The Highland Council

Agenda Item	**7**
Report No	**CCC/14/25**

Committee: **Climate Change**

Date: **21 May 2025**

Report Title: **Heat Network Feasibility Report**

Report By: **Assistant Chief Executive - Place**

1 Purpose/Executive Summary

1.1 The report provides an update on the Inverness city-wide strategic heat network technical feasibility study.

2 Recommendations

2.1 Members are asked to **note** progress to date.

3 Implications

3.1 **Resource** – The development of the strategic heat networks feasibility study has been led by internal resource dedicated to deliver the Heat Networks Project within Our Future Highland Delivery Plan 2024-2027 and Local Heat and Energy Efficiency Strategy (LHEES) and its delivery.

Buro Happold has been appointed as the technical consultant to assess the practicality of developing a heat network in Inverness.

The Council receives advisory support from Zero Waste Scotland (ZWS) and Scottish Futures Trust (SFT).

3.2 **Legal –** The report contributes to the Local Heat and Energy Efficiency Strategies (Scotland) Order 2022, which places a statutory duty on local authorities to prepare, publish and update a Local Heat and Energy Efficiency Strategy (LHEES) and Delivery Plan.

As part of the Council's statutory obligations to develop LHEES, the Council is required to identify areas of potential for heat networks.

3.3 **Risk** - There are no direct implications arising from this report.

3.4 **Health and Safety (risks arising from changes to plant, equipment, process, or people)** - There are no direct implications arising from this report.

3.5 **Gaelic** – There are no Gaelic implications arising from this report.

4 Impacts

4.1 In Highland, all policies, strategies or service changes are subject to an integrated screening for impact for Equalities, Poverty and Human Rights, Children's Rights and Wellbeing, Climate Change, Islands and Mainland Rural Communities, and Data Protection. Where identified as required, a full impact assessment will be undertaken.

4.2 Considering impacts is a core part of the decision-making process and needs to inform the decision-making process. When taking any decision, Members must give due regard to the findings of any assessment.

4.3 This is an update report and therefore an impact assessment is not required.

5 Background

5.1 The Local Heat and Energy Efficiency Strategies (Scotland) Order 2022 places a legal duty on all 32 Scottish local authorities to prepare a local heat and energy efficiency strategy and delivery plan by the end of December 2023 - LINK

5.2 The Council published the first iteration of the Strategy and high-level Delivery Plan in December 2023 - LINK

5.3 The Strategy has identified three potential Heat Network Zones (HNZs) in Inverness. The potential zones present theoretical and technical potential only at a strategic level, prior to any site level feasibility study alongside funding availability to progress them. Feasibility studies boundaries and LHEES heat network opportunities can be found in **Appendix 1**.

5.4 The Highland Council has successfully secured the Strategic Heat Network Support funding from the Heat Network Support Unit (HNSU) to conduct a city-wide feasibility study, explore delivery models and identify interested parties to get a full understanding of what an Inverness-wide heat network would entail. The study explores the potential for developing heat networks across several strategic areas within the city: City Centre, Longman, West Bank and Raigmore.

5.5 Most of the work is being funded by the HNSU, which is sponsored and managed by the Scottish Government, with partners SFT and ZWS. The HNSU covers up to 90% of the costs (capped at £150,000), requiring a 10% contribution from the Highland Council.

5.6 The summary report, which provides a high-level overview of the technical findings, can be accessed by Members in **Appendix 2**.

6 Next Steps

6.1 Consideration of delivery models: The Council has appointed Addleshaw Goddard as our legal consultant to assess and determine the optimum delivery model(s) and the role that the Council should take in the deployment of heat networks in Inverness.

6.2 Continuous stakeholder engagement: The Council is actively engaging with stakeholders in Inverness to understand their views and identify potential opportunities and barriers related to the development of heat networks in Inverness.

6.3 Market testing: The Council aims to establish the level of market interest in the development of heat networks in Inverness. This will also allow the Council to inform potential suppliers about upcoming procurement opportunities.

Designation:	Assistant Chief Executive - Place
Date:	10 April 2025
Author:	Ruta Burbaite, Project Manager
Background Papers:	Local Heat and Energy Efficiency Strategy (LHESS)
Appendices:	Appendix 1 – Feasibility studies boundaries and LHEES heat network opportunities Appendix 2 – Inverness Strategic Heat Network Summary Report: West Bank, City Centre, Longman and Raigmore

