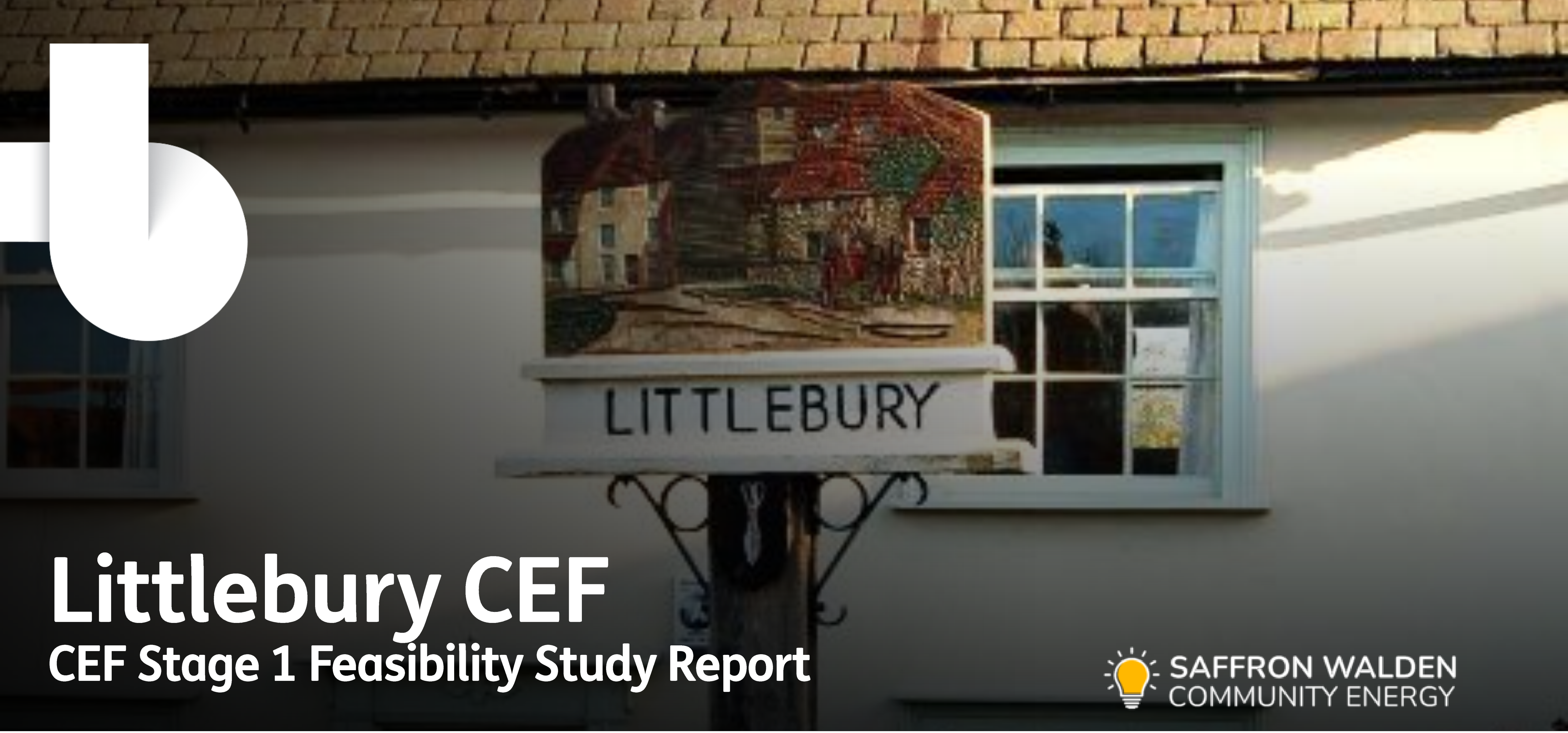


Littlebury CEF

CEF Stage 1 Feasibility Study Report

SAFFRON WALDEN
COMMUNITY ENERGY

February 2025 (Version 5)

Bioregional

EQUANS

Littlebury Energy Project

FEASIBILITY STUDY

Contents

1. Setting the scene
1.1 Introduction

Bioregional and Equans have been commissioned to support Saffron Walden Community Energy (SWCE) with the production of a community energy feasibility study. The aim of this study is to investigate the feasibility of the successful development of one or more community-scale renewable energy systems, infrastructure development and energy efficiency measures with the objective of replacing or supplementing existing residential and business energy systems in Littlebury village.

