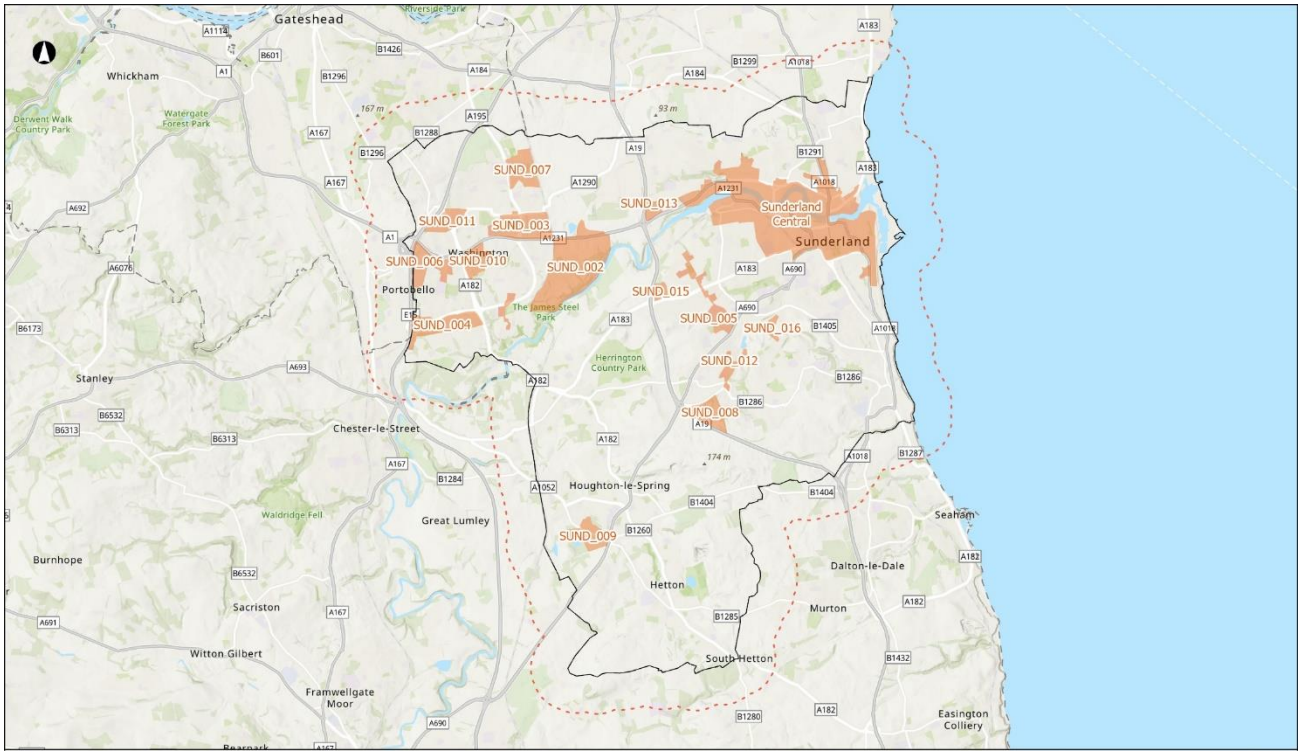
Department for Energy Security & Net Zero

Sunderland

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 WSP with support from Sunderland City Council. We are grateful to all stakeholders who participated in the Pilot programme.

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

Contents

Executive Summary

About Sunderland: Sunderland is a port city in Tyne and Wear, North-East England, which aims to be carbon neutral by 2040.

Local Energy Policy: Sunderland City Council declared a climate emergency in 2019 and has a Low Carbon Action Plan targeting carbon neutrality by 2040.

Existing heat networks: Sunderland has a heat network at Sunderland Royal Hospital and a shared ground loop network in Monkwearmouth and Roker. It is planning a large-scale city centre heat network.

Zones identified: Sixteen heat network zones were identified in Sunderland, with one considered a strategic zone. The total annual heat demand for all buildings required to connect within these zones is around 300GWh/yr.

Strategic heat network zones: The Sunderland Central strategic heat network zone covers the city centre, extending to the Port of Sunderland and Sunderland Royal Hospital, with a demand of 150GWh/yr from buildings required to connect.

Key heat demands: The total annual demand for buildings connected to the initial zone opportunities is 125GWh/yr. Key buildings include Sunderland Royal Hospital, the Aquatic Centre, and the University of Sunderland.

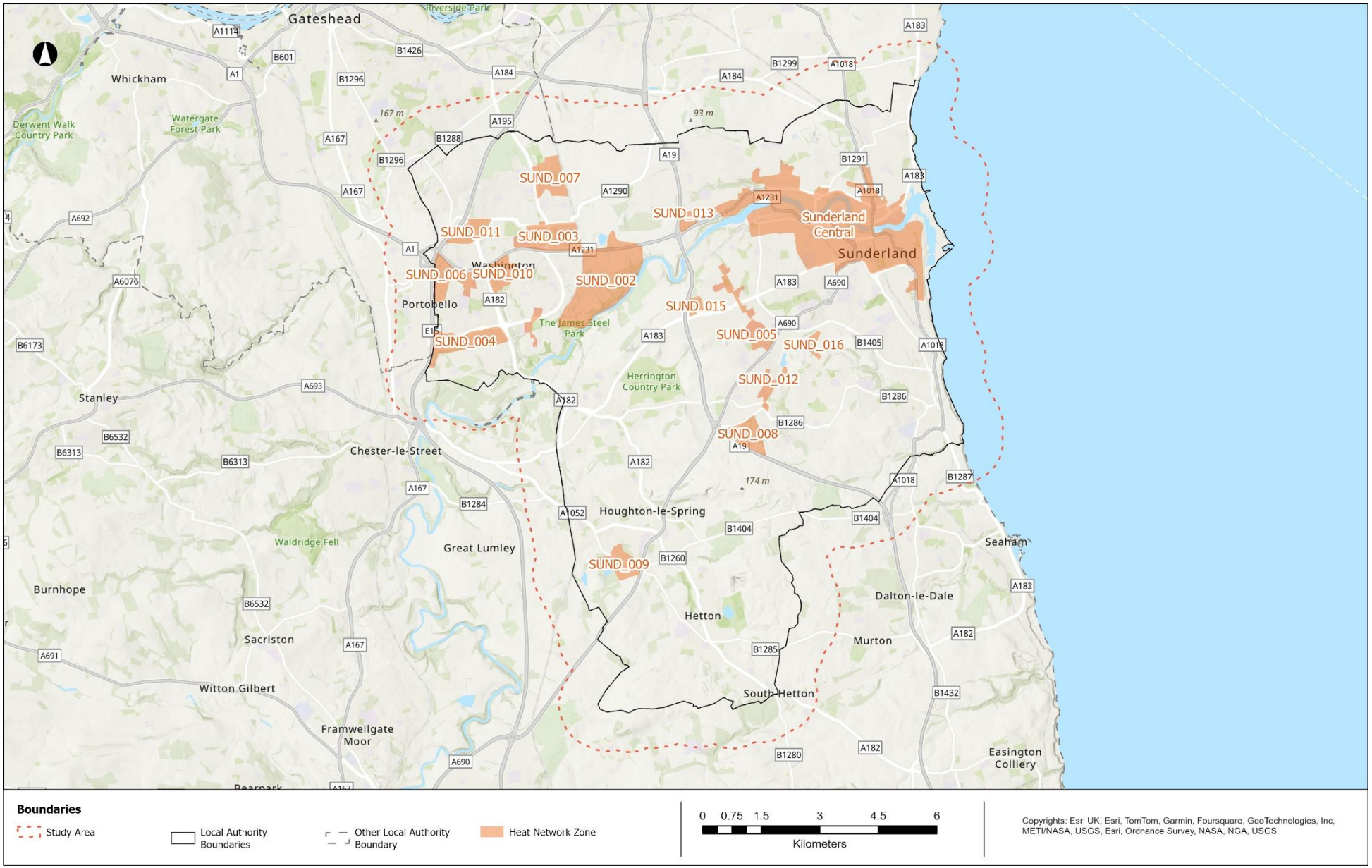
Key heat sources: Potential heat sources include water source heat pumps, mine water, waste water heat recovery and air source heat pumps.

Estimated CapEx: The high-level estimate of capital expenditure to network all buildings required to connect in all zones is approximately £375m, of which the initial zone opportunities amount to approximately £150m.

Other heat network zones: Smaller heat network zones identified in areas like Washington and Doxford International Business Park could be served by large-scale heat pumps.

Carbon savings: The initial zone opportunities identified could deliver carbon savings of more than 20ktCO_{2e} annually.

Figure 1: Overview of Heat Network Zones in Sunderland



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 demand in the UK 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 Sunderland 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[1]. 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 specific to the Pilot programme and the report focuses primarily on the strategic zones.