Appendix 1 - Feasibility studies boundaries and LHEES heat network opportunities

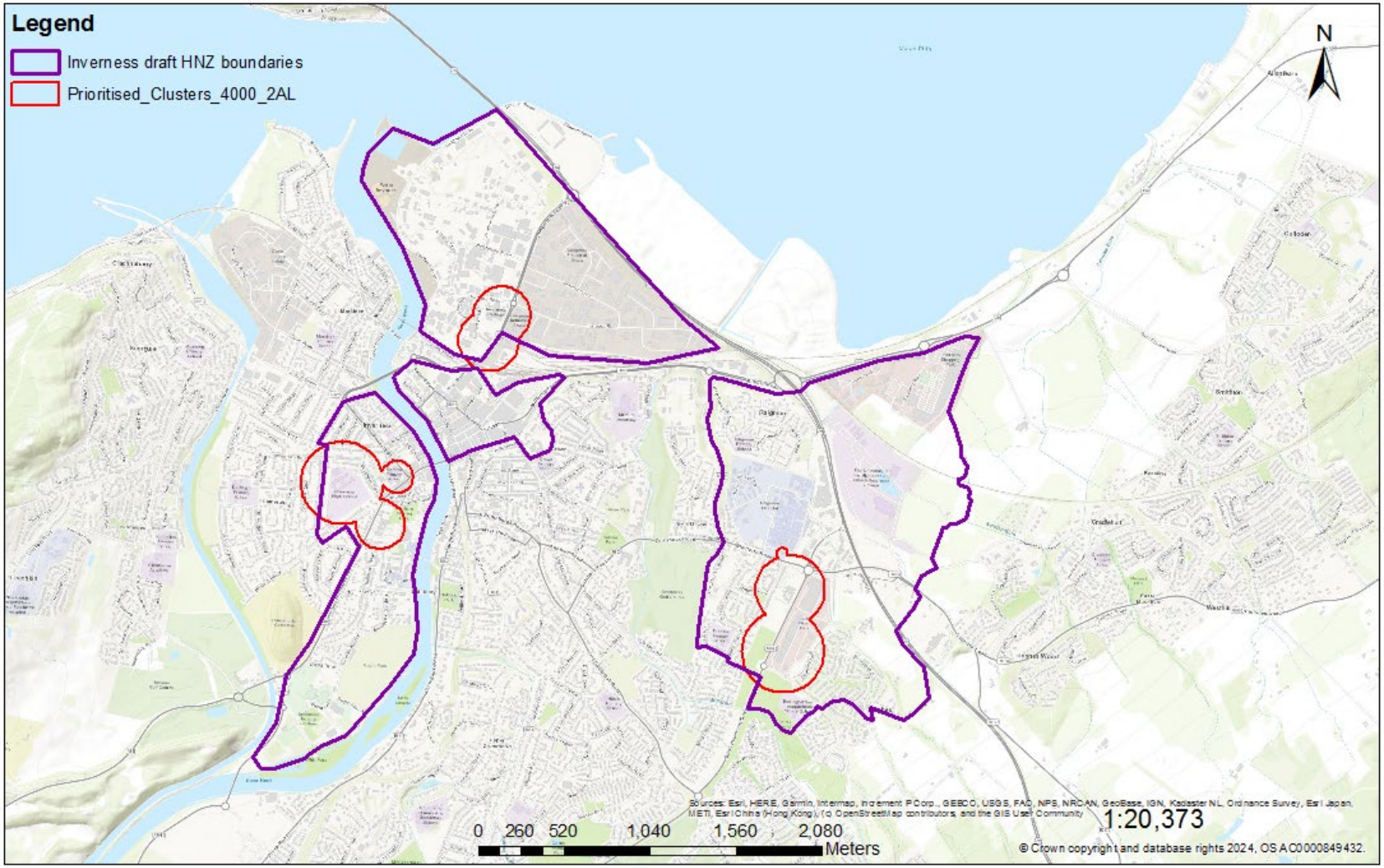

Figure 1 – Feasibility studies boundaries and LHEES heat network opportunities

Appendix 2.

The Highland Council
Comhairle na Gàidhealtachd

Inverness Strategic Heat Network Summary Report

West Bank, City Centre, Longman and Raigmore

www.highland.gov.uk

Abbreviation	Description
Anchor load	Anchor loads are high heat demand buildings and key connections on a heat network that usually drive the economics of heat works.
ASHP	An air source heat pump (air-to-water heat pump) transfers heat from the outside air to the water in your central heating system.
CAPEX	Capital expenditure are funds used to acquire or upgrade assets such as buildings or equipment.
Cluster	Clusters are typically defined by areas where there is a concentration of buildings, such as hospitals, universities, commercial buildings, or residential areas, that have a significant heat demand.
Core connection	Public buildings, social housing and existing communal schemes with ≥250MWh demand. Other tenure ≥500 MWh.
Dig type	It refers to the method used to excavate trenches for installing underground pipes: • soft dig – very easy such as footpath or greenspace; • suburban – road, pavement or car park but in lower impact streets; • hard dig – very urban environments and impacts busy routes.
Energy centre	An energy centre serves as the central heat generation facility, supplying heat and/or hot water to a network of buildings or a district.
GSHP	A ground source heat pump extracts heat from the ground and uses it to heat homes and buildings.
Heat demand	The heat demand describes the amount of thermal energy needed for heating.
Heat network	Heat networks, as defined under the 2021 Act, include both district and communal heating: • a district heat network is defined as a network by which thermal energy is distributed from one or more sources of production to more than one building; • a communal heating system is a system by which thermal energy is distributed from one or more sources of production to one building comprising more than one building unit.
HNSU	The Heat Network Support Unit is sponsored and managed by the Scottish Government, with partners Scottish Futures Trust (SFT) and Zero Waste Scotland (ZWS) providing a range of support services including financial and advisory support for the development of heat networks.
HQ	Headquarters
Infill connection	Buildings with demands ≥73 MWh/yr.
LHD	Linear heat density is an industry standard metric that relates heat to distance, for a heat network it is heat demand per meter of pipe. A higher LHD typically identifies better financial viability for a heat network.
MWh/yr	Megawatt-hours per year is a unit of energy that measures the total amount of energy produced or consumed over a year.
SEPA	Scottish Environment Protection Agency
SFT	Scottish Futures Trust
SSE	Scottish and Southern Electricity
SWH	Scottish Water Horizons
TCO2e	Tonnes of Carbon Dioxide Equivalent is a unit used to measure the global warming potential of various greenhouse gases, standardising their impact relative to carbon dioxide (CO2).
Thermal store	A thermal store acts as a buffer, storing heat energy to meet fluctuating demands and ensure consistent heating.
WSHP	A water source heat pump uses the heat energy from a body of water (like a river) to provide heating and cooling.
Waste water heat	A waste water heat network utilises the heat contained in wastewater, often from sewers, to provide sustainable and low-carbon heating and cooling for buildings and communities.
ZWS	Zero Waste Scotland