This feasibility study was funded by the Community Energy Fund (CEF) stage 1 and as such has focused on the technical and financial feasibility of community-scale retrofit and heat network. This report may form part of an application for CEF stage 2 funding.

Throughout the study, multiple approaches to decarbonising heating in the village have been considered. However, two primary options were identified for detailed assessment:
- A community-wide district heating network to decarbonise heating
- Individual home retrofitting to reduce energy and heating demand

A significant emphasis has been placed on exploring option 1, primarily due to the comparative complexity in establishing potential viability and the need for specialists such as Bioregional and Equans to support communities in conducting such an assessment. Notwithstanding, readers should not conclude that this is a favoured option merely as this option is given more focus within this report.

The outcomes of this report do not preclude any resident from taking immediate action to accelerate the decarbonisation of their home.

This report represents a summary of the full feasibility study, which has included:

- Initial **community engagement** to gauge the interest in retrofit, a heat network and to identify heating systems,
- Identification and assessment of Littlebury's **heat demand**,
- An **options assessment** reviewing potential solution in decarbonising Littlebury, including both individual and community-wide retrofit, decentralised heat provision and a centralised heat network
- **Conceptual development** of a centralised heat network solution and decentralised (i.e. individually heated) community-wide retrofit as the preferred technical options for decarbonising the village,
- A **financial appraisal** of the preferred solutions including potential funding options,
- An assessment of potential planning support and risks,
- A **governance assessment**,
- A future **delivery considerations assessment,**
- An assessment of the **community benefits**.

Though Bioregional and Equans have sought to take a comprehensive and complete approach with the goal of providing reliable outcomes, it should be noted that this is an initial study to guide further development. It is aligned to the budget constraints and scope expectations of this initial stage and does not constitute a complete and detailed engineering solution for procurement and construction.

1. Setting the scene
1.2 The challenge

Source: Google maps

Reducing carbon emissions

The UK must become a net-zero carbon emission country by 2050, requiring every community to contribute to this goal.

Home heating in Littlebury is largely derived from oil and other fossil fuels. 23% of the UK's carbon emissions come from heating our buildings.

High energy use and high carbon emissions require an efficient renewable heating solution to deliver on net-zero ambitions.

Many villages, including Littlebury rely predominantly on stored fossil fuels as their primary heat source.

Historic buildings

Littlebury is a historic village with 44 buildings within the conservation area, covering most of the village.