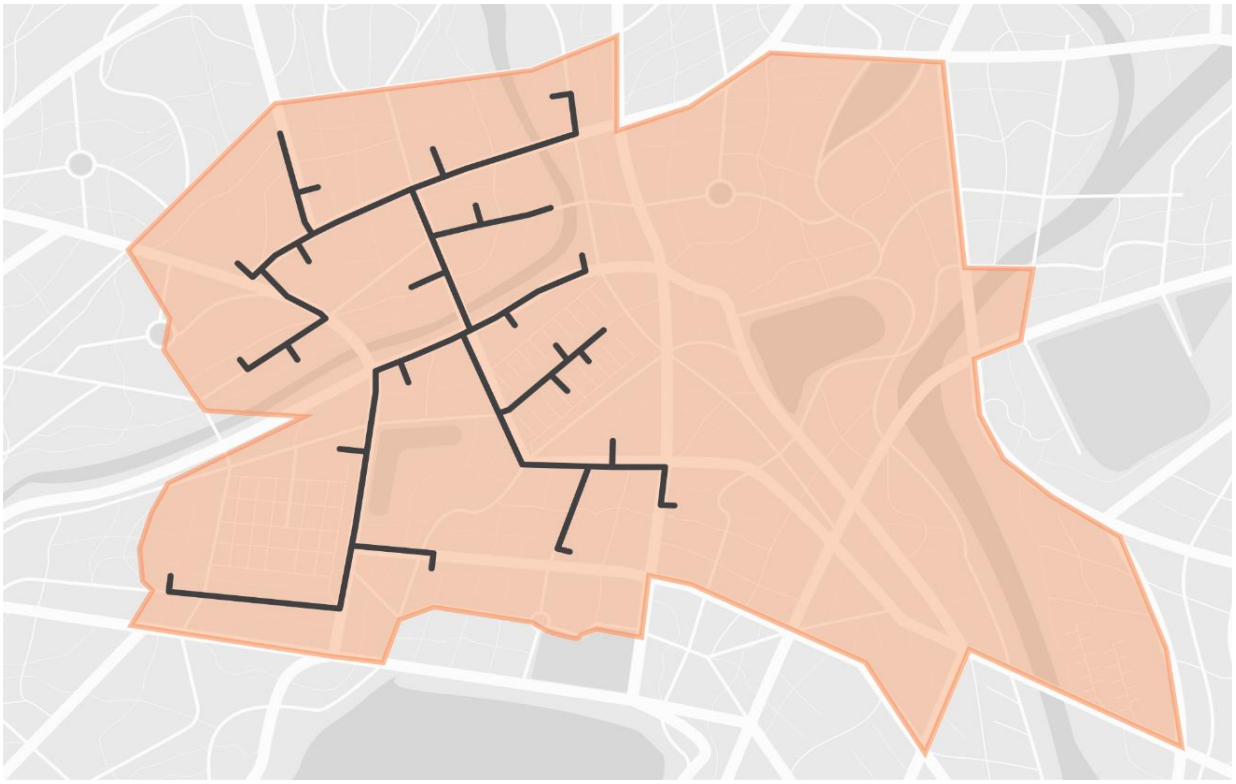
[1] More information can be found in the Heat Network Zoning Methodology Statements (Appendix 3, 4 & 5)

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[2] 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)



[2] 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) Sunderland Heat Networks Context

2.1) Sunderland City Overview

Sunderland is a port city in the metropolitan county of Tyne and Wear in northeast England. The city sits at the mouth of the River Wear, which runs west-east through the city centre. The local government is Sunderland City Council (SCC), a unitary authority. The city administrative boundary covers an area of 137.5km^2 and the population, as of 2021, is 274,200[3]. It is the second largest city in Tyne and Wear.

The city centre is bordered to the west by Washington, where large car manufacturing facilities are located and associated supply chain facilities, and to the east by the Port of Sunderland. The administrative boundary extends south away from the city of Sunderland, incorporating small towns, suburban residential areas and open countryside. The topography of the administrative area is generally flat. Much of the city centre sits 25-30m above the River Wear.

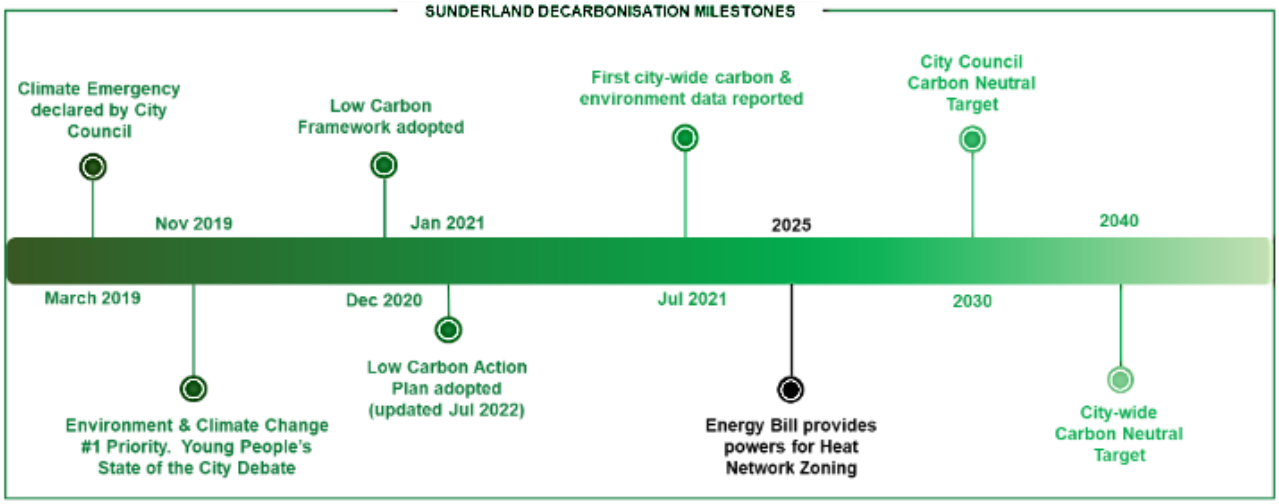
The largest social housing provider in Sunderland is Gentoo Group, which owns more than 80% of the social housing in the city. The rest of the social housing is owned by privately owned providers, including Bernicia Group and Home Group Limited.

2.2) Sunderland Net Zero Targets and Commitments

The Council's Low Carbon Action Plan is centred on seven strategic priorities for reducing carbon emissions through behaviour change, renewable energy generation, building energy efficiency enhancements, low carbon and active transport, waste reduction, development of a green economy, policies, and operational practices. SCC aim to achieve carbon neutrality for their entire estate by 2030, and for the city to be carbon neutral by 2040. Figure 3, summarises key dates in the SCC's plans for decarbonisation and demonstrates their progress towards decarbonisation targets to date.

[3] Office for National Statistics (2022) How the population changed in Sunderland: Census 2021, ONS. Available at: https://www.ons.gov.uk/visualisations/censuspopulationchange/E08000024/

Figure 3: Sunderland Decarbonisation Milestones



2.3) Delivering Heat Networks in Sunderland

There is an existing heat network at Sunderland Royal Hospital, where a low temperature hot water distribution system supplies most of the hospital site from a centralised energy centre comprising gas CHP and gas boilers. In addition to this, there is an existing network with a shared ground open loop supplying individual ground source heat pumps (GSHPs) in apartments, named Core 364, in Monkwearmouth and Roker which connects seven high rise buildings of Gentoo Group[4].

A proposed city centre heat network supplying various public sector buildings is currently under development. This scheme has received support from the Green Heat Network Fund Transition Scheme for the procurement of a contractor to undertake drilling of pilot boreholes to explore the mine water resource identified in the area. The commercialisation of this scheme is ongoing.

Furthermore, a feasibility study is underway for the development of a network that would serve the new Northern Spire Park development. The preferred heat source for this scheme is water source heat pumps recovering heat from the River Wear.

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

2.4) Sunderland Heat Network Zones

A total of 16 potential HNZs were identified in Sunderland, with one considered a Strategic HNZ. Figure 4 shows the study area boundary as well as the boundaries of all HNZs identified

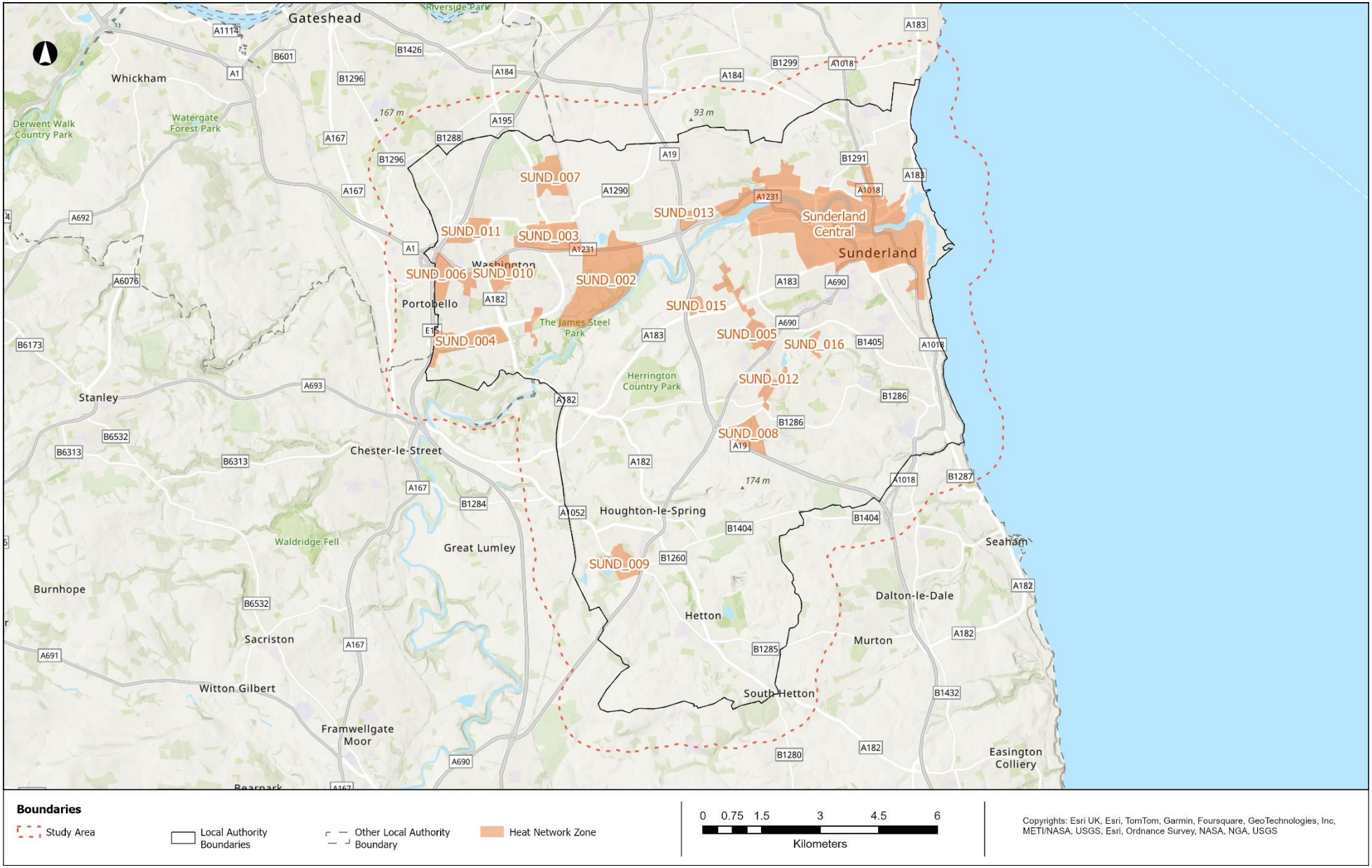
[4] Gentoo Group (2024) Monkwearmouth and Roker district heating. Available at: https://www.gentoogroup.com/your-home/monkwearmouth-and-roker-district-heating/

within Sunderland. For the purposes of this programme, the Strategic HNZ was allocated a meaningful local name, whereas all other HNZs were given a reference number. These are shown on the map.