West Bank

Overview: The West Bank area of the River Ness in Inverness has several buildings with high heating demands, including Highland Council Headquarters (HQ), Eden Court, Leisure Centre, Botanic Gardens and Ice Centre.

The Highland Council has a significant proportion of land and assets, which makes the Council well placed to focus on the West Bank area. The area also contains a high level of social housing and risk of fuel poverty. Due to similar ownership and Council's ambition to alleviate fuel poverty, the area could benefit from a heat network.

The suggested approach for West Bank is to focus on the area between the southern area A82 and B861 and the river, with the only demand for connection outside of this being Inverness High School. The strategic feasibility study suggested to focus on the area around and including the Leisure Centre as first phase, and then potential housing connections and those around Eden Court and the Highland Council HQ as second phase if a phased approach is selected.

Table 1 – West Bank summary

Assessment criteria	Core network	Core and infill
Total demand (MWh/yr)	24,015	33,213
Network length (m)	5,200	9,500
LHD (MWh/yr/m)	4.6	3.5
Planned growth in the area	Low	Low
Council land (share) %	46.80	46.80
Dig type (hard) %	58	64
Number of anchor loads (>=500MWH/yr)	13	13
Number of connected buildings	23	94
Number of Council buildings	8	14
Number of public sector buildings	8	12
Fuel poverty (mean) %	29	29
Count of properties with fuel poverty probability over 50%	162	162
Total social housing	419	419

Heat Source: Several potential heat sources were considered including an air source heat pump (ASHP), closed loop and open loop ground source heat pump (GSHP)[1] and water source heat pump (WSHP)[2].

A large centralised ASHP was identified as the primary low carbon heating technology for the West Bank. The ASHP size is estimated to be around 5.9 MW for the core network and 7.8 MW for the core and infill network. In both heat network options, over 85% of heat demand is expected to be met by a heat pump. Gas boilers are included for back-up due to their reduced capital and operational cost and compact size[3].

A potential location for the energy centre was proposed on council-owned land parking area adjacent to the Highland Rugby Club. This site was chosen due to proximity to key heat loads in the area, including Leisure Centre and Ice Centre.

Capital cost[4] and carbon savings: The below table presents an indicative capital cost and estimate carbon savings compared to a gas boiler counterfactual[5] for both networks.

Table 2 – Indicative capital cost and carbon savings

Assessment criteria	Core	Core and infill
CAPEX £m	20.3	37.1
Carbon saving TCO2e over 40 years	158,170	224,750

[1] A subsequent ground condition study conducted by the Council in 2024 found the ground condition unsuitable for GSHP deployment in Bught Park.
[2] The decision to discount WSHP was made due to insufficient data on river temperature, flowrate, and depth variations, making it difficult to assess WSHP viability. While engagement with the Scottish Environment Protection Agency (SEPA) suggested potential for river water usage, a more detailed study is needed to understand practical limitations and feasibility, including water abstraction. The existing Glen Mhor WSHP, while suggesting potential, was deemed not vital due to factors like distance from heat demands and the lack of spatial constraints, ultimately making it less crucial for the scheme's viability.
[3] In order to meet the long-term goal of full decarbonisation by 2045, gas boiler will be replaced by low-carbon alternatives, such as electric boilers, before 2045 to assist in working towards Net Zero targets.
[4] Capital costs have been developed through consultation with manufacturers, industry reference data and previous Buro Happold (the technical consultant) experience of similar projects. Additional costs include contingency (10%), overhead and prelims (15%), and design fees (10%).
[5] A gas boiler counterfactual, in the context of heating system evaluation, refers to the alternative heating system that would be installed in a building or community if no grant or incentive was offered to promote a more sustainable option. For instance, in a project considering a district heat network, the counterfactual could be individual gas boilers for each building.