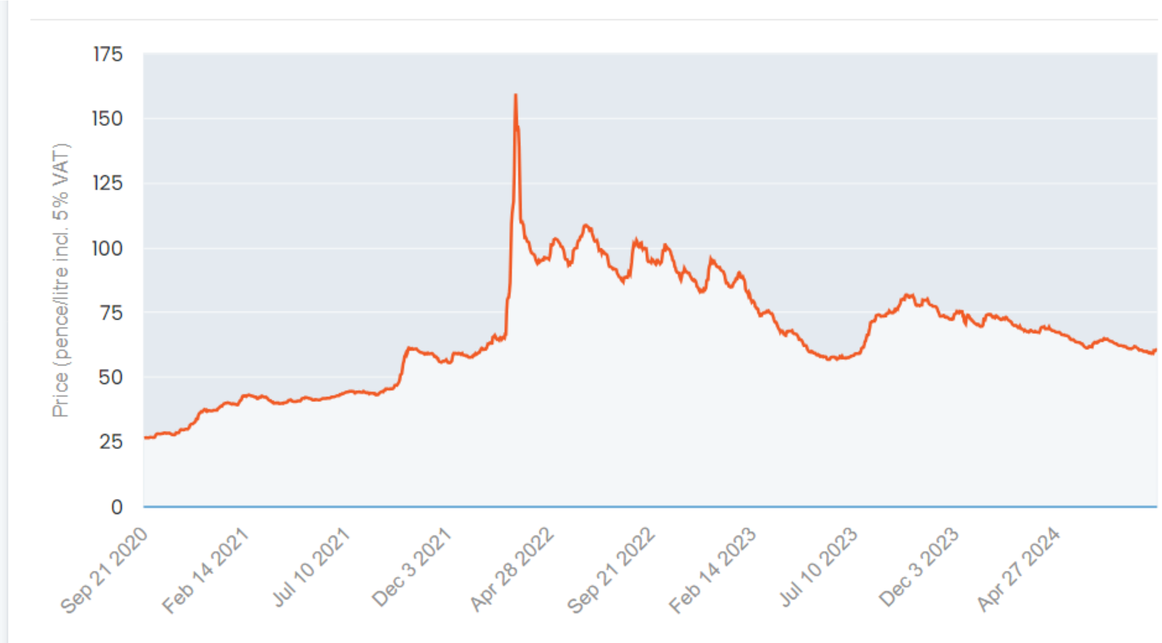
Buildings that form part of the conservation area may be of an age and character that require a bespoke approach to retrofit.

Recent guidance from Historic England recognises the importance of improving the energy performance of heritage buildings, and the publication advises on the permissions required to retrofit these buildings.

https://historicengland.org.uk/images-books/publications/adapting-historic-buildings-energy-carbon-efficiency-advice-note-18/

Historic England advice note, issued July 2024

1.2 The challenge



Source: Boilerjuice.com September 2024

The cost of heating homes

Heating reliant on fossil fuels face increasing market volatility. Global events affecting the supply chain can result in unaffordable price spikes. The cost trend of oil and gas as a whole is upward.

The cost per litre of heating oil since 2020 has more than doubled.

Reducing the energy required to heat and power homes is one way to protect yourself from price rises.

Switching to an alternative heat source, such as a heat pump or a district heating solution powered by local, renewable energy may provide price stability.

Complexity of delivery

District heat networks have been operated in the UK for many decades. However, in the UK, they are infrequently found in a rural setting and therefore carry the perception of risk. The complexity of delivery certainly does carry risk, but careful management of the project can mitigate these uncertainties.

Individual home decarbonisation can also appear complex. Homeowners holding varying levels of understanding for selecting effective measures, combined a range of installer expertise and quality result in higher delivery uncertainty.

Feasibility studies, such as this one, examine a variety of solutions and test whether they are deliverable. The government’s continued support for community energy projects such as this creates confidence and builds a pipeline of case studies and successes to model.