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.
- G: Coal Mine Authority Map - shows area where coal mine water may be a possible heat source.

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



3) Strategic Heat Network Zones

Strategic HNZs in Sunderland

This section examines the strategic HNZ identified and the IZOs identified within it. This covers the key heat demands, heat sources, energy centre locations and potential routing constraints. 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 Sunderland. 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[5]	300
All buildings required to connect in strategic zones	150
All buildings connected to the IZOs	125

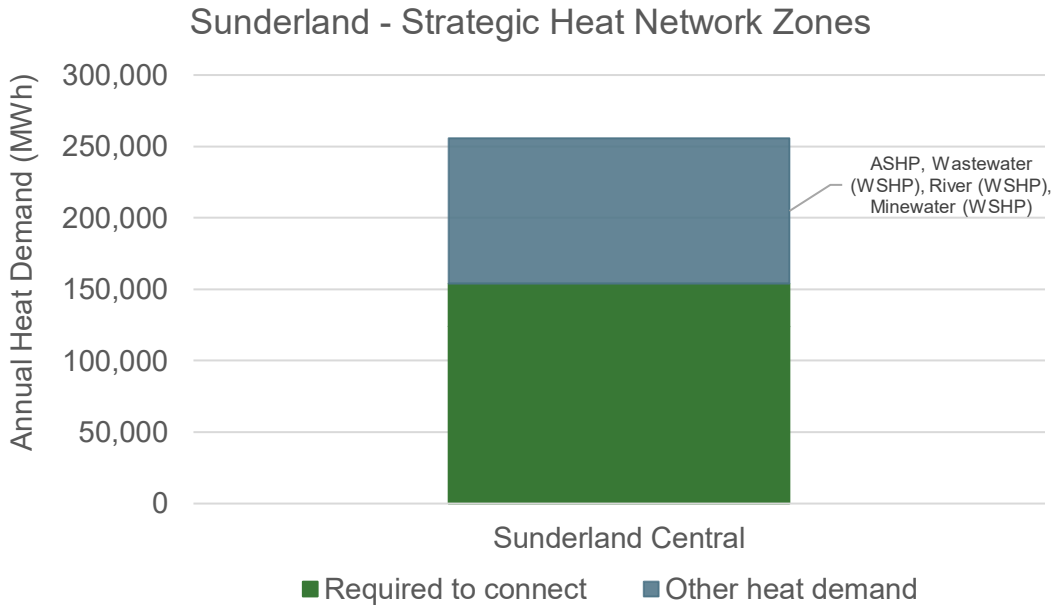
Existing/planned heat networks that overlap with IZOs are described, though their locations may vary due to different approaches. The Pilot programme applied a standard set of technical and economic assumptions across each of the 28 areas that participated in the programme and uses a proxy for economic 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 strategic zone is summarised below. Figure 5 illustrates its size, alongside the potential key heat sources and the proportion of buildings that may be required to connect.

Sunderland Central covers the city centre of Sunderland, extending east to the Port of Sunderland, south to the Sunderland Royal Hospital and west to encompass Northern Spire Park and Sunderland Enterprise Park/Hylton Riverside. A single IZO was identified within the HNZ which builds on previous heat network studies which have been ongoing since 2019.

[5] 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.

Figure 5: Summary of Heat Demands in the Strategic HNZ Identified



3.1) Sunderland Central

3.1.1) Sunderland Central – HNZ Summary

Sunderland Central is the largest of the 16 HNZs identified. The HNZ contains 343 buildings that may be required to connect, including Sunderland Royal Hospital, two Sunderland University campuses, the Stadium of Light, City Hall, Sunderland College, and the Riverside Sunderland development. Of these buildings, 68% are included within the IZO identified in Section 3.1.3. Potential low carbon heat sources identified within the HNZ include air source heat pumps (ASHPs) and water source heat pumps (WSHPs) recovering heat from mine water, the River Wear and Hendon Sewage Treatment Works (see Section 3.1.5).

Key constraints to the development of heat networks are the River Wear and the railway line that runs north-south at shallow depth beneath the city centre. Potential mitigations are explored in Section 3.1.7.

3.1.2) Sunderland Central - Existing Heat Networks

There is an existing centralised distribution system at Sunderland Royal Hospital, an existing ambient network with a shared ground loop in Monkwearmouth and Roker, and two district heat networks currently in development in the HNZ. The district heat networks currently under development are further described below.

Planned Heat Networks – Late stage

City Centre Network

The Sunderland Heat Network, which has been developed by SCC and WSP through the Heat Networks Delivery Unit (HNDU) detailed project development and commercialisation process,

is a planned city centre heat network utilising heat from flooded mine shafts on land adjacent to the Stadium of Light football ground. Heat will be generated by 6MW of heat pumps, with 600m^3 of thermal storage. The heat demand at full built-out is anticipated to be ~39GWh/yr. Key anchor loads include Sunderland University City and St Peter's campuses, Sunderland Royal Hospital, Sunderland College, and buildings on the Sunderland Riverside development including approximately 900 residential units. Under the current project delivery programme, construction is likely to begin in 2026.

Table 2 Planned Heat Network Key Metrics

Annual Demand	Heat Sources	Estimated CapEx	Construction Start Date
~39GWh/yr	Mine water (WSHP)	£40m	2026

Proposed Heat Networks – Early stage

Northern Spire Park Network

Northern Spire Park is a residential new development consisting of 1000 homes. It is located on the south side of the River Wear, to the west of the city centre. A HNDU feasibility study was completed in 2023. It investigated serving the residential developments with a river WSHP. The total heat demand is expected to be approximately 3GWh/yr, with a CapEx of £12m. A large-scale film studio development has recently been proposed as part of the new developments at Northern Spike Park. The heating proposal for the studio will be progressed at a relevant point in time.

3.1.3) Sunderland Central - Initial Zone Opportunities

A single IZO was identified in the Sunderland Central zone. Potential routing[6] for the IZO is shown in Figure 6 and summary statistics provided in Table 3.

Table 3 Sunderland Central - Summary Statistics for Initial Zone Opportunities[7]

CapEx	Heat	Network	CO_{2e} savings	Linear Heat Density	Heat Sources
>£175m[8]	~125 GWh/yr	>30 km	>20 ktCO_{2e}/yr	4.1 MWh/m	ASHPs and WSHPs

This IZO builds on the planned heat network identified in Section 3.1.2. The IZO serves 231 buildings potentially required to connect within a 2km radius of the city centre, with a total demand of 125GWh/yr. The IZO connects to key anchor loads on the planned network including the two Sunderland University campuses, the Sunderland Riverside development

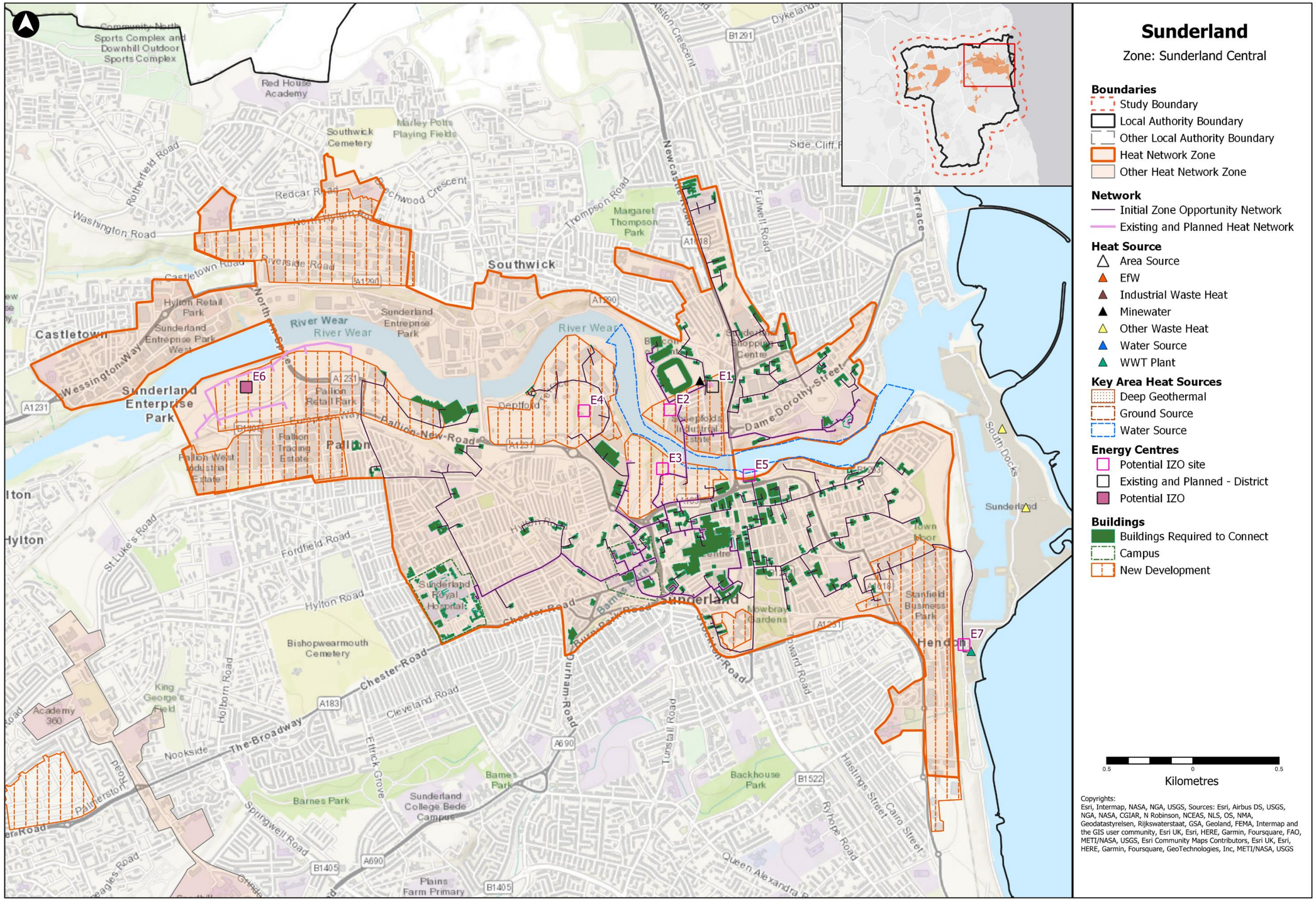
[6] Routes can be expected to change as a better understanding of local constraints is developed through design.
[7] Please see Appendix 3 – Glossary, "Specific definitions" of the main report for definitions related to this table.
[8] The CapEx presented here has been estimated from high-level modelling of the IZO. The value is lower than bidders have been stating during recent dialogue with SCC.

