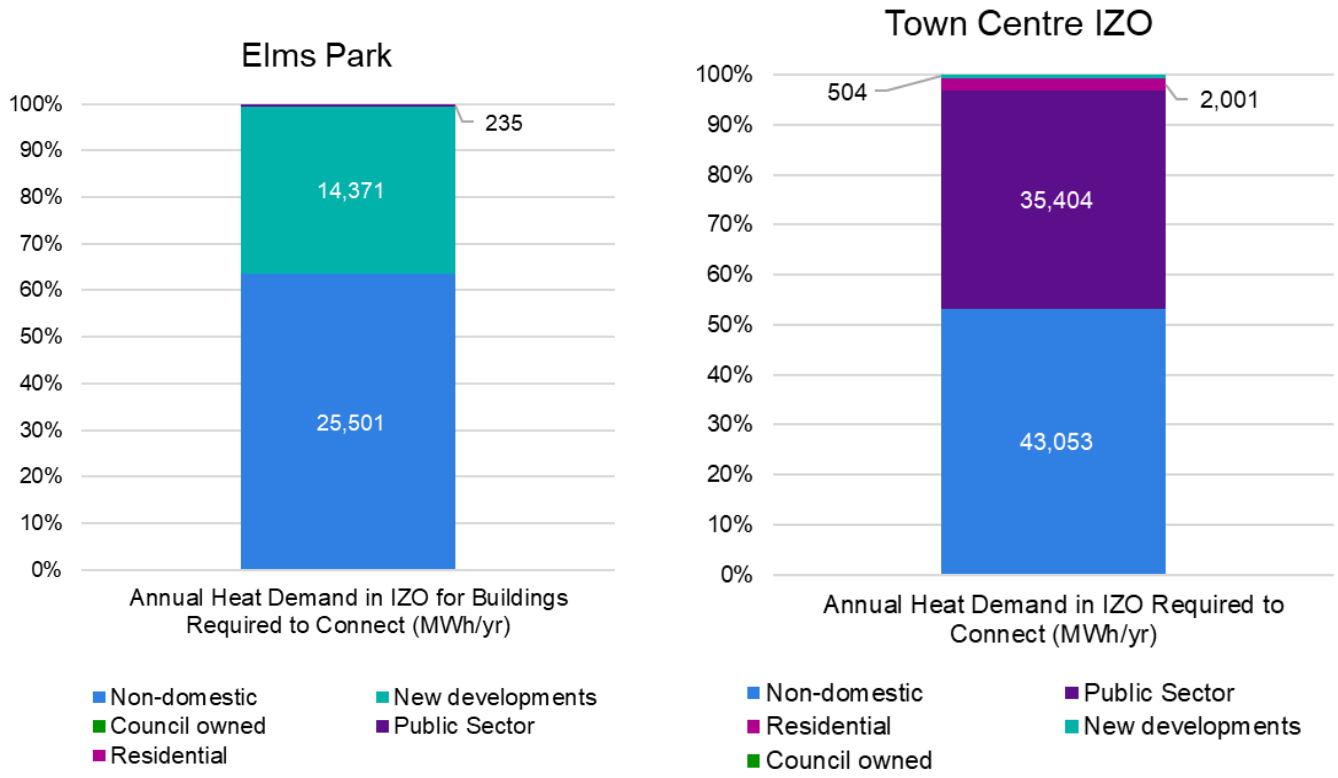
3.1.4) Town Centre and Elms Park – IZO Heat Demands

The heat demands identified within the IZO are described below. The Pilot programme used several sources including local data collected from building owners; national energy demand datasets; benchmarks applied via the National Zoning Model (NZM); and a standardised approach to estimate the potential heat demands of new development sites. More information is provided in Appendix 4.

Where there are different values between datasets, the methodology prioritised the use of the early prototype version of the National Zoning Model, for consistency. This has led to an overestimation of some commercial and light industrial heat demands presented in this report. Large anchor loads that are already connected to existing district-scale heat networks are not listed.

The estimated total heat demand for buildings potentially required to connect is approximately 120GWh/yr. The categorisation of heat demand in both IZOs is shown in Figure 7.

Figure 7: Town Centre and Elms Park - Categorisation of Heat Demand for Buildings Required to Connect in IZOs



The **Town Centre IZO** heat demand is a mix of public and privately owned non-domestic buildings, representing 35GWh/yr and 43GWh/yr respectively. Significant heat demands connecting to the Town Centre IZO include Cheltenham General Hospital, representing over 25% of the IZO heat demand, secondary and tertiary education campuses, and a municipal leisure centre. There are a small number of residential buildings with a heat demand of around 2GWh/yr.

The **Elms Park IZO** heat demand includes the Elms Park urban expansion with an expected residential heat demand of approximately 14GWh/yr, representing over 30% of the IZO heat demand, alongside a mixture of retail, commercial and industrial buildings with a combined heat demand of about 25GWh/yr.

Further details of key heat demand of buildings required to connect in both IZOs are provided in Table 3.

Table 3: Town Centre and Elms Park - Key Heat Demands Required to Connect in the IZOs[6]

Building name	Building category	Number of connections	Annual Heat Demand (MWh)	Data Source
Town Centre IZO				
Cheltenham General Hospital	Public Hospital	1	21,500	ERIC
Cheltenham Leisure Centre	Municipal leisure centre	1	4,350	Metered
Waitrose LTD	Retail	1	2,000	Benchmark (NZM)
Cheltenham Ladies College	Education (further and higher)	1	1,850	Benchmark (NZM)
University of Gloucestershire: Francis Close Hall	Public university	8	1,700	Benchmark (NZM)
John Lewis Department Store	Office	1	1,550	Benchmark (NZM)
Cavendish House	Office	1	1,450	Benchmark (NZM)
Eagle Tower	Office	1	1,300	Benchmark (NZM)
St James House	Office	1	1000	Benchmark (NZM)
Welcome Gym	Sports and recreation	1	950	Benchmark (NZM)

[6] Please refer to Appendix 3 for definitions related to building categories in this table.

Building name	Building category	Number of connections	Annual Heat Demand (MWh)	Data Source
Elms Park IZO				
Elms Park Development: Housing	New development (Residential)	3,600	12,600	Pilot Methodology
Elms Park Development: Offices	New development (Non-domestic)	11	1,800	Pilot Methodology
Vibixia Works	Office	1	1,600	Benchmark (NZM)
Vodaphone	Retail	1	1,350	Benchmark (NZM)
Sainsbury supermarket	Retail	1	1,250	Benchmark (NZM)
Spirax Sarco LTD	Offices	1	1,000	Benchmark (NZM)
Cotswold Architectural Products	Offices	1	650	Benchmark (NZM)
Centrum Park	Retail	1	600	Benchmark (NZM)
Kingsditch Retail Park	Retail	1	600	Benchmark (NZM)
Bristol Street Motors LTD	Commercial	1	550	Benchmark (NZM)

3.1.5) Town Centre and Elms Park – IZO Heat Sources

Low carbon heat sources have been identified within or near the Town Centre IZO and Elms Park IZO. These are shown in Figure 6 in Section 3.1.3 and in Appendix 1: Map C.

In the **Town Centre IZO** the proposed primary heat supply option is a centralised ASHP solution. Other heat supply options which require further study include waste heat from the Marle Hill power substation (E6), the Safe Hosts data centre (E10) and Cheltenham General Hospital (E7). Waste heat sources would likely need to be supplemented with heat supply from

a centralised ASHP energy centre. Cheltenham General Hospital is identified as a possible location for an energy centre, however space for expansion/replacement of its existing energy centre is limited. A second energy centre would likely be required to house additional supply plant. Other possible energy centre locations identified are located on council-owned land which are currently used for parking.

For the **Elms Park IZO**, centralised ASHPs are the primary heat source (E8 and E9), with potential for open and closed-loop ground source heat pump (GSHP) solutions on-site (E9). An aquifer approximately 1km from energy centre E9 has also been identified. The surrounding farmland could potentially host a large-scale solar thermal array. There is flexibility regarding the energy centre location within the site of the Elms Park planned residential development. In addition, a council-owned waste management site just outside the development may become available in the future as an energy centre location.