2. Littlebury context

2.1 The Site
2.2 Village heating demand

2. Littlebury Context

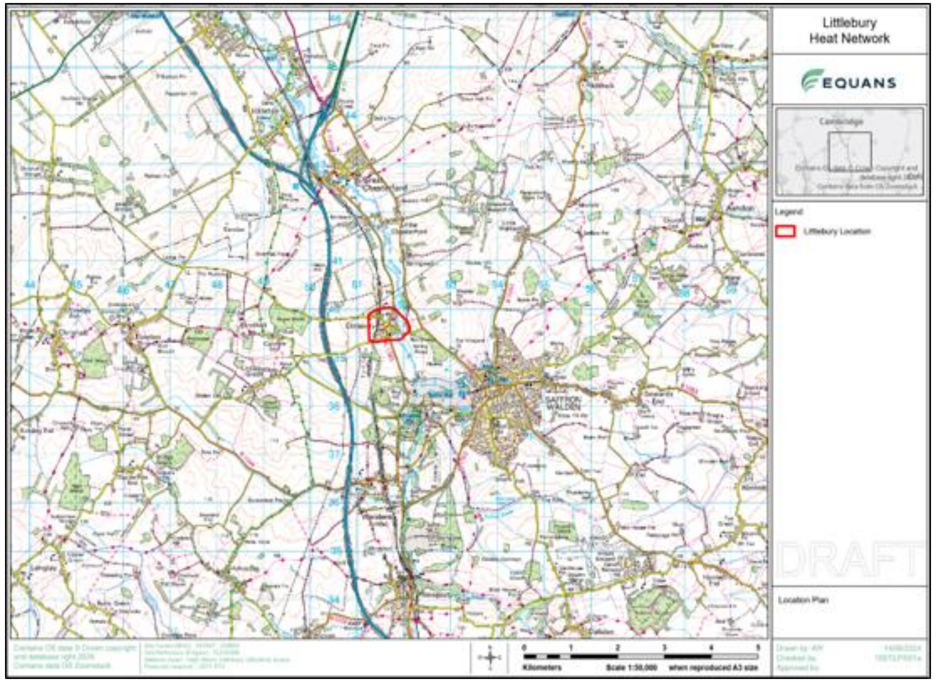
2.1 The Site

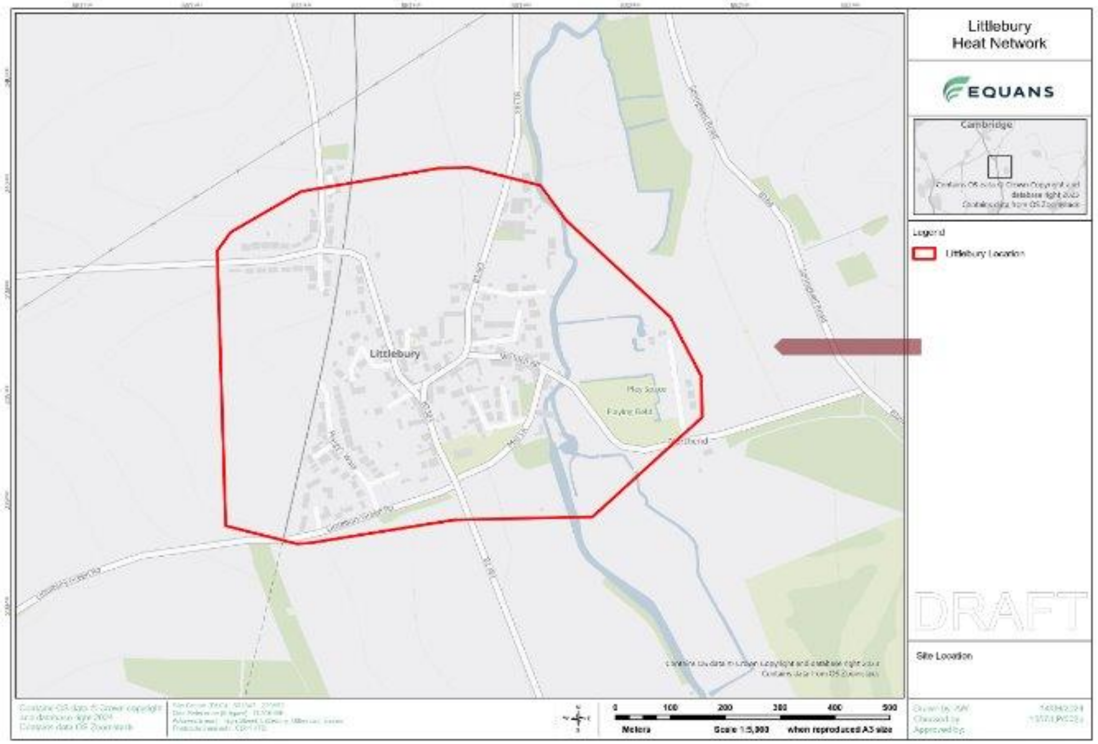
Overview

The village of Littlebury lies between Saffron Walden to the southeast and Great Chesterford to the north. Although close to the borders of Cambridgeshire, Hertfordshire and Suffolk, the village is part of the county of Essex. For geographical context, the village has been outlined in red and shown in the map below.