area, Sunderland Royal Hospital and Sunderland College. The IZO has multiple low carbon heat source opportunities, including mine water, river water, and wastewater WSHPs.

Sunderland Central Heat Network Procurement

Sunderland City Council are in the process of procuring a heat network funder/operator for ‘Sunderland Central’. Under a competed process the Council will select a preferred bidder to enter into a Joint Development Agreement (JDA) to commercialise an initial ‘core scheme’ and, subject to Zoning legislation, benefit from exclusive rights to deliver the IZO of ‘Sunderland Central’ Heat Network. The extent and scope of the network being procured under the JDA are the same as presented by the Sunderland Central IZO however some of the numbers may differ, including the CapEx, due to more detailed work completed since the Pilot programme.

Figure 6: Initial Zone Opportunities in Sunderland Central



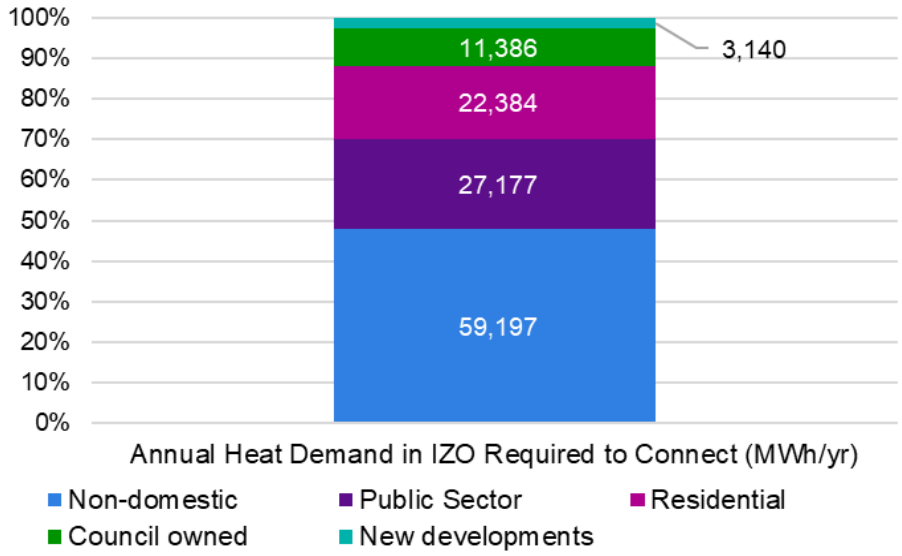
3.1.4) Sunderland Central – IZO Heat Demands

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.

There are 231 buildings potentially required to connect within the IZO, with a total heat demand of 125GWh/yr. As shown in Figure 7 most of the buildings potentially required to connect in the IZO are non-domestic sector buildings, accounting for 49% of the total number and 48% of the heat demand. Public sector buildings account for 12% of the buildings, and 22% of the demand.

Figure 7: Sunderland Central - Categorisation of Heat Demand for Buildings Required to Connect Buildings in IZO



Further details of the key heat demands for buildings that may be required to connect in the IZO are provided in Table 4. The most significant single heat demand is Sunderland Royal Hospital, with a LTHW heat demand of approximately 14GWh/yr. There is additional steam distribution at the hospital, some of which is process steam and some is used for heating. Conversion of the heat demand could add a further ~6GWh/yr, taking the total to ~20GWh/yr.

The University of Sunderland Central Campus accounts for approximately 2.7GWh/yr, and the Sir Tom Cowie Campus around 3GWh/yr. Gentoo, the social housing provider, accounts for approximately 5GWh/yr split across 18 separate connections – this excludes the Core 364 site,

which is served by a shared ground open loop serving individual GSHPs in each dwelling. Other significant buildings that may be required to connect include the Stadium of Light, the Beacon of Light and several buildings on the Riverside Sunderland development. One of the existing buildings in the Riverside Sunderland development area, The Beam, is already operational but not included on the IZO. This is because it is known to have been installed with a variable refrigerant flow heating system which is incompatible with a heat network connection.

Table 4 Sunderland Central - Key Heat Demands Required to Connect in the IZO[9]

Building name	Building category	Number of connections	Annual Heat Demand (MWh)	Data Source
Royal Hospital	Public sector	1	20,000	Metered
Aquatic Centre	Non-domestic	1	4,100	Metered
Stadium of Light	Non-domestic	1	3,000	Metered
Sunderland University Central Campus	Public sector	7	3,000	Metered
Sunderland University Sir Tom Cowie Campus	Public sector	9	2,700	Metered
Sheepfolds	New developments	4 bulk, 500 dwellings	1,750	Pilot Methodology
Eye Infirmary	Public Sector	1	1,050	Benchmark (NZM)
City Hall	Public Sector	1	1,000	Metered
Prospect House	Public sector	1	900	Benchmark (NZM)
Farringdon Row	New developments	2 bulk, 250 dwellings	800	Pilot Methodology

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

3.1.5) Sunderland Central – IZO Heat Sources

The key potential low carbon heat sources identified to supply the IZO are heat pumps recovering heat from the River Wear, Northumbrian Water's Hendon Sewage Treatment Works, and mine water in flooded mine shafts located ~600m below ground level. Table 5 and Table 6 in this section summarise the key heat sources and potential energy centre locations. These are also shown in the zone-level map in Figure 6 in Section 3.1.3 and on the city-level Maps C and G in Appendix 1.

Specific Heat Source Points

Of the available heat sources, mine water is particularly attractive based on the quality of the heat and so is considered a strategic heat source. Exploratory boreholes and pump tests would be required to prove this resource at scale. If viable, the preferred energy centre location is close to a preferred borehole location identified by the Coal Authority, which is in the Stadium of Light car park (E1 in Figure 6). There are two further potential energy centre locations in proximity of the river that would be close to the borehole location (E2 and E3).

For heat recovery from Hendon Sewage Treatment Works, an energy centre location will be required close to the works at the Port of Sunderland (E7). Additionally, waste heat is likely to be available from two planned pyrolysis plants, though capacities are not yet known.

Natural Heat Resources

River water abstraction and energy centre locations could be on either side of the River Wear. No energy centre locations that have been identified immediately adjacent to the river on the north side, due to a lack of space and the land rising steeply away from the river, however, there is potential land north of Easington Street (E3) and at Pann's Bank (E5).

Location Agnostic Sources

Ambient air for large-scale ASHPs is also an option, and it is expected that the required plant could be located at potential energy centres E3 and E5.

Table 5: Sunderland Central - Key Heat Source Opportunities for the IZO

Heat source type	Full Opportunity Capacity (kWp)	Temperature (Degrees Centigrade)	Potential Energy Centre (Ref number)
WSHP			
Sewage Treatment Works	15,000	15°C	E7
Minewater	3,000	20ºC	E1, E2, & E3
River Wear	6,000	12ºC	E3 & E5
ASHP	13,500	8 ºC	E1 & E3

Table 6: Sunderland Central - Potential IZO Energy Centre Locations

EC ref number	Site type	Size (m^2)	Ownership	Heat Source
E1	Land	1,350	SCC	Minewater WSHP
E2	Land	6,000	SCC	ASHP, River WSHP, or Minewater WSHP
E3	Land	1,300	SCC	Minewater WSHP
E4	Land	2,000	SCC	ASHP
E5	Land	1,000	SCC	River WSHP
E7	Land	1,100	Northumbrian Water	Sewage Treatment Works WSHP

3.1.6) Sunderland Central – 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. Table 7, shows the network statistics for the IZO including the network length and associated cost. Please see Appendix 5 for more detail.

The heat distribution network for the IZO is shown in Figure 6. It is anticipated that the route will adhere to the city centre road network. There are minimal areas of soft dig land available to potentially lower trenchwork costs. However, some segments of the main network spine may be cost-effective if they pass through privately-owned properties. For example, the section of pipe passing through the Sunderland University City Centre campus.

The sections of the IZO pipe system immediately north and south of the River Wear fall within the Sunderland Riverside development. The network routing could potentially follow the highway route, coordinating with existing utilities. For certain sections, integration with the wider development infrastructure works might be possible, provided their construction schedule aligns with the development of the IZO.