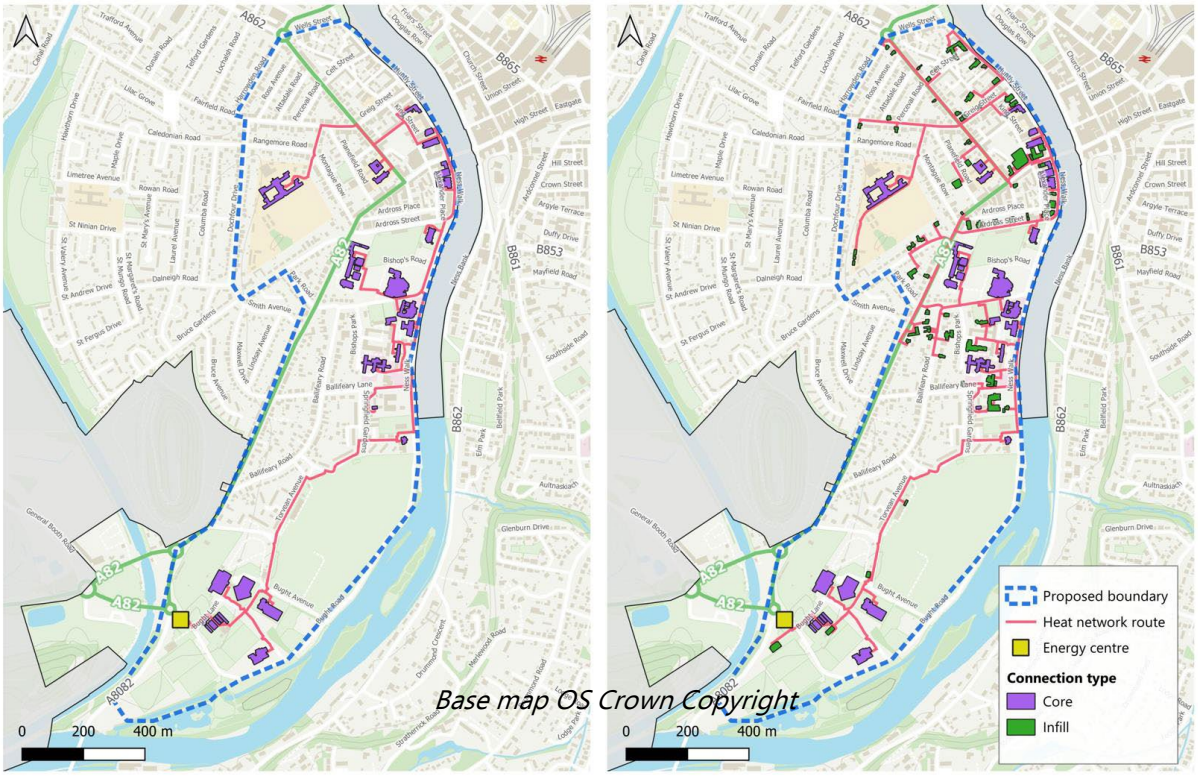

Figure 1 - West Bank indicative heat network

City Centre

Overview: Inverness city centre is one of the highest density areas in the city with over 298 buildings. The area includes a mix of retail, offices and hotels, alongside several council-owned buildings, such as Inverness Castle, Inverness Library and Inverness Town House. The Eastgate shopping centre represents the largest heat load in the area.

The initial proposed study boundary encompasses the City Centre, expanding from the A82 in the north to the Inverness Castle[6] area in the south. The proposed cluster also extends southeast to the Crown area of Inverness, which includes Wasps Inverness Creative Academy, a retirement living complex and several council-owned low-rise flats, making it viable for heat network connection consideration.

Table 3 – City Centre summary

Assessment criteria	Core	Core and infill

[6] A low-carbon energy centre is currently under construction on Castle Street to supply heat to the redeveloped Inverness Castle and the Town House. It has been confirmed that the energy centre does not have the capacity to accommodate additional equipment and heating plant. As the Castle area is already integrating low-carbon heat sources, it is not considered priority for connection and was excluded from the proposed City Centre cluster. However, the Castle area could be considered for future integration, with the potential to link to the energy centre.

Total demand (MWh/yr)	21,540	35,000
Network length (m)	2.7	6.4
LHD (MWh/yr/m)	7.77	5.57
Planned growth in the area	Moderate/High	Moderate/High
Council land (share) %	9.70	9.70
Dig type (hard)	67	67
Number of anchor loads (>=500MWh/yr)	16	16
Number of connected buildings	17	107
Number of Council buildings	2	3
Number of public sector buildings	1	12
Fuel poverty (mean)	36	36
Count of properties with fuel poverty probability over 50%	44	44
Total social housing	153	153

Heat source: Several potential heat sources were considered including an ASHP and WSHP[7]. The proposed heating system uses a large-scale ASHP as the primary heat source, with a gas boiler acting as a back-up. The ASHP size is estimated to be around 4.9 MW for the core network and 8.2 MW for the core and infill network. In both heat network options, over 79% of heat demand is expected to be met by an ASHP, and the remaining demand is supplied by the gas boiler back-up.