Littlebury village is part of Littlebury Parish, which also includes Littlebury Green and Catmere End in addition to Littlebury village itself. It is approximately 2 miles to the northwest of Saffron Walden and 20 miles south from Cambridge.

According to the 2021 census, the population of the village was 868. The centre of Littlebury village is within a conservation area.





The map shown above contains more detail within the village boundary, including all the roads, the buildings (although not the building type), and provides the opportunity to see important characteristics of the village which could influence a centralised heat solution – such as the railway to the western side and the River Cam to the east.

2. Littlebury Context

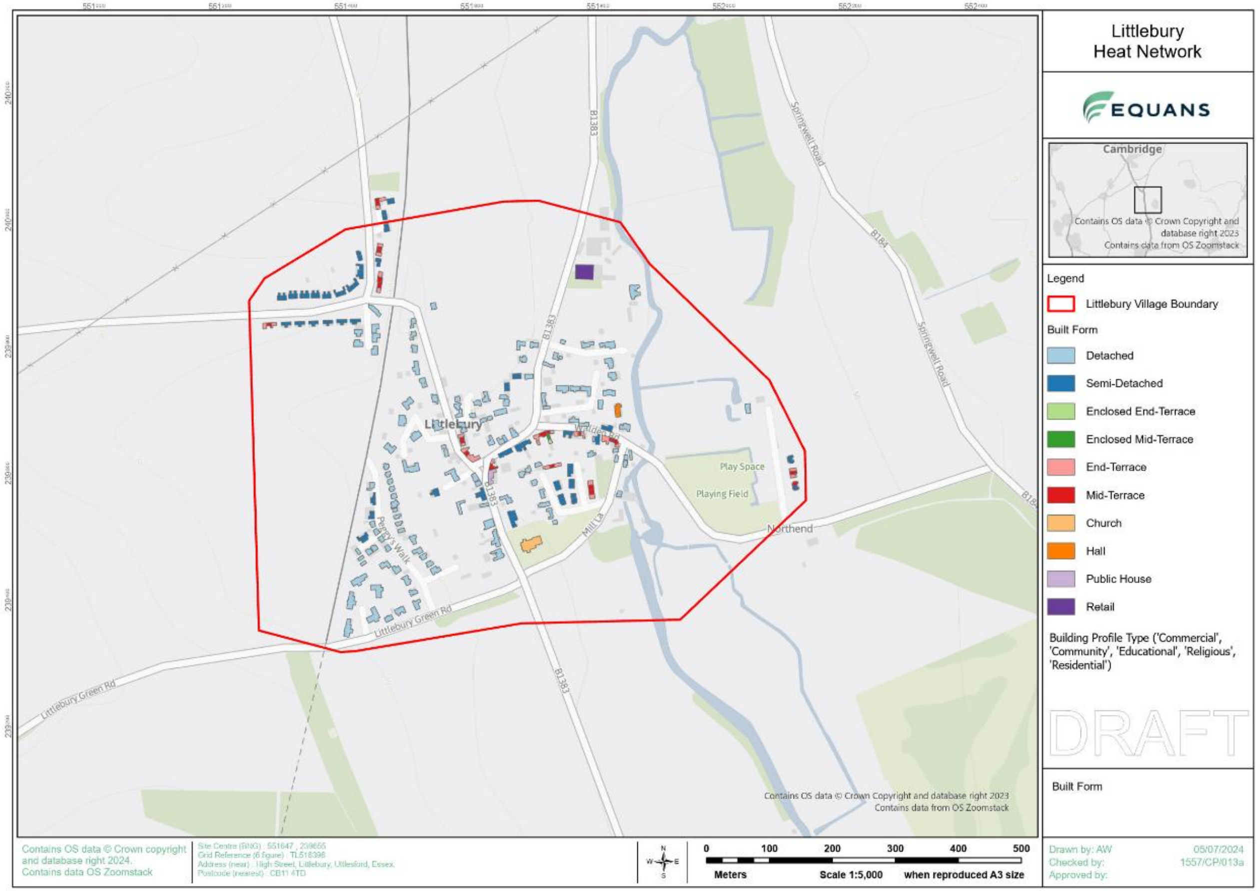
2.1 The Site

GIS Mapping

To inform the selection and appraisal of technically and economically viable heat decarbonisation solutions for Littlebury village, we have developed a series of maps to aid in the selection and optioneering phases.

Although these maps have been compiled primarily to assist with the development of a centralised heat network solution, a secondary objective has been to obtain an understanding of potential constraints affecting individual home retrofit. This process has also helped to identify constraints that could prevent a parcel of land, for example from being utilised for a complementary renewable electricity generation source such a ground mounted solar photovoltaic array. Some of the key maps and a brief description as to their purpose – are outlined as follows:

- Location Plan – a scaled map showing the relation of Littlebury to the surrounding area.
- Site Location – a more detailed map showing areas such as roads and buildings.
- Built form (shown opposite), type, current energy rating and kWh energy demand per property
- Land Boundaries – Shows land parcel layers sourced from the Land Registry.
- Environmental Land Designations – Designations such as National Parks, Sites of Special Scientific Interest, Areas of Outstanding National Beauty which impose restrictions on development.
- Flood Map for Planning – Shows data from the Environment Agency denoting flood risk
- Terrain – Displays LiDAR ground surface data.
- Utilities – Includes all underground utility infrastructure such as water pipes, gas lines, electricity cables and sewer systems within the indicated area/ boundary.



2. Littlebury Context

2.1 The Site

Terrain Map

The terrain map displays LiDAR (Light Detection and Ranging) ground surface data for Littlebury.

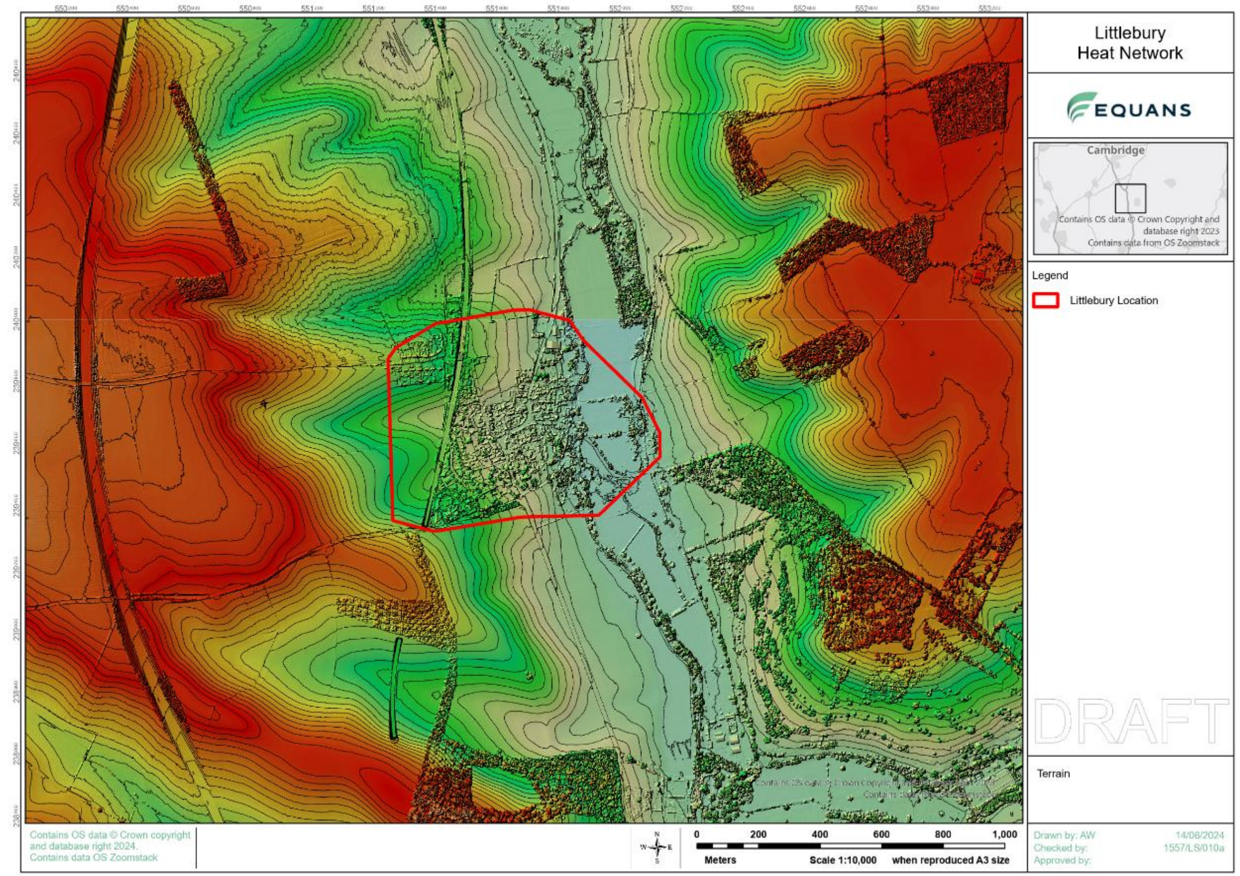
LiDAR can accurately capture the terrain, vegetation, and even buildings with incredible detail and generate a 3D digital surface model. Heat mapping has been applied to show the changes in the elevation of the ground and other features.