Table 7 Sunderland Central - Indicative Heat Network Statistics for the IZO

IZO Heat Network description	Network length (km)	Network cost (£m)
Sunderland Central	30	85

3.1.7) Sunderland Central – IZO Key Constraints and Mitigations

[C1] Heat source: The availability and capacity of mine water heat is currently unknown, and pilot borehole and pumping tests are required to better understand this opportunity. These tests have been commissioned by SCC, and alternative heat sources including river water, waste heat and ambient air have been identified.

[C2] River crossing: To access loads to the north of the IZO, the pipe route must cross the River Wear. It is proposed that this will be achieved by using a new box section pedestrian bridge, which will link both sides of the Northern Spire development. The bridge is currently under construction and has been designed to carry pipework sizes up to DN350. However, the pipe size will be constrained by the available space within the box section.

[C3] Rail crossing for hospital connection: The pipe route crosses Tyne & Wear Metro line to connect Sunderland Royal Hospital. At this point the railway runs beneath several road bridges. The most likely crossing point is at Chester Street East, which is a reasonably wide road bridge that connects two residential areas – it is for pedestrian access only and closed to traffic. An assessment will be required to identify options for utilising the existing bridge structure to cross the railway.

[C4] Rail crossing: To extend a network east towards the Port of Sunderland, it will be necessary to cross a major railway line that runs underground north-south through the city centre. Assessments to date have been based on a pipe bridge behind the Sunderland College site, running over the tracks to the old Civic Centre site. A feasibility study will be required to evaluate the options in more detail.

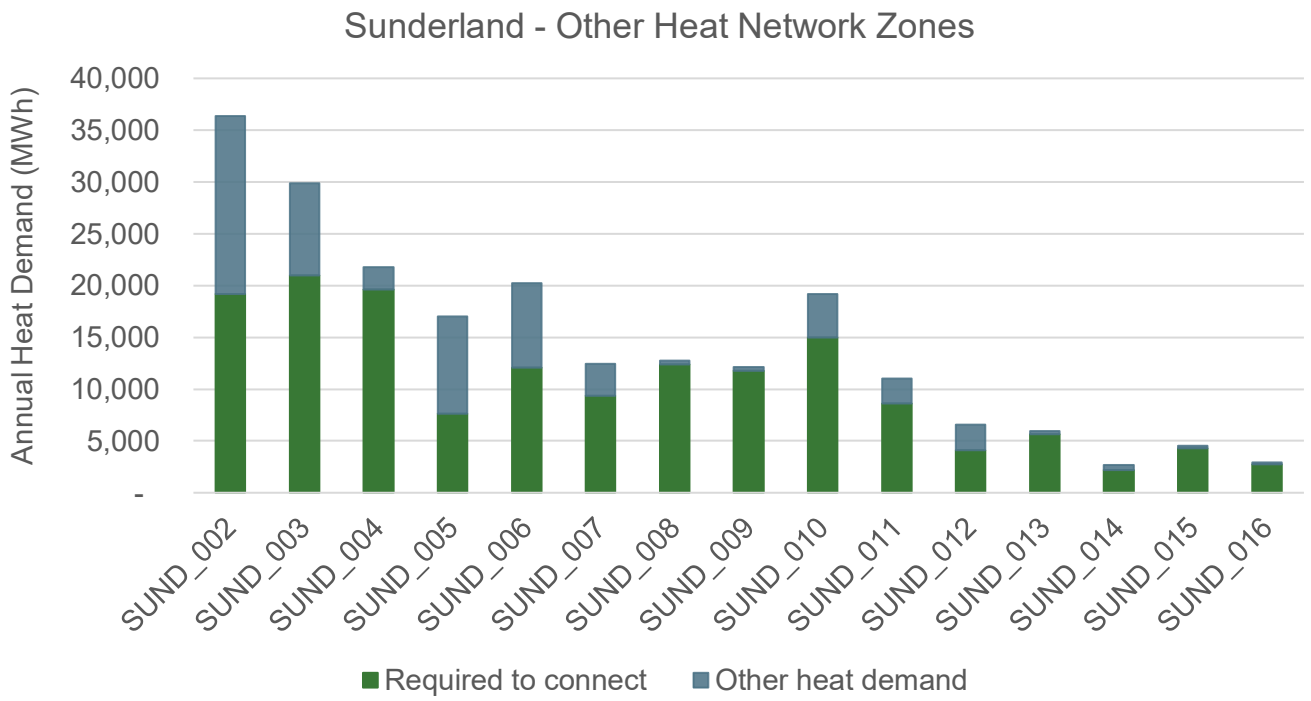
[C5] Conversion of Sunderland Hospital steam network: There is a steam distribution network at the hospital, which is used to provide both process steam and space heating to the site. Without de-steaming, it will not be possible to provide the space heating portion of this load via a heat network, which the hospital advise could equate to ~6 GWh/yr. To access this load conversion of the steam network would require feasibility assessment and full design.

4) Other Heat Network Zones

This section describes the 'Other' potential heat network zones that were identified in Sunderland. 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 8 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 8: Total Heat Demand and Proportion Required to Connect in Other HNZs



These zones may be grouped by predominant load types as follows:

The **SUND_002, SUND_003, SUND_004, SUND_006, SUND_007, SUND_009, SUND_011, SUND_013, & SUND_015** zones are dominated by buildings of an industrial nature and contain key anchor loads such as and HM Revenue & Customs Washington (1.9GWh/yr), and Washington Academy (1GWh/yr). These zones represent 154GWh/yr of total demand, of which 111GWh/yr could be required to connect.

The **SUND_005, SUND_008, SUND_010, SUND_012 & SUND_014** zones do not have clear dominant typologies, and contain anchor loads such as The Galleries (8GWh/yr), and Durham House (2.5 GWh/yr). These zones represent 58 GWh/yr of total demand, of which 42 GWh/yr could be required to connect.

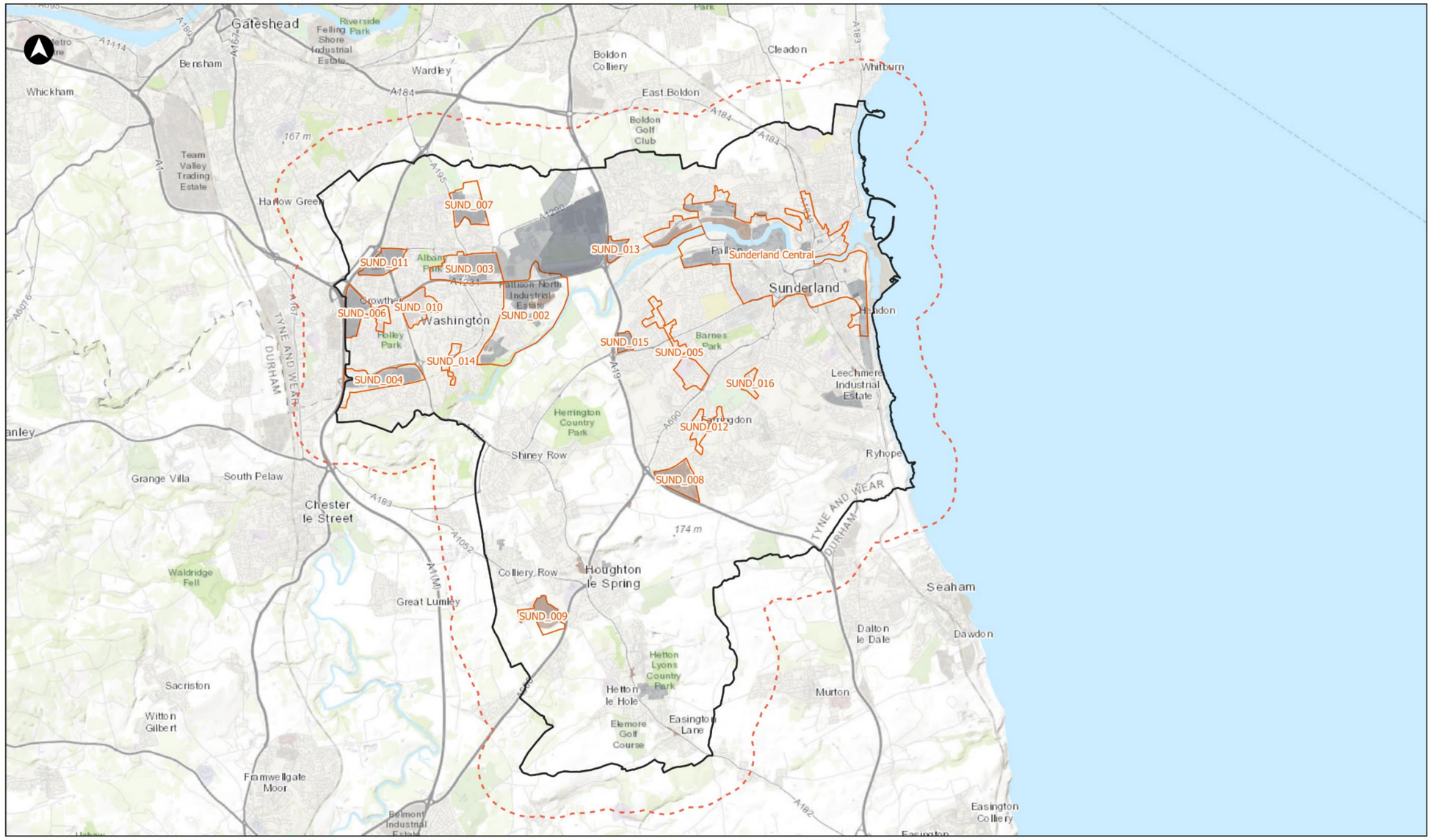
Appendix 1: Maps and Legends

This section provides guidance on interpreting the icons and legends used throughout this report and Maps A-G 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	‘Communal’ energy centres are those operated within a single building or across a campus
	Report maps	Existing/planned energy centre - District HNs	‘District’ 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. Sunderland 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

2 0 2
Kilometres
Scale: 1:87,500
Coordinate System: OSGB36 / British National Grid