Table 4: Town Centre and Elms Park - Key Heat Source Opportunities for the IZOs

Heat source type	Full Opportunity Capacity (kWp)	Temperature (ºC)	Potential Energy Centre (Ref number)
Town Centre IZO			
ASHP	19,200[7]	5-20 ºC	E1 to E7
Waste heat Hospital chiller heat recovery	1,950	10-20 ºC	E7
Waste heat Power substation	330	50 ºC	E6
Waste Heat Data centre	2,140	25-45 ºC	E10
Elms Park IZO			
ASHP	9,600[7]	5-20 ºC	E8 to E9
GSHP Closed loop	Limited by available area and borehole depth	13 ºC	E9
GSHP Open loop	170	13 ºC	E9
Solar Thermal	Unknown[8] (~450kWh/m^2/yr)	50-80 ºC	Unknown

[7] Sized requirement for IZO rather than maximum capacity
[8] Dependent on available land area

Table 5: Town Centre and Elms Park - Potential IZO Energy Centre Locations

Ref Number	Site type	Size (m^2)	Ownership	Heat Source
Town Centre IZO				
E1	Car park	3,500	CBC	ASHP
E2	Car park	900	CBC	ASHP
E3	Car park	3,100	CBC	ASHP
E4	Car park	5,200	CBC	ASHP
E5	Car park	2,400	CBC	ASHP
E6	CBC land assumed around existing leisure centre facility	Unknown – requires review of land use	CBC	ASHP (waste heat)
E7	Existing hospital energy centre	425	Gloucestershire Hospitals NHS Foundation Trust	Chiller waste heat / gas boiler
E10	Safe hosts (data centre)	TBD	Private	Cooling waste heat
Elms Park IZO				
E8	Waste management site	37,000	CBC	ASHP
E9[9]	Private development land (Elms Park development site)	Unknown	Elms Park developer	ASHP (GSHP, solar thermal)

[9] Location is purely indicative. Various locations on the Elms Park development are possible but would need to be resolved with developer

3.1.6) Town Centre and Elms Park – IZO Heat Distribution

The approach to developing the heat network route considered economic viability, investment scale and returns, decarbonisation impact and deliverability. These criteria were applied in a standardised manner across all opportunities identified in the Pilot programme and therefore may not reflect detailed designs or proposed routes identified in more detailed feasibility work. Routing within the site boundary of a building or campus may not have been included if insufficient information was available. The IZO routing was developed solely around buildings which could be required to connect and did not consider potential voluntary connections.

The purpose of the concept heat network route is to define the scale, potential routing and identified associated constraints within the zone. Further work will be required to undertake a more detailed route assessment to take account of the buried utilities, building connections and other local strategic and local planning considerations.

For the **Town Centre IZO**, the indicative network routing considers potential energy centre locations and identifies the most efficient routes to connect anchor loads with other consumers. This strategy also involves linking to the core network around the central and most heat-dense area of the town centre. Bath Road (around the Cheltenham Colleges) and St Luke's Road (to the General Hospital) will likely be important as will Montpellier Walk, High Street and St. Margaret's Road/Swindon Road (A4109) to enable the spine to pass through the town centre towards the Leisure Centre on Tommy Taylors Lane. There will be alternative options which will need to be explored to address congestion and other constraints. The Promenade is generally avoided as an important pedestrian thoroughfare. Additional legs of the indicative network routing are included to reach the outer parts of the IZO including Lansdown, Leckhampton and the Leisure Centre.

For the **Elms Park IZO**, much of the heat network routing requires connection to planned new developments. The precise routing for this would need to be resolved with the property developer. As such, at this point, the new development is considered as a single consumer based on the standardised Pilot programme methodology. The proposed routings for the distribution networks are shown in Figure 6. As far as possible, the heat network routes avoid the primary highway routes.

Table 6 provides estimated summary statistics for the proposed network routes for both IZOs. See Appendix 5 for related methodology statements and assumptions.

Table 6: Town Centre and Elms Park - Indicative Heat Network Statistics for the IZOs

IZO Heat Network Description	Network length (km)	Network cost (£m)
Town Centre and Elms Park	~50	~100

3.1.7) Town Centre and Elms Park – IZO Key Constraints and Mitigations

Town Centre IZO

No significant constraints have been identified for the Town Centre IZO. However, potential constraints may be encountered due to the town centre being designated as a conservation area with a character appraisal and management plan Supplementary Planning Document[10]. This could affect routing options and connections to individual buildings, which may need specific approvals. However, it is anticipated that heat network connections are likely to be less constrained than other decarbonisation solutions and therefore may readily receive approval. Physical constraints described here, with reference numbers, are shown in Appendix 1: Map E.

[C1] Promenade: The Promenade is a busy pedestrian street in the town centre where CBC recommends minimal distribution pipework, except for individual property connections.

[C2] Rail crossing: The Bristol to Birmingham rail line crosses through the zone. No severe technical network constraints have been identified because the Town Centre IZO does not require the crossing of the rail line. However, the rail line was one of the constraints that influenced the creation of the Town Centre IZO and Elms Park IZO, rather than it being a single IZO. In the eventuality that the Town Centre IZO network expands west and was to connect to Elms Park IZO, then the rail line would need to be crossed. There are various existing road bridges that could be explored to facilitate this interconnection. Interconnection costs have not been costed in the analysis.

[C3] Road crossing: The A4019 is a significant road managed by Gloucestershire County Council, running east to west across the Town Centre IZO. It will need a careful feasibility assessment to determine the most suitable crossings.

Elms Park IZO

[C2] Rail crossing: As discussed above, if the two IZOs seek to interconnect the Bristol to Birmingham rail line will need to be crossed.

[C3] Road crossing: As with the Town Centre IZO, the A4019 is an important link road running east to west and it also intersects with the Elms Park IZO and will require careful feasibility assessment to determine the most appropriate crossings.

[10] https://www.cheltenham.gov.uk/info/52/conservation/644/cheltenhams_conservation_areas/2

3.2) Golden Valley

3.2.1) Golden Valley – HNZ Summary

The Golden Valley HNZ is the second largest zone identified in Cheltenham. It is located on the western edge of the borough and is dominated by the planned Golden Valley developments (various plots) which expand beyond the borough boundary. The eastern edge of the HNZ starts from Hester's Way where it includes two separate existing education sites. The southern end of the zone contains the GCHQ complex, a prominent public sector heat demand.

Various opportunities for heat supply exist, including utilisation of waste heat from the Hayden Sewage Treatment Works and the GCHQ complex, which is assumed to have a significant data centre cooling arrangement. Other potential sources involve utilising GSHPs connected to nearby aquifers, centralised ASHPs or the use of large-scale solar thermal plant.

3.2.2) Golden Valley - Existing Heat Networks

No existing district heat networks have been identified in the zone.

3.2.3) Golden Valley – Initial Zone Opportunities

A single IZO was identified in the Golden Valley zone. Potential routing[11] for the IZO is shown in Figure 8 and summary statistics provided in Table 7.