The area near Rose Street has been identified as a suitable location for the energy centre, as it allows for streamlined planning and infrastructure work alignment and it serves as a trigger for enabling heat network development.

Capital cost and carbon savings: The below table presents an indicative capital cost and estimate carbon savings compared to a gas boiler counterfactual for both networks.

Table 4 – Indicative capital cost and carbon savings

Assessment criteria	Core	Core and infill
CAPEX £m	22.2	44.3
Carbon saving TCO2e over 40 years	131,690	214,130

[7] There is also potential to utilise WSHP due to proximity to the River Ness. However, there is insufficient data on key factors such as river temperature variations through the year, flowrate and depth fluctuations. A more detailed study is required to understand the feasibility for a WSHP and assess the practical limitations of installing equipment for processes such as water abstraction.

Figure 2 - City Centre heat network

Longman

Overview: The Longman area has a previous feasibility (2019) for a heat network, which focused on linking the Scottish Water pumping station with the Bairds Maltings site. The Bairds Maltings site represents a significant potential heat load in Longman area. The Tarmac plant which is adjacent to the Maltings (in the north) was only captured in the project close out meeting, but it also has a significant heat load.

The Longman area has a very high level of Council land ownership, particularly around the sewer pumping station, but relatively limited direct public or Council control of heat demands. Recently announced strategic partnership between the SWH (Scottish Water Horizons) and SSE (Scottish and Southern Electricity) is driving a heat network in Longman by leveraging waste heat recovery, particularly from a Scottish Water pumping station. This means that the Council is more likely to act as an enabler rather than a primary driver for the development of a heat network.

Table 5 – Longman summary for core scenarios

Assessment criteria	Longman Full	Longman Full + Bairds	Longman West	Longman West + Bairds

Linear heat density	2	7.4	1.97	11.61
Council land (share)	38.30%	38.30%	44.30%	44.30%
Planned growth in the area	Low	Low	Low/Moderate	Low/Moderate
Dig type (hard)	67%	67%	67%	67%
Number of anchor loads (>=500MWh/yr)	12	13	6	7
Number of core connections	14	15	6	7
Number of connected buildings	14	15	6	7
Number of Highland Council buildings	0	0	0	0
Number of public sector buildings	4	4	2	2

Table 6 – Longman summary for core and infill scenarios

Assessment criteria	Longman Full	Longman Full + Bairds Malting	Longman West	Longman West + Bairds
Linear heat density	2.15	5.2	2.37	10.22
Council land (share)	38.30%	38.30%	44.30%	44.30%
Planned growth in the area	Low	Low	Low/Moderate	Low/Moderate
Dig type (hard)	67%	67%	67%	67%
Number of anchor loads (>=500MWh/yr)	12	13	6	7
Number of core connections	14	15	6	7
Number of connected buildings	47	48	16	17
Number of Highland Council buildings	3	3	1	1

Number of public sector buildings	6	6	4	4

Heat source: The main source of heat is the SW pumping station, which is already being explored by SSE/SWH. The land availability next to the heat source makes this an ideal site for the energy centre.

In addition to the SW pumping station site there is potential waste heat form hydrogen electrolysis at site of historic landfill. This hydrogen opportunity is thus relatively early stage. The area is important strategically for Inverness, representing the best area in terms of heat source with the SW pumping station and also being a potential key route for waste heat from a hydrogen electrolysis.

Capital cost and carbon savings: The below table presents an indicative capital cost and estimate carbon savings.

Table 7 – Indicative capital cost and carbon savings

Assessment criteria	Longman Full	Longman Full + Bairds	Longman West	Longman West + Bairds
CAPEX £m (core)	17.5	27.7	9.38	19.23
CAPEX £m (core and infill)	33.75	41.97	12.48	22.2
Carbon saving TCO2e over 40 years (core)	62,789	258,888	34,039	230,710
Carbon saving TCO2e over 40 years (core and infill)	129,029	325,753	50,333	247,538