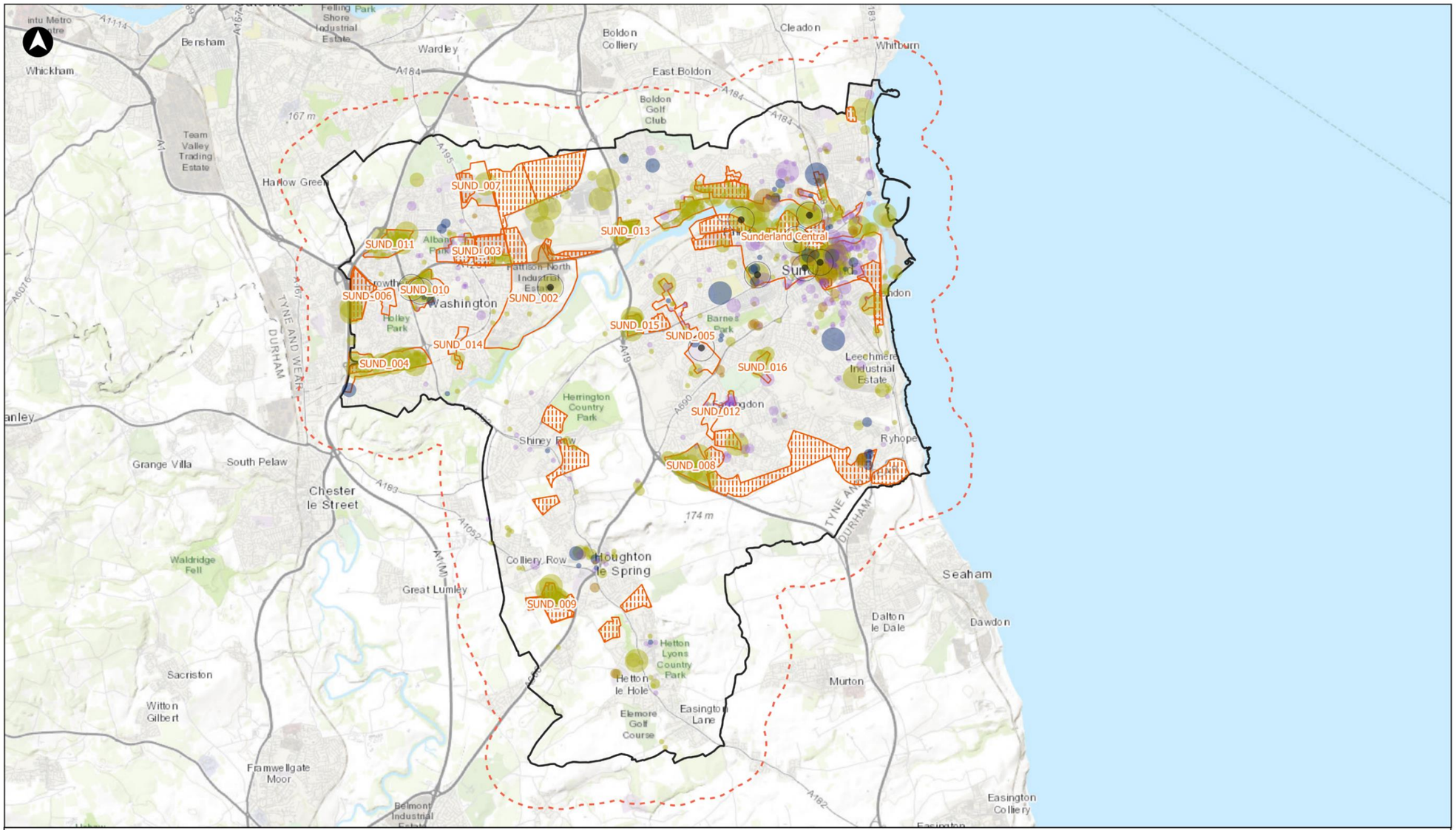
Department for Energy Security & Net Zero

Sunderland

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)
- 100 - 200
- 200 - 400
- 400 - 600
- 600 - 1000

4 0 4
Kilometres
Scale: 1:87,500

Coordinate System: OSGB36 / British National Grid

Department for Energy Security & Net Zero

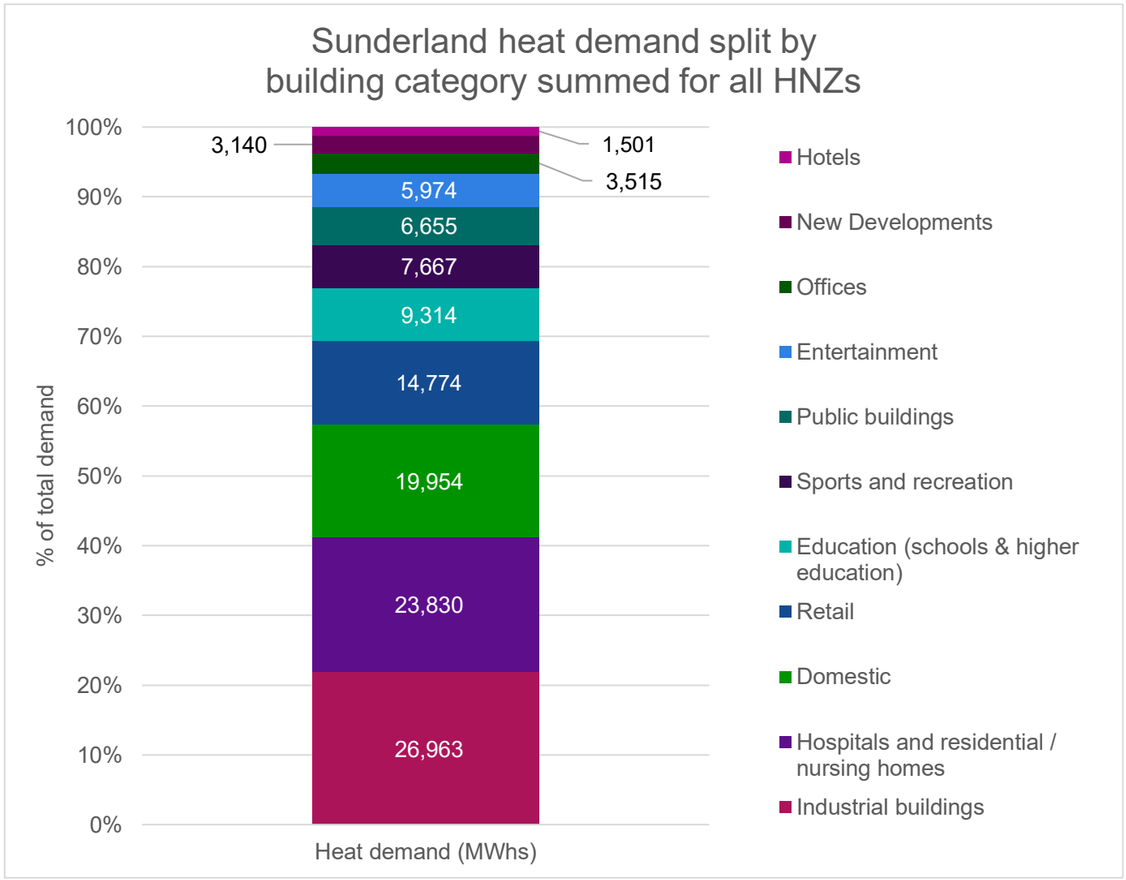
Sunderland

Map B

Key Heat Demand

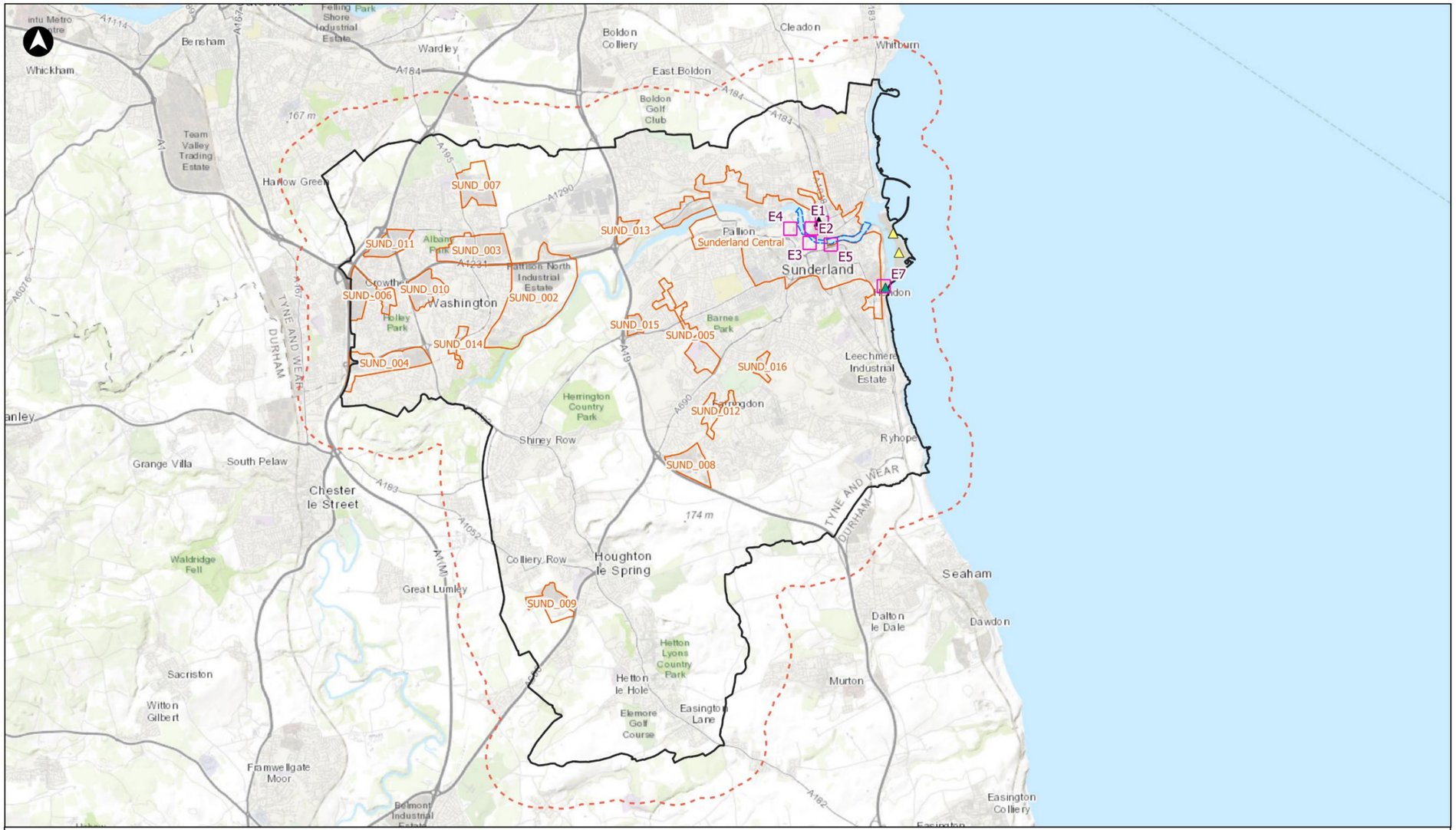
Table 8: Heat Demand split further by Building Categories across all Initial zone Opportunities identified in Strategic HNZs in the Study Area