Table 7: Golden Valley - Summary Statistics for Initial Zone Opportunities[12]

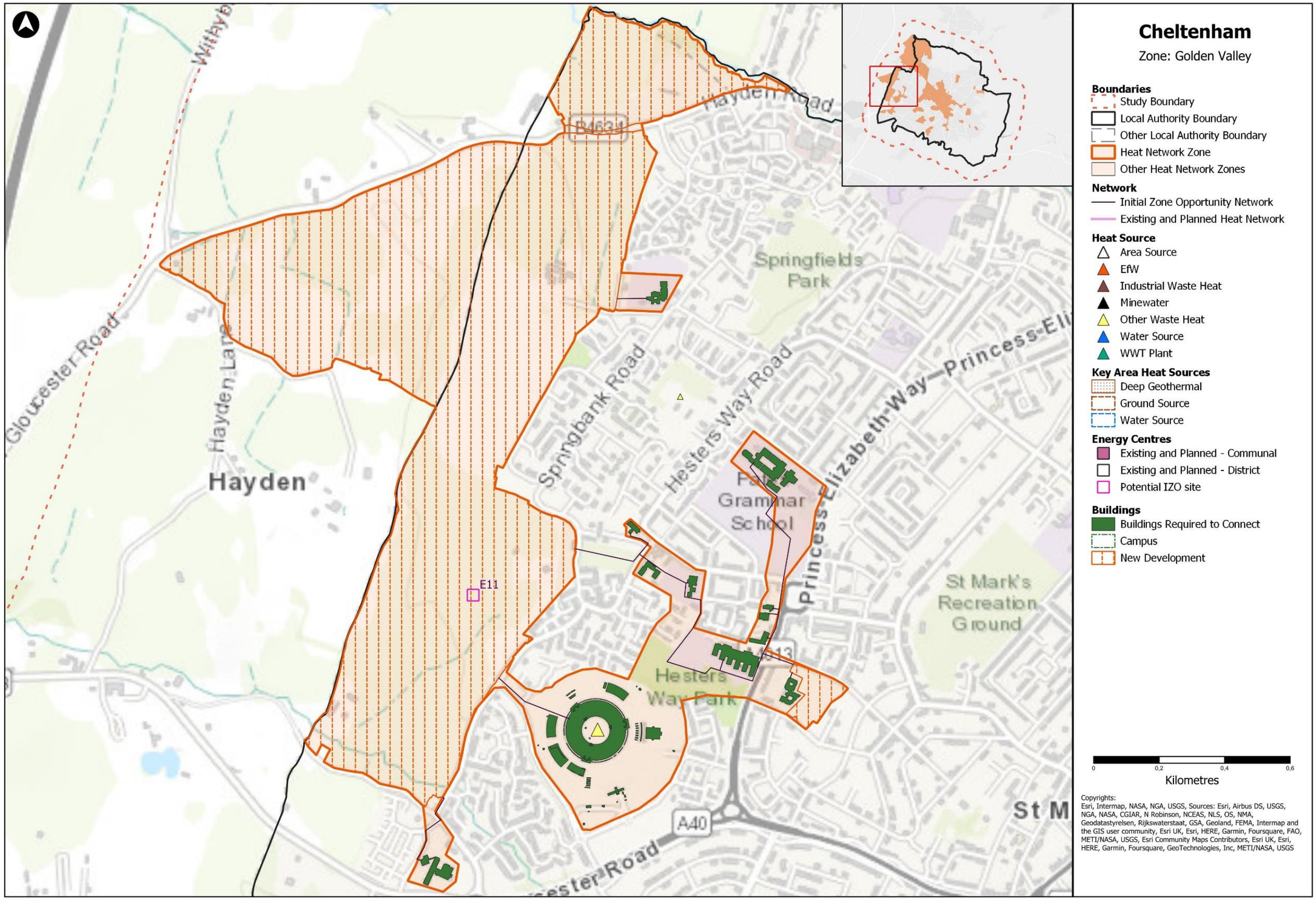
CapEx	Heat	Network	CO_{2e} savings	Linear Heat Density	Heat Sources
~£35m	~25GWh/yr	18km	5ktCO_{2e}/yr	4.5MWh/m	ASHPs

The IZO has been identified due to the scale of demand, proximity of consumers and the decarbonisation potential for the Golden Valley development, the masterplan for which is led by CBC. Within the IZO, it is assumed that the Golden Valley development is connected along with existing non-domestic buildings to the east, including GCHQ.

A centralised ASHP solution is proposed, at this stage, prior to further examination of other options, with the energy centre assumed to be located on the Golden Valley development site. It is plausible that the IZO could expand over time to the south, crossing the A40 to reach a commercial and retail zone (which is represented as heat network zone Chelt-03). Further expansion beyond this is unlikely since the zones are generally surrounded by lower density housing areas.

[11] Routes can be expected to change as a better understanding of local constraints is developed through design.
[12] Please see Appendix 3 – Glossary, "Specific definitions" of the main report for definitions related to Table 7.

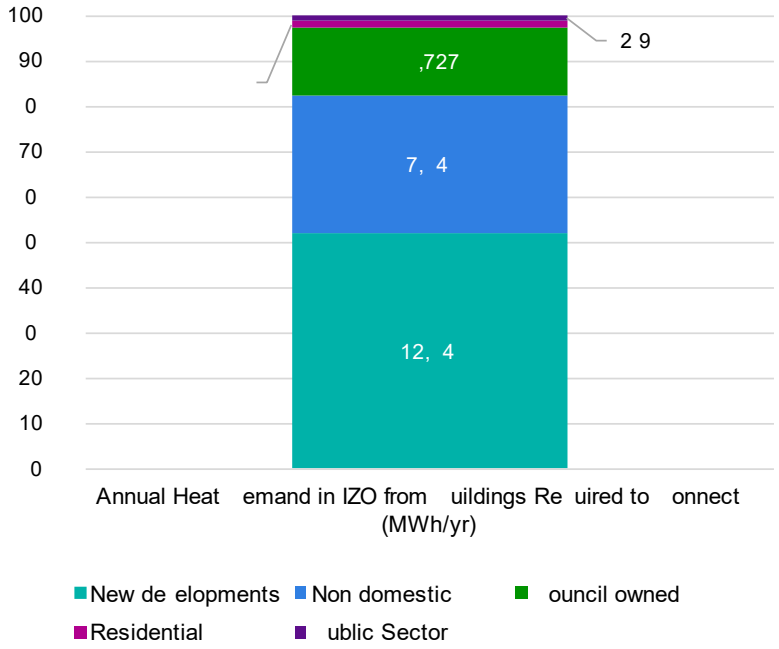
Figure 8: Initial Zone Opportunity in Golden Valley HNZ



3.2.4) Golden Valley – IZO Heat Demands

The Golden Valley IZO covers a large new development area and multiple adjacent non-domestic buildings. The Golden Valley HNZ includes an estimated heat demand of 25GWh/yr from buildings that could be required to connect. Categorisation of this heat demand is shown in Figure 9.

Figure 9: Golden Valley - Categorisation of Heat Demand for Buildings Required to Connect in IZO



The heat demand connected to the IZO is made up principally of new development and existing non-domestic buildings. The IZO includes the Golden Valley development, a large public campus of serviced offices (GCHQ) and several education campuses.

The Golden Valley development plan consists of multiple development zones due to be built between 2025 and 2038. The development includes almost 2,100 homes, multiple non-domestic buildings within a business technology park estate, a school and other non-domestic community, service and leisure buildings. A Development Framework was published in 2017, and a development partner (for council-led elements) was secured in 2021. Since then, masterplanning and land assembly have been underway with the main landowners. It is understood that initial outline planning applications were submitted in the summer of 2023 and detailed applications are due to be submitted in the summer of 2024. A Golden Valley Development Supplementary Planning Document was also published in 2020.

Further details of the key heat demands for buildings that may be required to connect in the IZO are provided in Table 8.

Table 8: Golden Valley - Key Heat Demands Required to Connect in the IZO[13]

Building name	Building category	Number of connections	Annual Heat Demand (MWh)	Data Source
GCHQ	Office	To be provided	To be provided	To be provided
Golden Valley development	Domestic	Circa 2,100	6,300	Pilot Methodology
Golden Valley development	Offices	Unknown	6,100	Pilot Methodology
Pates Grammar School	Education	4	1,600	Benchmark (NZM)
Gloucestershire College	Education	1	1,400	Metered
Jurys Inn	Hotel	1	850	Benchmark (NZM)
Old Gloucester development	Domestic	Unknown	500	Pilot Methodology
Springbank Primary Academy	Education	1	350	Benchmark (NZM)
Hesters Way Neighbourhood Project	Office	1	250	Benchmark (NZM)
Royal Court	Domestic	1	200	Benchmark (NZM)

3.2.5) Golden Valley – IZO Heat Sources

A range of potential heat sources have been identified within or near the Golden Valley IZO. These are shown in Figure 8 in Section 3.2.3 and Appendix 1: Map C.