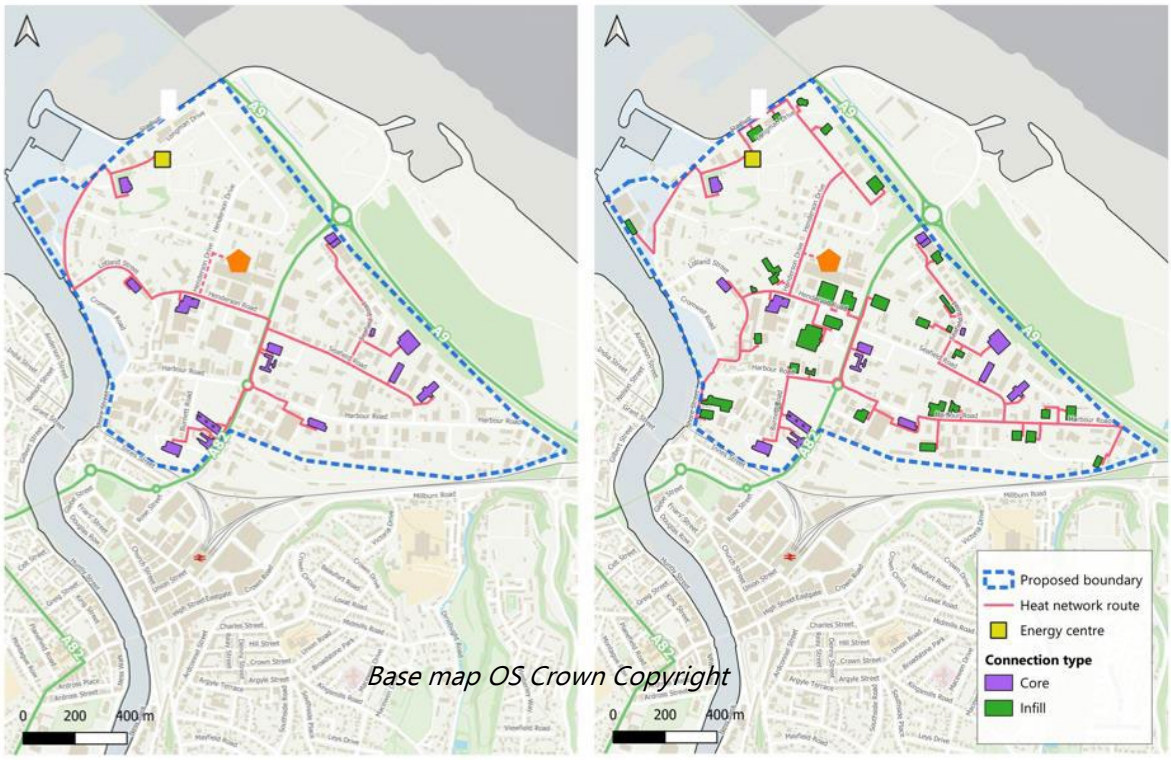

Figure 3 - Full Longman area indicative heat network

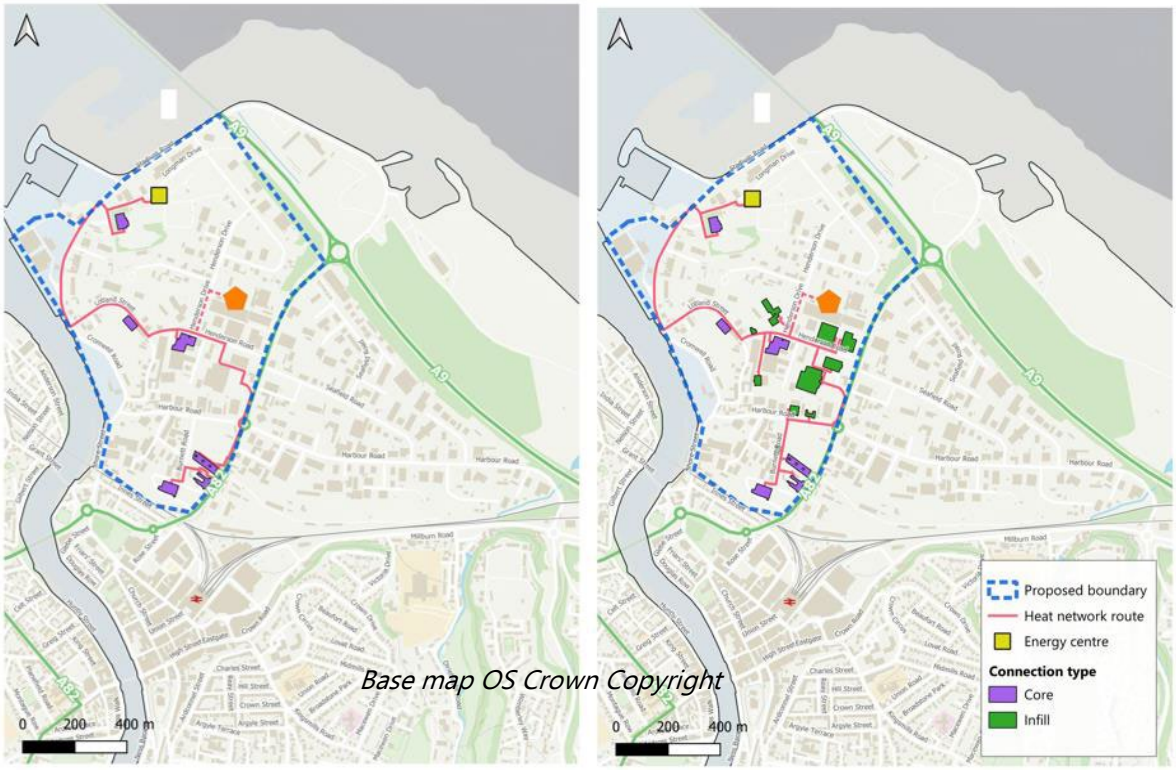

Figure 4 - West Longman area indicative heat network

Raigmore

Overview: The Raigmore area is situated in the east of the city. The heat network feasibility study area is split by the A9: Raigmore estate on the west and on the east side of the A9 is Inverness Campus[8]. The area comprises both anchor and non-anchor loads and presents the opportunity to utilise existing low carbon heat sources, including ASHP, GSHP, wastewater, and biomass.