Building category	Number of buildings required to connect in this category	Annual Heat Demand of buildings required to connect across IZOs (MWh)
Industrial buildings	33	26,963
Hospitals and residential/nursing homes	14	23,830
Domestic	44	19,954
Retail	39	14,774
Education (schools & higher education)	24	9,314
Sports and recreation	5	7,667
Public buildings	26	6,655
Entertainment	19	5,974
Offices	15	3,515
New Developments	7	3,140
Hotels	5	1,501
Totals	**231**	**123,287**



Note: In Sunderland there are 16 HNZs with one IZO identified across them. The table and graph above summarise the heat demand for buildings required to connect to the IZO.

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 or Coal Minewater
- Ground Source
- Water Source

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

Capacity (GWh/year)
- 0 - 2
- 2 - 4
- 4 - 6
- 6 - 8

Energy Centres
- Potential IZO

2 0 2
Kilometres
Scale: 1:87,500
Coordinate System: OSGB36 / British National Grid

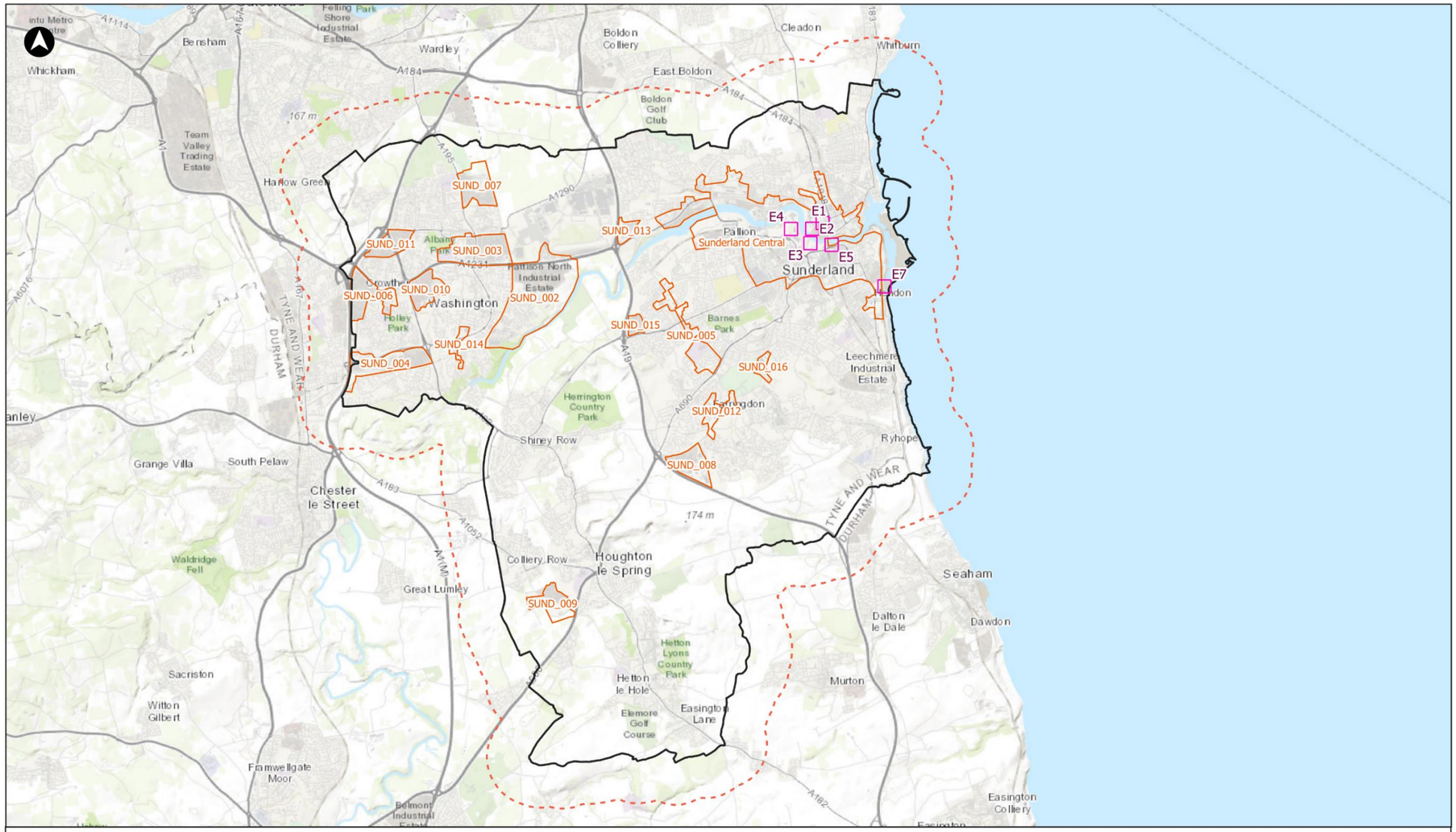
Department for Energy Security & Net Zero

Sunderland

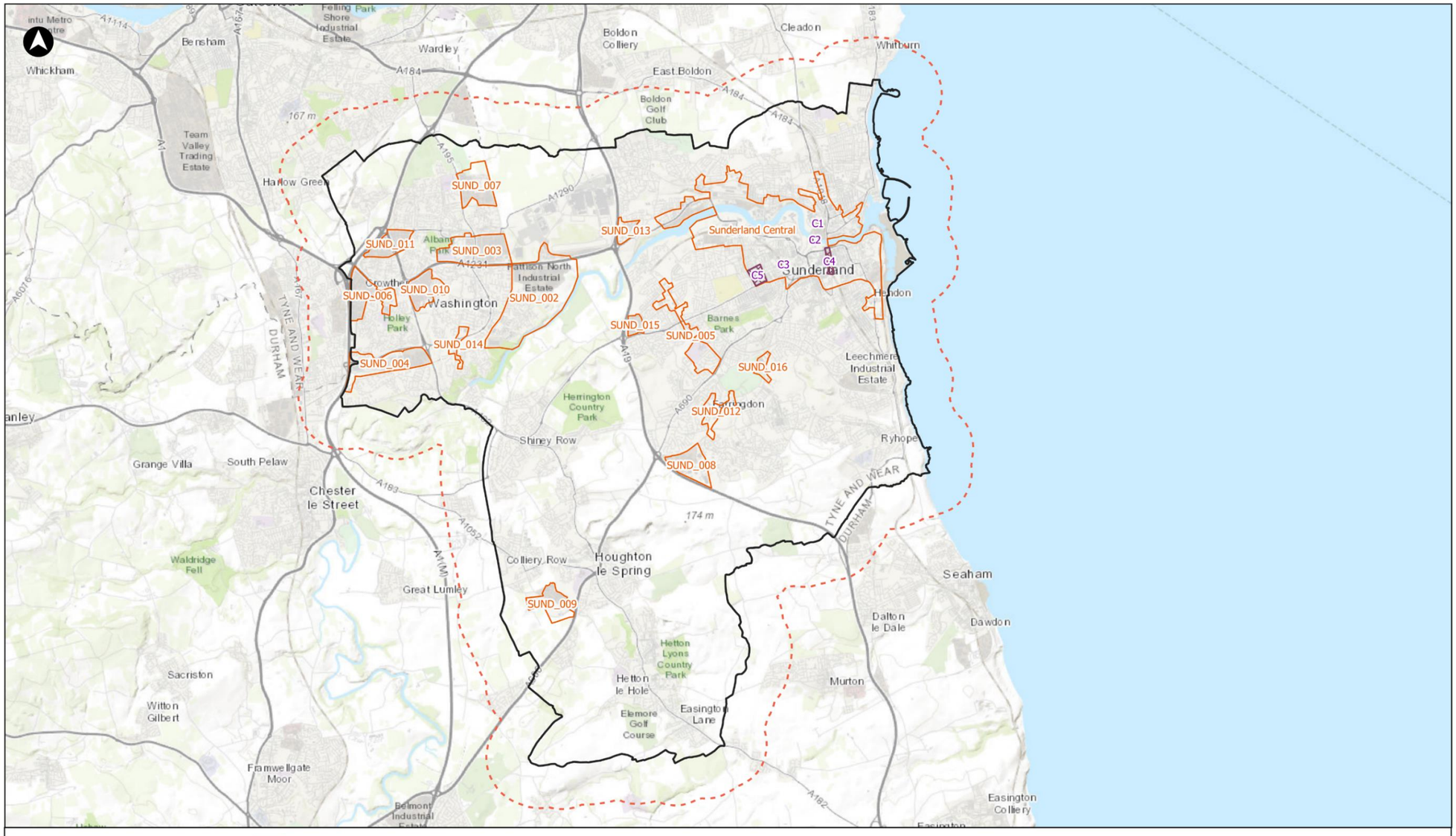
Map C

Key Heat Sources and Energy Centres

D. Existing and Planned Heat Networks



E. Physical Constraints



Boundaries

- Study Boundary
- Local Authority Boundary
- Other Local Authority Boundary
- Heat Network Zones
- Key Constraints