The most promising heat sources are waste heat recovery from the Hayden Sewage Treatment Works (Severn Trent Water) and from GCHQ, although as a sensitive facility, this may constrain the latter. Alongside these, water source heat pumps (WSHPs) using heat from the nearby aquifer and a large-scale solar thermal array situated on neighbouring farmland are options.

[13] Please refer to Appendix 3 for definitions related to building categories in this table.

For all the above options further work technical assessments would be required. Therefore, the IZO has been modelled based on supply from a centralised ASHP system. It is envisioned that the energy centre will be situated within the Golden Valley development site (E10), however, the specific location will need to be defined in collaboration with CBC and their delivery partners.

Table 9 and Table 10 summarise the key heat sources and potential energy centre locations identified for this IZO.

Table 9: Golden Valley - Key Heat Source Opportunities for the IZO

Heat source type	Full Opportunity Capacity (kWp)	Temperature (ºC)	Potential Energy Centre (Ref number)
ASHP	5,900[14]	5-20	E10
Waste heat GCHQ	Unknown	20-50	E10
Waste heat Hayden Sewage Treatment Works	Confidential	5-10	E10
WSHP Nearby aquifer	Unknown	5-10	E10
Solar Thermal	Unknown[15] (~450 kWh/m^2/yr)	50-80	E10

Table 10: Golden Valley - Potential IZO Energy Centre Locations

Ref number	Site type	Size (m^2)	Ownership	Heat Source
E11	Private development land	Unknown – potentially unrestricted relative to need	CBC/site developers	ASHP, waste heat recovery, WSHP or Solar thermal

[14] Sized to requirement for IZO rather than capacity
[15] Depends on land area made available

3.2.6) Golden Valley – IZO Heat Distribution

Table 11 shows the network statistics for the IZO including the network length and associated costs. Please refer to Section 3.1.6 and Appendix 5 for the assumptions used.

Much of the heat network infrastructure for the planned new development would need to be resolved with the property developer. As such, the new development is considered as a single consumer based on a standardised methodology used in the Pilot programme. Indicative heat network routes to connect the existing consumers are proposed from different points of the Golden Valley development area, limiting the extent of pipework required. To reach GCHQ, a route along Telstar Way is proposed. To reach the cluster of consumers around Cheltenham College, the Elm Farm Play Area (soft dig) is proposed followed by Fiddlers Green Lane, Marsland Lane and Lewis Road before reaching the college and travelling on to Princess Elizabeth Way, to connect to the remaining consumers. Various alternative routes would be possible where identified constraints are identified. Due to its sensitive nature, routing through the GCHQ estate is avoided.

Table 11: Golden Valley - Indicative Heat Network Statistics for the IZO

IZO Heat Network Description	Network length (km)	Network cost (£m)
Golden Valley	~20	>20

3.2.7) Golden Valley – IZO Key Constraints and Mitigations

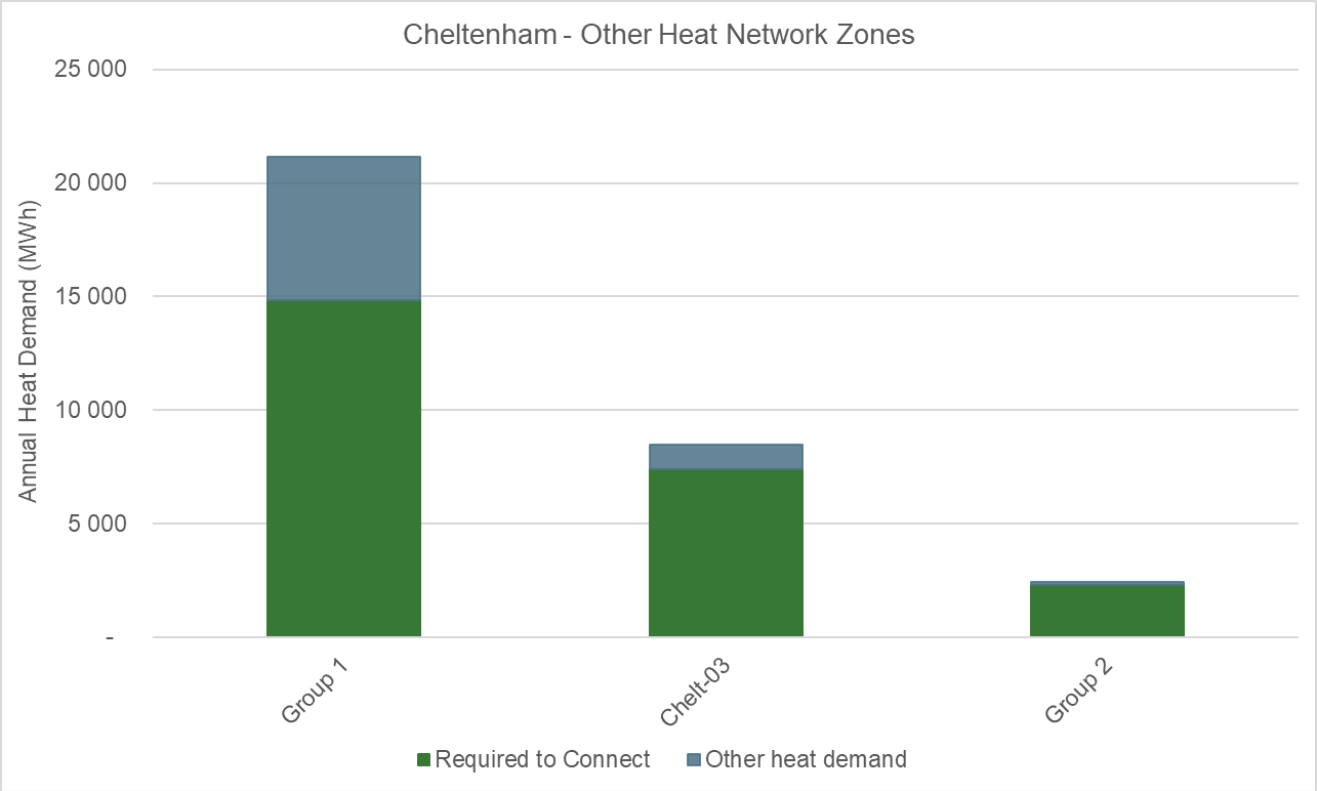
There are no major constraints identified for the proposed IZO.

4) Other Heat Network Zones

This section describes the 'Other' potential heat network zones that were identified in Cheltenham. These are areas where heat networks were deemed to offer the lowest carbon route to decarbonising heat but are often much smaller or discrete in nature than the 'Strategic' heat network zones identified. The approach taken in the Pilot programme did not apply a minimum threshold for zone identification and therefore future work will need to consider factors such as size and aggregation to ensure efficient and effective delivery of heat networks in the area.

Figure 10 illustrates the total annual heat demand, and the proportion of which is associated with buildings that may be required to connect within each zone. A map of all zones can be found in Figure 4.

Figure 10: Total Heat Demand and Proportion Required to Connect in Other HNZs



In addition to the two Strategic HNZs described in Section 3.1 and 3.2, eleven other HNZs were identified in Cheltenham. The largest of these zones by heat demand (Chelt-03), is described first and the remaining HNZs are then grouped for discussion.

Chelt-03: is a discrete zone south of the Golden Valley Strategic HNZ. It includes a mix of new development and existing healthcare and commercial buildings. Key anchor consumers are Nuffield Hospital, Asda and Ultra Electronics. Buildings potentially required to connect have a total heat demand of 7GWh/year which equates to circa 85% of the total heat demand of the

zone. There is potential to connect Chelt-03 to the Golden Valley Strategic HNZ. However, this reduces the estimated economic viability of the Golden Valley HNZ. It was concluded that the zones should be presented separately thereby avoiding the connecting infrastructure costs.

Group 1: contains eight discrete zones (Chelt-04 to Chelt-06, Chelt-08 to Chelt-11 and Chelt-13) which are located around Cheltenham. All of these were considered to have potential to support independent heat networks. Many of the zones are centred around school campuses. Buildings potentially required to connect present a total heat demand of 15GWh/yr, which equates to around 70% of the total heat demand within these zones.