The study identified opportunities to develop heat networks to both the east and the west of the A9 in Raigmore. The viability of crossing the A9 via the Golden Bridge would require a structural assessment to ascertain the viability of the bridge supporting the pipework[9].

The study recommended to progress a single heat network opportunity to the east of the A9, which is the recommended option to pursue for Raigmore due to more active stakeholder engagement during the feasibility study. The west side heat network is highly dependent on Raigmore Hospital.

The proposed Raigmore east heat network would be developed over three phases. The phasing strategy has been established based on the existing heating plant in the buildings selected for the network. The buildings with existing low carbon heating plant are to be phased in line with the expiration of their current low carbon plant.

Table 8 – Raigmore summary

Assessment criteria	Raigmore full	Raigmore West	Raigmore East
Annual heat demand (MWh/y)	48,750	28,000	20,750
Trench length (m)	-	5,220	4,500
Linear heat density	5.02	5.4	4.6
Council land (share)	12%	18%	1%
Planned growth in the area	Moderate/High	Moderate/High	High
Dig type (hard)	91%	100%	81%

[8] A masterplan has been developed to expand the offerings of the site and create Inverness Campus Phase 2. The Freeport developments are key to driving the heat network to the East of the A9.
[9] The option for directional drilling could be assessed as a means of connecting the network.

Number of anchor loads (>=500MWh/yr)	20	8	12
Number of core connections	38	15	23
Number of connected buildings	38	15	23
Number of THC buildings	4	4	0
Number of public sector buildings	24	6	18

Heat source: A qualitative technology appraisal was carried out to assess the suitability of different low carbon technologies for the Raigmore heat network. Technologies were assessed against various criteria, including resource availability, capital cost, spatial requirements. Several technologies including ASHPs, GSHPS, biomass and wastewater WSHPs were considered. Gas boilers for back-up were identified as the most economical solution for the Raigmore area, with lower associated operational and capital cost. Additionally, the analysis indicated that thermal storage was an attractive option to assist in meeting the heat demand for the network.

The Raigmore heat network feasibility study indicates that with consideration of grant funding opportunities available, there is scope to develop a heat network in Raigmore. However, the analysis concluded that the best performing network for the east of the A9 is ASHP with back-up gas boilers. It is proposed that 87% of the heat demand will be met by low-carbon technology heat pump.

Multiple potential energy centre locations were identified. The selected energy centre location should be close to the low-grade heat source and network anchor loads. It is preferable to place the energy centre on council-owned or stakeholder land and away from residential dwellings.

Capital cost and carbon savings: The below table presents an indicative capital cost and estimate carbon savings.

Table 9 - Indicative capital cost and carbon saving

Assessment criteria	Raigmore full	Raigmore West	Raigmore East
CAPEX £m	54.34	26.04	28.3
Carbon saving TCO2e over 40 years	270,611	191,367	79,244