4 0 4

Kilometres

Scale: 1:87,500

Coordinate System: OSGB36 / British National Grid

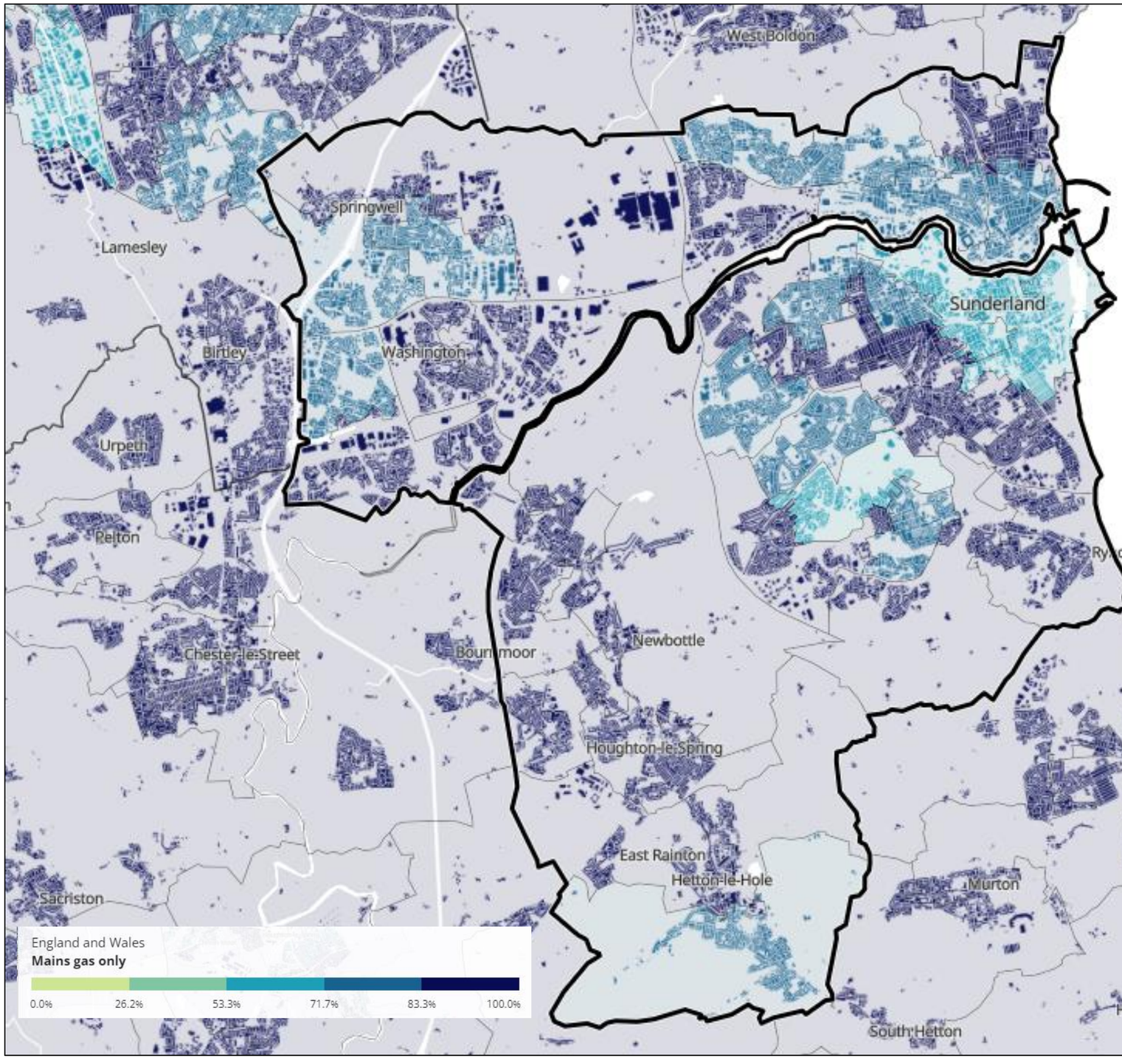
Department for Energy Security & Net Zero

Sunderland

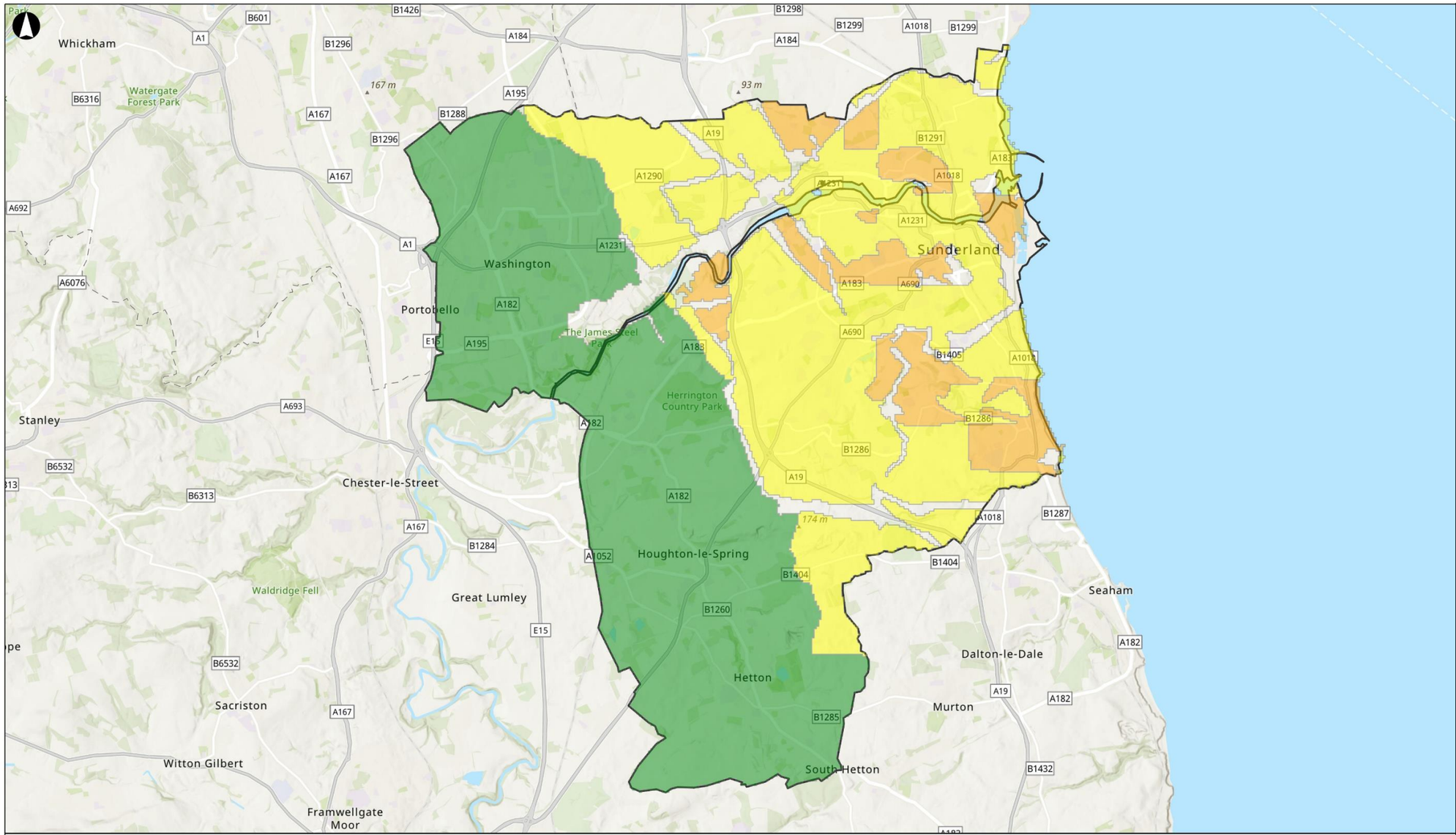
Map E

Physical Constraints

F. Off-Gas Grid Areas in Sunderland



G. Coal Mine Water Areas in Sunderland



Local Authority Boundary

Minewater Opportunity
- Challenging
- Possible
- Good

0 1 2 4
Kilometers

Scale: 1:81,000
Coordinate System: British National Grid

Department for Energy Security & Net Zero

Sunderland

Coal Authority:
Mine water opportunity

This mine-water heat opportunity map, developed by The Coal Authority, provides an indication of where water from former mine workings could potentially be extracted to provide a source of heat to supply heat networks. The areas of historic coal mine workings within the Local Authority boundary were assessed and several factors, such as depth to workings and water levels, were analysed to identify areas of potential opportunity and classified as either 'Good', 'Possible' or 'Challenging'. This opportunity map can be used in combination with plans for heat network projects to identify specific locations where more detailed feasibility studies could be undertaken.

Appendix 2: Data Room Resources

Throughout the delivery of the Pilot programme in Sunderland, information resources have 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 9: 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 10: Pilot Programme Study-Area-Specific Information Resources

Information resource	Description of resource
WSP Sunderland Heat Network Detailed Project Development Report	DPD report for the planned Sunderland City Centre network. Used as a source of heat demand and resource data.
Sunderland Heat Network GHNF Application	GHNF fund application for the above-mentioned city centre network.
Sunderland City – Review of Mining and Hydrogeology	Coal Authority Desk based study to identify the location of mine workings that may be able to supply heat for a DH scheme.
Sunderland Riverside – Mine Energy Options	Coal Authority investigation detailing the process, and results of their investigation into the expected mine water heat potential at the Sunderland Riverside Area.

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.