Group 2: contains two discrete zones (Chelt-07 and Chelt-12) just to the south and east of the town centre. These zones are dominated by new developments. The combined total heat demand from this group is around 2.5GWh/yr and new developments account for almost all (about 95%) of the total heat demand.

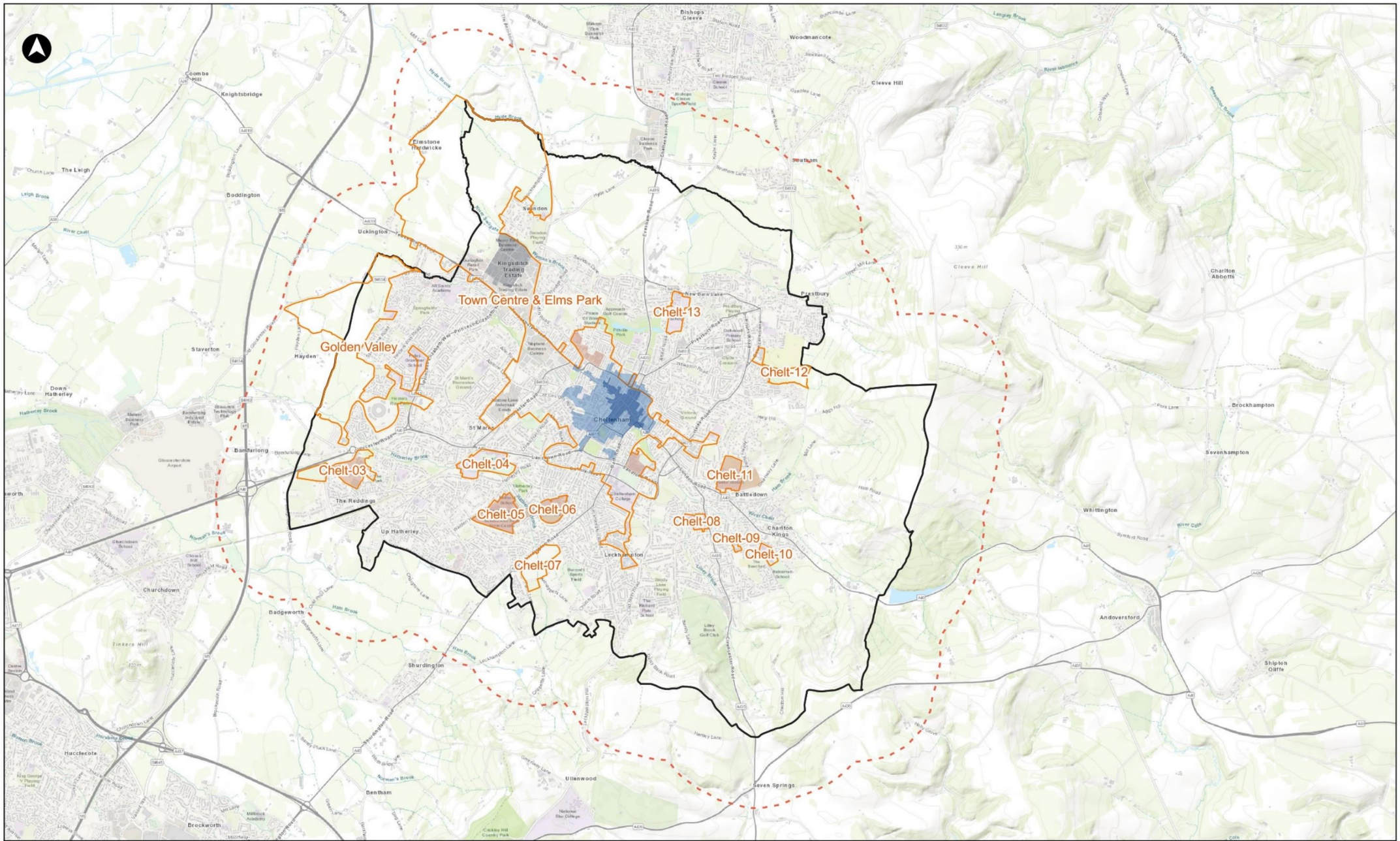
Appendix 1: Maps and Legends

This section provides guidance on interpreting the icons and legends used throughout this report and Maps A-F that follow:

Legend / icon	Relevant map(s)	What this represents on the map	Comments on interpretation
	Report maps	Study boundary	Extends 1km beyond Local Authority boundary to include cross boundary opportunities
	Report maps	Local Authority boundary	
	Report maps	Other Local Authority boundary	
	Report maps	Heat network zones	This includes both Strategic HNZs and Other HNZs.
	Report maps	Other heat network zones	Smaller or discrete heat network zone opportunities
	Report maps	New developments	New development within heat network zones and IZOs that will still be in construction post-2025
Gates Hill	Report maps	Heat network zone name / reference number	‘Strategic’ zones are named; ‘Other’ zones are represented by a reference number
	Report maps	Buildings potentially required to connect	Buildings that could be required to connect (as described in the HNZ Consultation 2023)
	Report maps	Campuses	Multiple buildings owned and operated by the same organisation (e.g. Universities, Hospitals)
	Report maps	Initial Zone Opportunity concept network route	Conceptual heat network pipe routes between buildings that could be required to connect
	Report maps	Existing and Planned Heat Networks	Known existing or planned heat network pipe routes as provided by local stakeholders
	Report maps	Potential energy centre - IZO	Potential energy centre location for an IZO (see section 3)
	Report maps	Existing/planned energy centre - Communal HNs	‘ ommunal’ energy centres are those operated within a single building or across a campus
	Report maps	Existing/planned energy centre - District HNs	‘ istrict’ energy centres supply multiple buildings across multiple sites
Appendix 1: A – Typology map			
	Appendix 1: Map A	Dense City Centre	Locally recognised as the City or Town centre, where buildings development is most dense
	Appendix 1: Map A	City Centre Fringe	Around the City or Town Centre or at its outskirts, where both building density reduces
	Appendix 1: Map A	Mixed Use District	A variety of building typologies, with no single typology prevailing in the area
	Appendix 1: Map A	Social Housing	Public, private and third sector social housing
	Appendix 1: Map A	Campus (health / education)	Buildings that are owned and operated together (e.g. Universities, Hospitals)
	Appendix 1: Map A	Commercial / business office	Public & private office space

	Appendix 1: Map A	Industrial areas	Primarily used for manufacturing, engineering, and warehousing
Appendix 1: B – Key heat demands			
	Appendix 1: Map B	Top 10 Heat Demands	The largest (anchor) heat loads within the Pilot programme study area (see Section 3)
	Appendix 1: Map B	Local Authority	Buildings owned or operated by the Local Authority
	Appendix 1: Map B	Other public sector	Other buildings owned or operated by the public sector (e.g. hospital, universities, Govt. estates)
	Appendix 1: Map B	Residential with existing communal heating	Residential buildings with existing communal heating systems installed
	Appendix 1: Map B	Non-domestic private	Non-domestic private buildings (e.g. commercial, offices)
	Appendix 1: Map B	Industrial	Mixed industrial sites (e.g. light or heavy industry, manufacturing, warehouses and distribution)
400 - 600	Appendix 1: Map B	Building heat demand (MWh/yr)	Circle size increases with size of heat demand
Appendix 1: C – Key Heat Sources and Potential Energy Centres			
	Appendix 1: Map C	EfW plant	**Point heat sources** have known or likely points of heat offtake/abstraction Mine water and water source 'points' indicate potential abstraction points. Other waste heat sources include sewers, electrical substations and other sources of heat. See section 3 for more detail on heat source capacities, where known. On the City-level Map C only, the heat waste symbol is sized according to its scale in GWh/yr
	Appendix 1: Map C	Industrial Waste Heat	
	Appendix 1: Map C	Mine water	
	Appendix 1: Map C	Other Waste Heat	
	Appendix 1: Map C	Water Source	
	Appendix 1: Map C	Waste Water Treatment	
	Appendix 1: Map C	Deep geothermal or mine water heat	**Area heat sources** differ from point-heat sources in that the exact location for extracting heat from the resource is not yet determined
	Appendix 1: Map C	Ground source	
	Appendix 1: Map C	Water source	
Appendix 1: D – Existing and planned heat networks			
	Appendix 1: Map D	Existing and planned heat networks	At this scale the route of an existing HN cannot be displayed, so an area outline is used instead
Appendix 1: E – Physical constraints			
	Appendix 1: Map E	Key constraints	Key heat network routing constraints as described in section 3