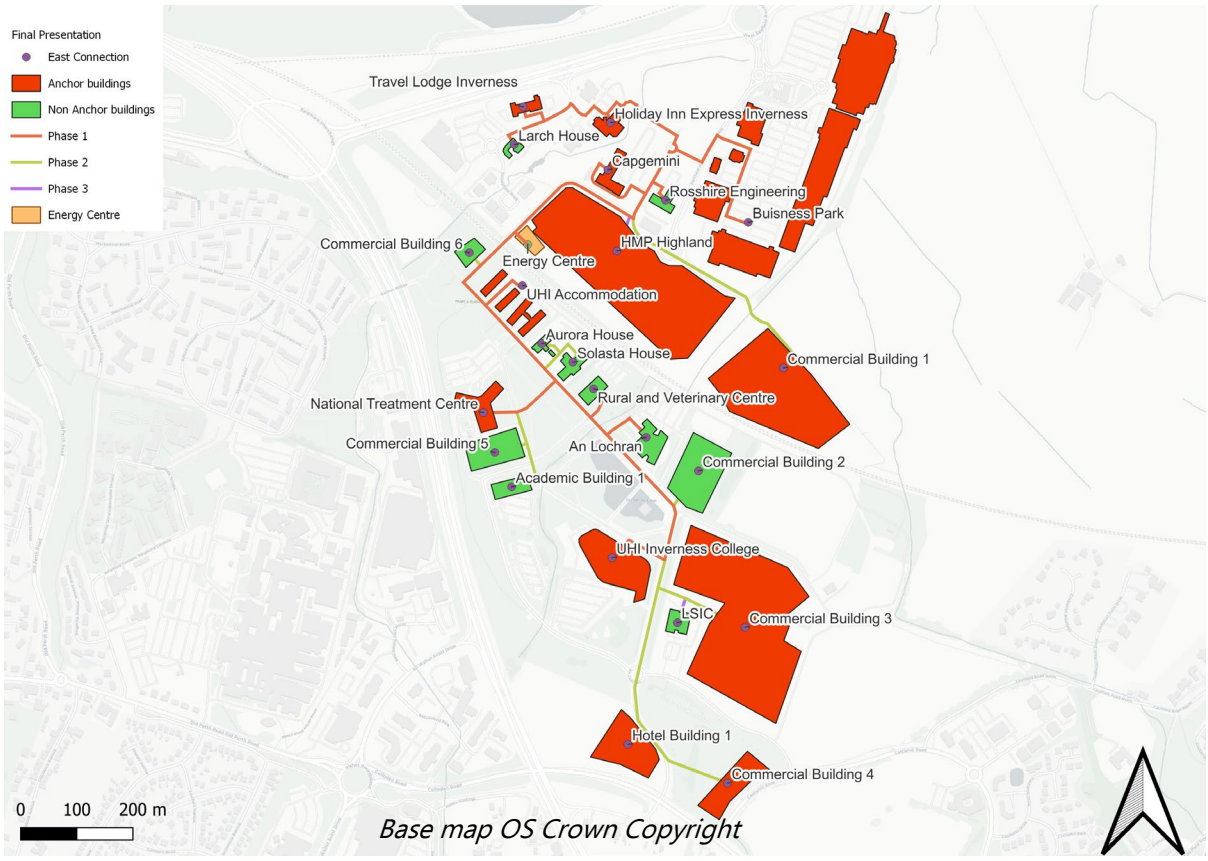

Figure 5 – Raigmore East network

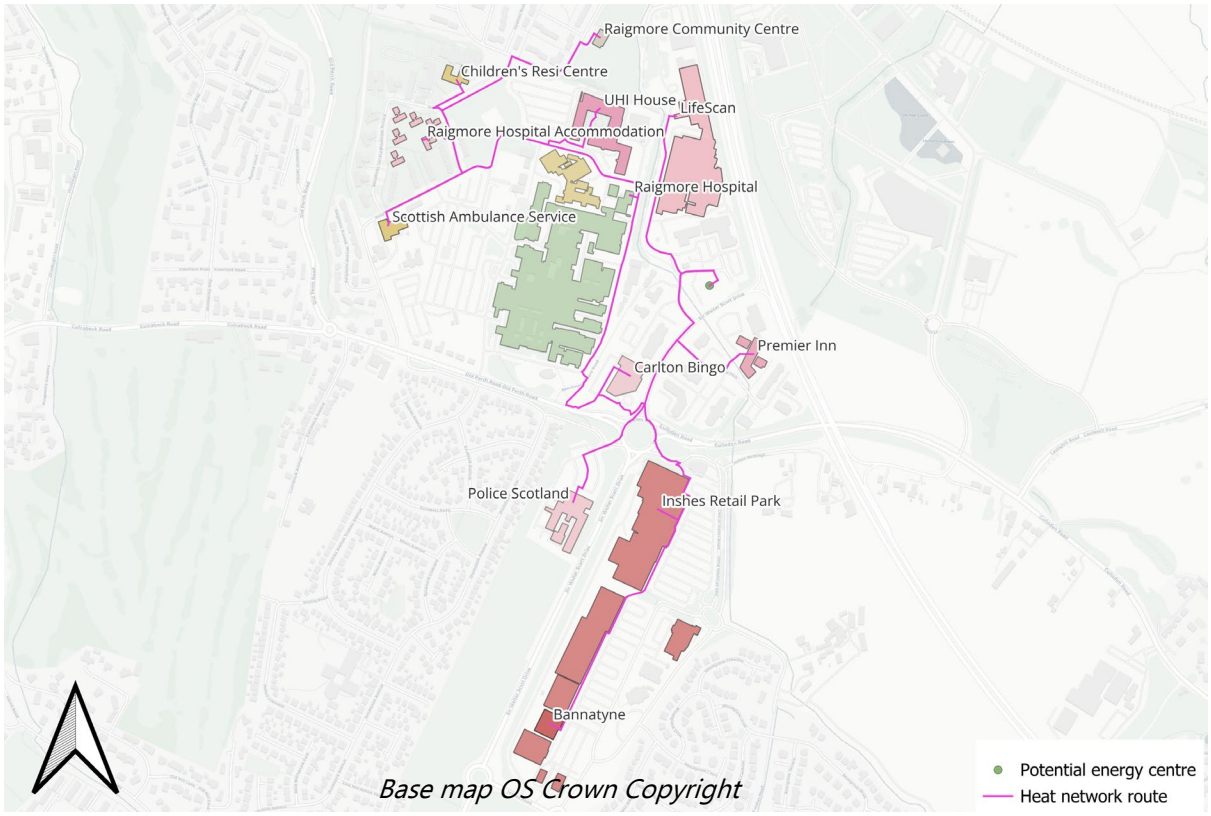

Figure 6 – Raigmore West network