A. Cheltenham Typology Map



Boundaries
- Study Boundary
- Local Authority Boundary
- Other Local Authority Boundary
- Heat Network Zones

Key Typologies
- Dense city centre
- City centre fringe
- Mixed use district
- Social housing
- Campus (health/education)
- Commercial / business office district
- Industrial areas

0 1 2 3
Kilometres

Scale: 1:50 000

Coordinate System: OSGB36 / British National Grid

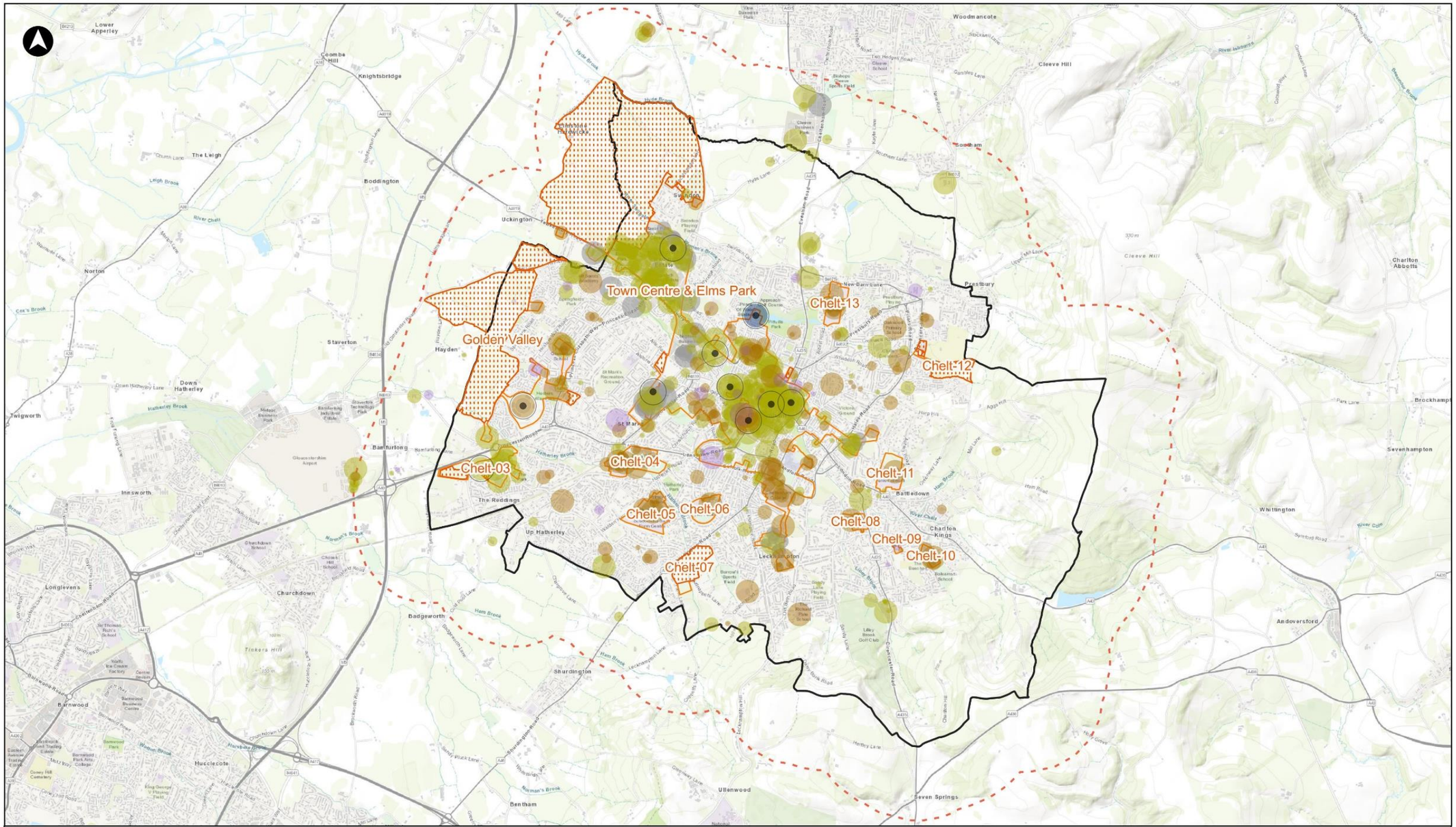
Department for Energy Security & Net Zero

Cheltenham

Map A

City Typologies

B. Key Heat Demands



Boundaries
- Study Boundary
- Local Authority Boundary
- Other Local Authority Boundary
- Heat Network Zones
- New Development

Key Heat Demand
- Local authority loads
- Other public sector loads
- Residential with communal heating
- Non-domestic private buildings
- Industrial
- Top 10 heat demands

Heat Demand (MWh/Year)
- 0 - 140
- 140 - 190
- 190 - 330
- 330 - 6 500

0 1 2 3
Kilometres
Scale: 1:50 000

Coordinate System: OSGB36 / British National Grid

Department for Energy Security & Net Zero

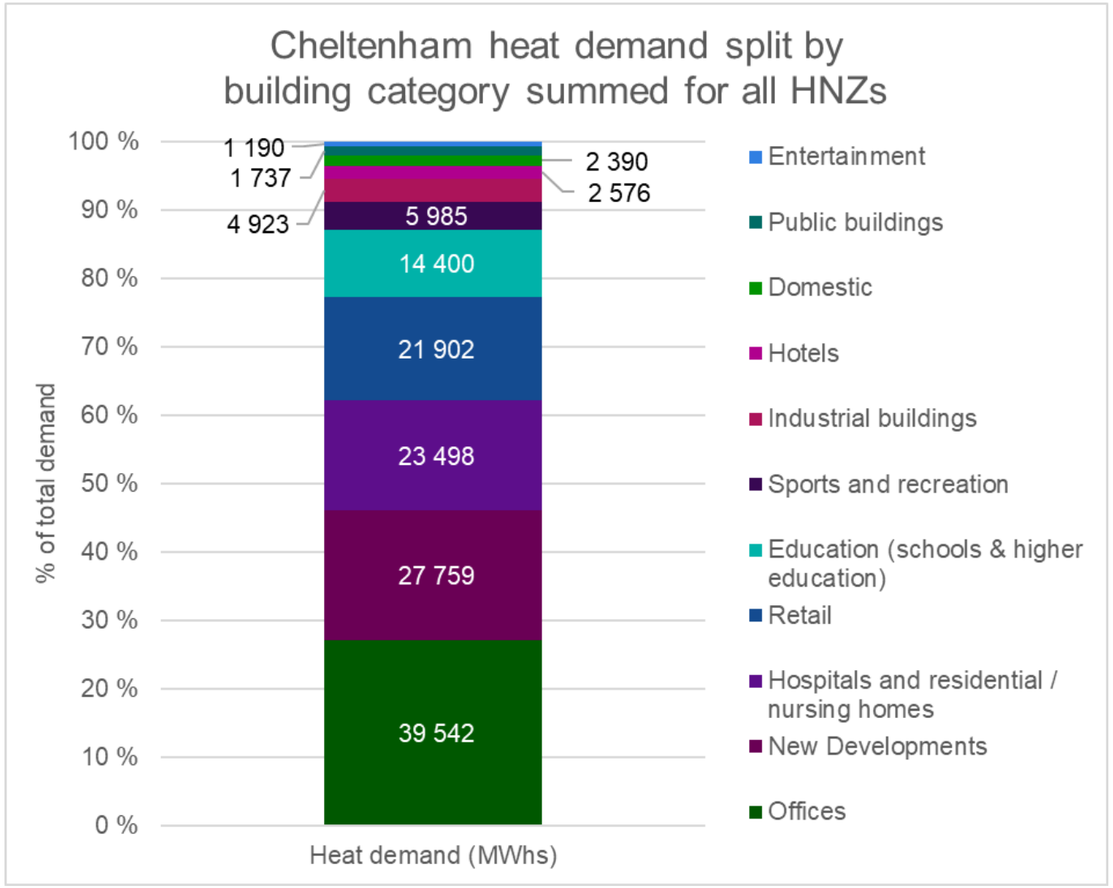
Cheltenham

Map B

Key Heat Demand

Table 12: Heat Demand split further by Building Categories across all Initial Zone Opportunities identified in Strategic HNZs in the Study Area

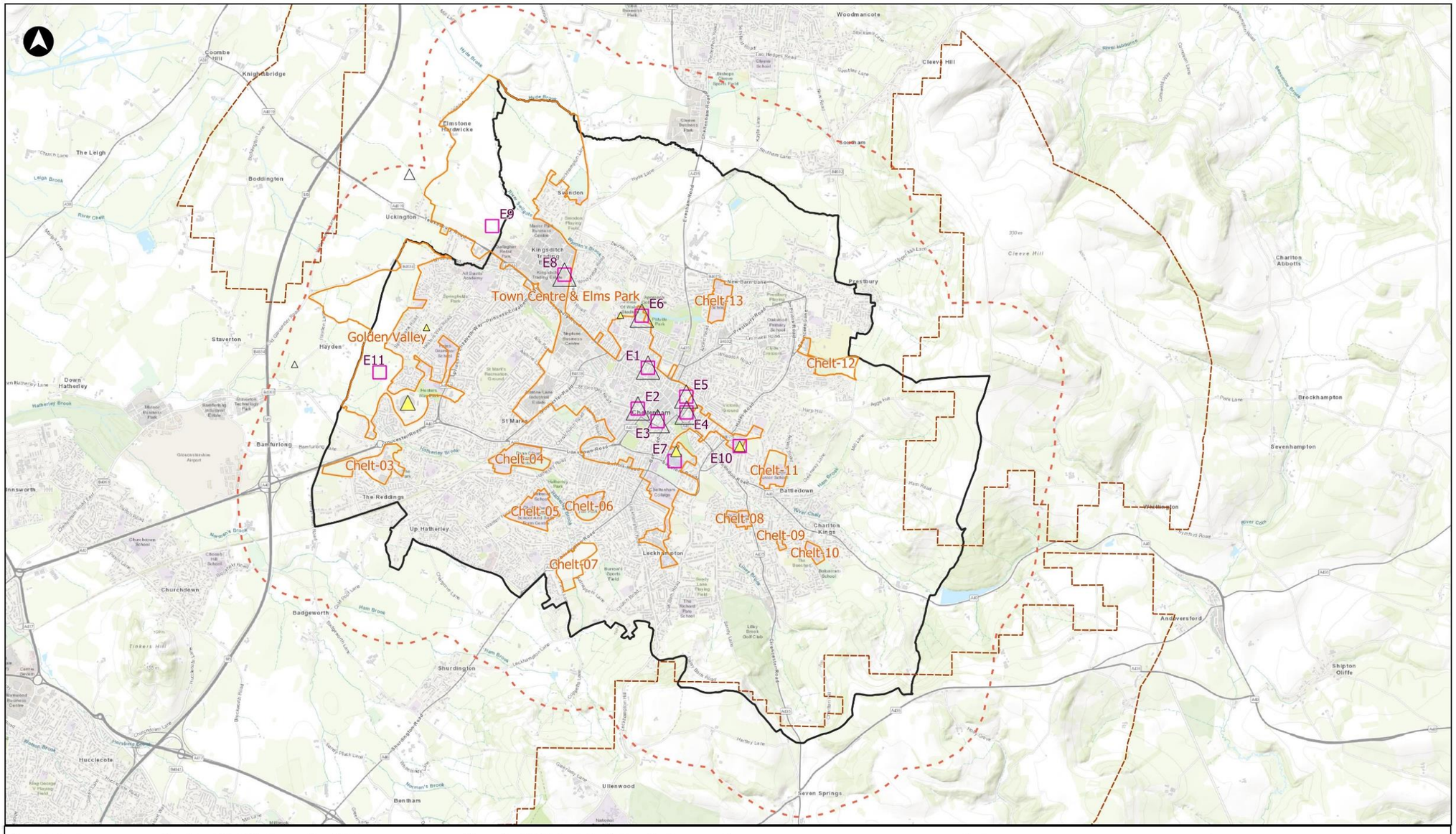
Building category	Number of buildings required to connect in this category	Annual Heat Demand of buildings required to connect across IZOs (MWh)
Domestic	12	2,400
Education (schools & higher education)	37	14,400
Entertainment	4	1,200
Hospitals and residential / nursing homes	10	23,500
Hotels	7	2,600
Industrial buildings	25	4,900
Offices	102	39,550
Public buildings	8	1,750
Retail	76	21,900
Sports and recreation	4	6,000
New development	6[16]	27,750
Totals	**291**	**145,900**



Note: In Cheltenham, there are two Strategic HNZs identified with a total of three IZOs. The table and graph above summarise the heat demand for buildings required to connect to these IZOs.

[16] The number of new development connections is uncertain. They are presently presented as a single connection per new development type e.g. Golden Valley has two: one domestic and one non-domestic.

C. Key Heat Sources and Potential Energy Centres



Boundaries
- Study Boundary
- Local Authority Boundary
- Other Local Authority Boundary
- Heat Network Zones

Key Area Heat Sources
- Deep Geothermal
- Ground Source
- Water Source

Heat Source
- Area Source
- EfW
- Industrial Waste Heat
- Minewater
- Other Waste Heat
- Water Source
- WWT Plant

Capacity (GWh/year)
- 0 - 5
- 5 - 15
- 15 - 50
- 50 - 100

Energy Centres
- Potential IZO

0 1 2 3
Kilometres
Scale: 1:50 000
Coordinate System: OSGB36 / British National Grid

Department for Energy Security & Net Zero

Cheltenham

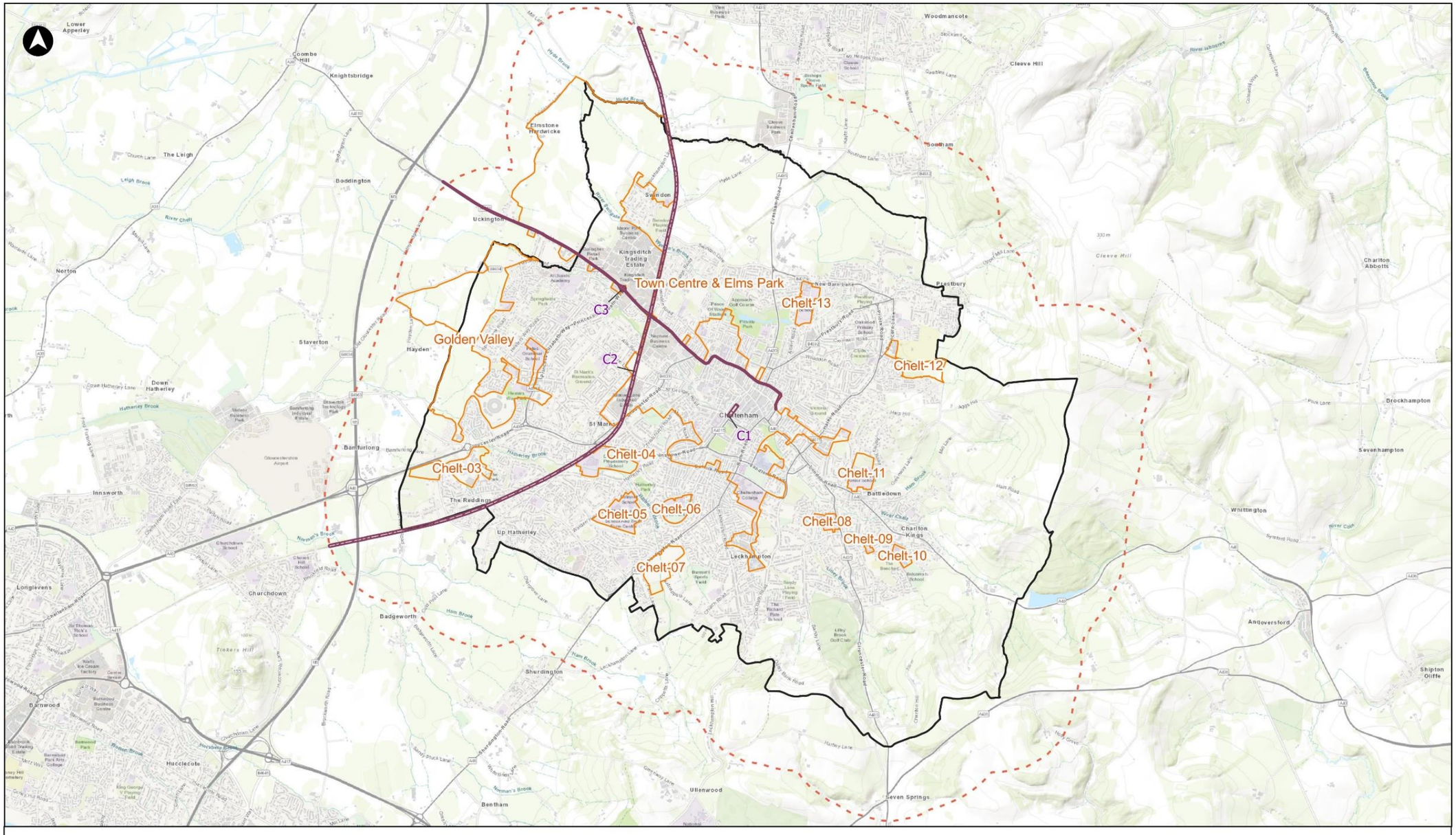
Map C

Key Heat Sources and Energy Centres

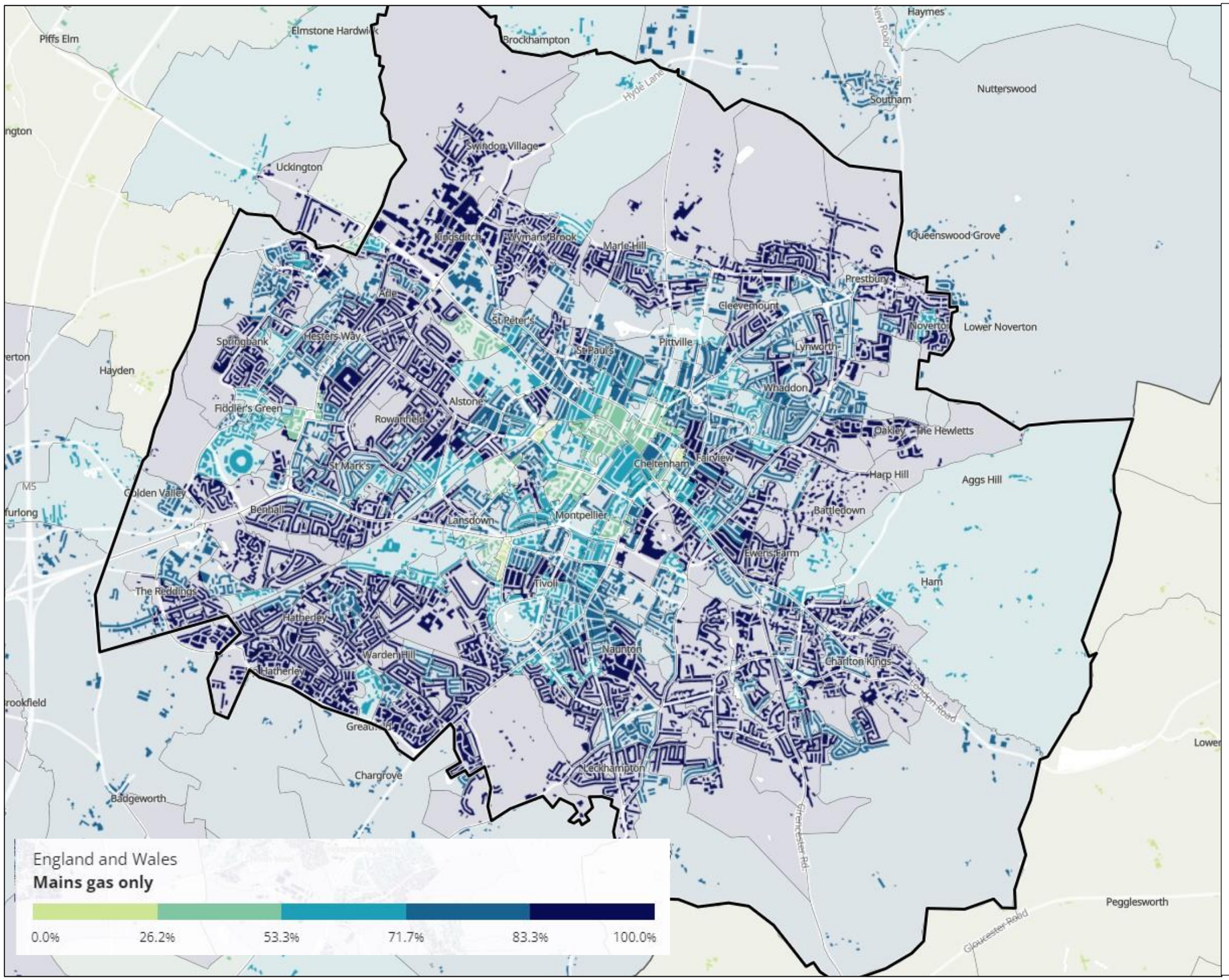
D. Existing and Planned Heat Networks

No relevant information available

E. Physical Constraints



F. Off-Gas Grid Areas in Cheltenham



Appendix 2: Data Room Resources

Throughout the delivery of the Pilot programme, information resources have been compiled for future use in relation to the development of heat network zones.

These resources will remain restricted to DESNZ and the local authority. This is to ensure that the department remains within its Data Privacy Notice as shared with stakeholders providing the information. GIS outputs are not being published alongside the report as they are subject to change.

Table 12: Pilot Programme Standardised Information Resources

Information resource	Description of resource
Stakeholder Directory	A directory listing key stakeholders identified and approached during the Pilot programme, including organisation name, address, or website, contact names, work title and contact details.
Stakeholder meetings log and records	A log of key meetings held and related meeting records.
Datasets Directory	A list of datasets / reports shared by stakeholders cross-referencing who provided the item from the stakeholder directory and a description of the dataset.
Geospatial packages and related geo-coded datasets	Geo-coded datasets and descriptions related to maps produced in this report.

Table 13: Pilot Programme Study-Area-Specific Information Resources

Information resource	Description of resource
Golden Valley Development - Supplementary Planning Document	Planning information on the new development area in Golden Valley
Planning application for principal development	Range of documents from prior outline planning applications for schemes in Golden Valley and Elms Park
Gloucestershire Climate Change Strategy 2nd Annual Report & Action Plan 2022/23 – 2026/27.	Presents details of net zero targets and plans
Cheltenham Climate Change Supplementary Planning Document (Rev G, June 2022)	Presents details of development standards required to meet climate change objectives

Information resource	Description of resource
Delivering a 'Net Zero' National Health Service (B1728, July 2022)	Net Zero targets and plans which sets obligations for NHS Trusts
University of Gloucestershire Carbon Net Zero Strategy (2021-2030)	Net Zero targets and plans for the university estate
Land assets of council	Provide identification of potential energy centre locations
Energy demand data	Consumption data for a range of large consumers
Local Plan and Joint Core Strategy	Planning document providing information regarding the nature and standard of future development
Heat Network Metering and Billing Regulation data	Information regarding registered existing heat networks (all communal heating system)
Gloucestershire Energy Strategy (2019)	Countywide energy strategy

This publication is available from: https://www.gov.uk/government/collections/heat-networks

If you need a version of this document in a more accessible format, please email alt.formats@energysecurity.gov.uk. Please tell us what format you need. It will help us if you say what assistive technology you use.