Understanding the surrounding terrain within and around the village boundary is useful in identifying potential locations for an Energy Centre serving a centralised heat network where this is the preferred solution.

Avoiding areas where there is significant elevation change is crucial in optimising the network's overall efficiency, reducing the cost of associated civil works and ensuring that the heat losses are minimised.

Within the context of Littlebury, we can see that the terrain within the village itself is relatively consistent without significant elevation changes, although to the southwest boundary and in proximity to the railway line there is a clear elevation increase. This can be seen where the railway line transitioning north to south appears to stop – and clearly enters a tunnel to avoid going over the hill to the southwest.

When considering energy centre locations therefore it would be sensible to avoid this part of the village, with more level locations to the north and south appearing more suitable. It is noted however that this needs to be considered alongside other criteria which can also influence a centralised solution. Decentralised or individual property solutions are less likely to be impacted by the topography changes within Littlebury village.



2. Littlebury Context

2.1 The Site

Grid & Utilities

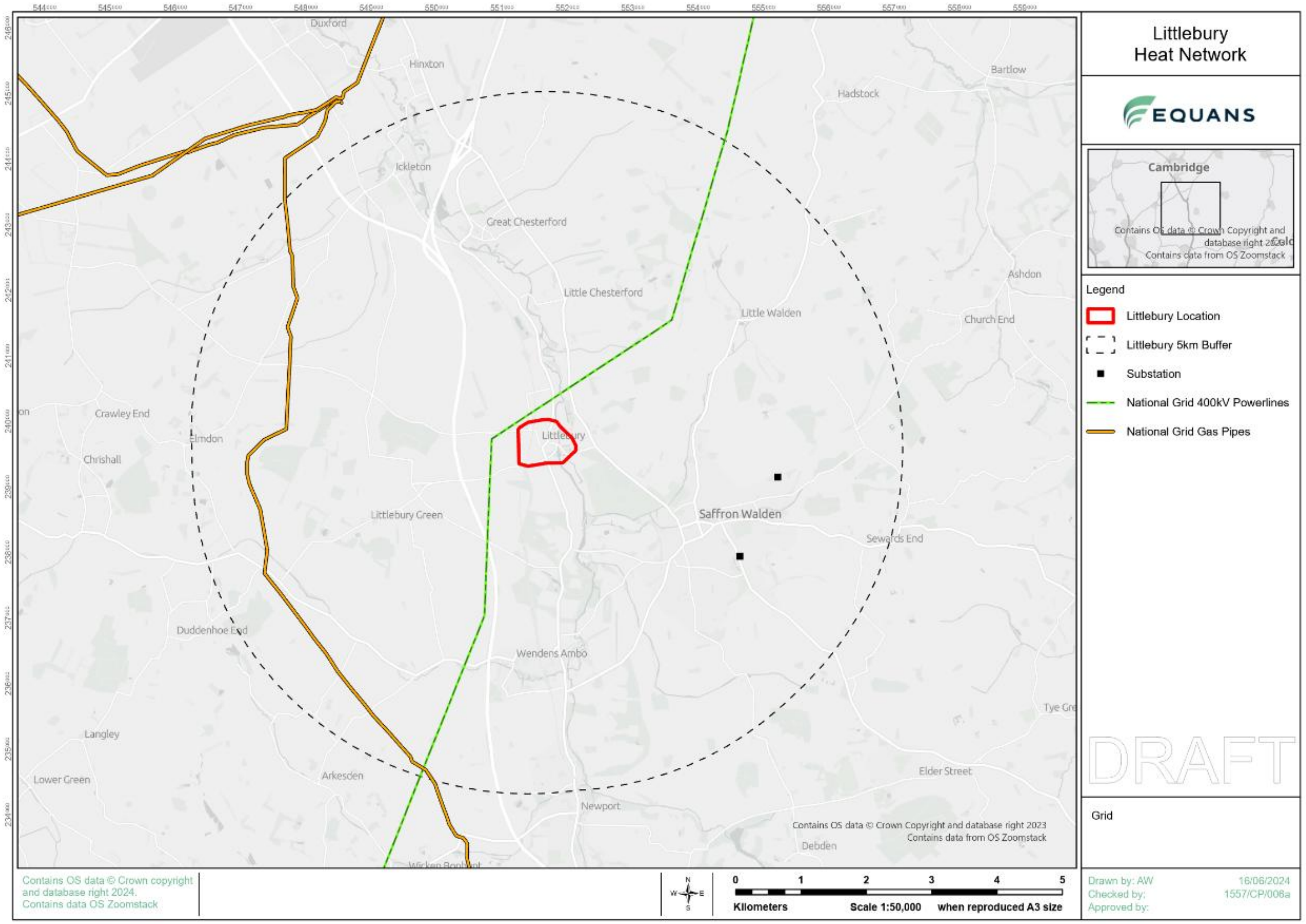
As part of our appraisal process it is important to consider existing utility infrastructure which is likely to have an impact on any transition towards a decarbonised heating solution for Littlebury whether this is decentralised, centralised, or a hybrid approach combining both approaches.

The grid map shown on the right has been compiled to show the proximity of the existing national gas grid to the village boundary, existing electrical high voltage network cables, and the nearest electrical sub stations.

Littlebury village is not on the national gas network, and we have compiled a map which shows the gas grid pipeline some 4-5km to the southwest of the village boundary.

Employing natural gas supplied by the network to heat buildings within the village has therefore never been an option for Littlebury and would clearly not facilitate a transition away from fossil fuels to low/zero carbon heating technologies for the village for either individual or centralised / networked solutions.

There are two electricity substations (to the northeast and south of Saffron Walden) between 2-3km away from the village centre. An initial review of electrical demand headroom at the Saffron Walden Primary 11kV substation has shown that this is ranked as 'green' (in the context of a red/amber/green ranking) and has approximately 12% headroom. As a result, no reinforcement works, or flexibility services are currently forecast within the next 5 years as being required at the Saffron Walden Primary by UK Power Networks (the Distribution Network Operator for the region).



2. Littlebury Context

2.1 The Site

Constrained Land

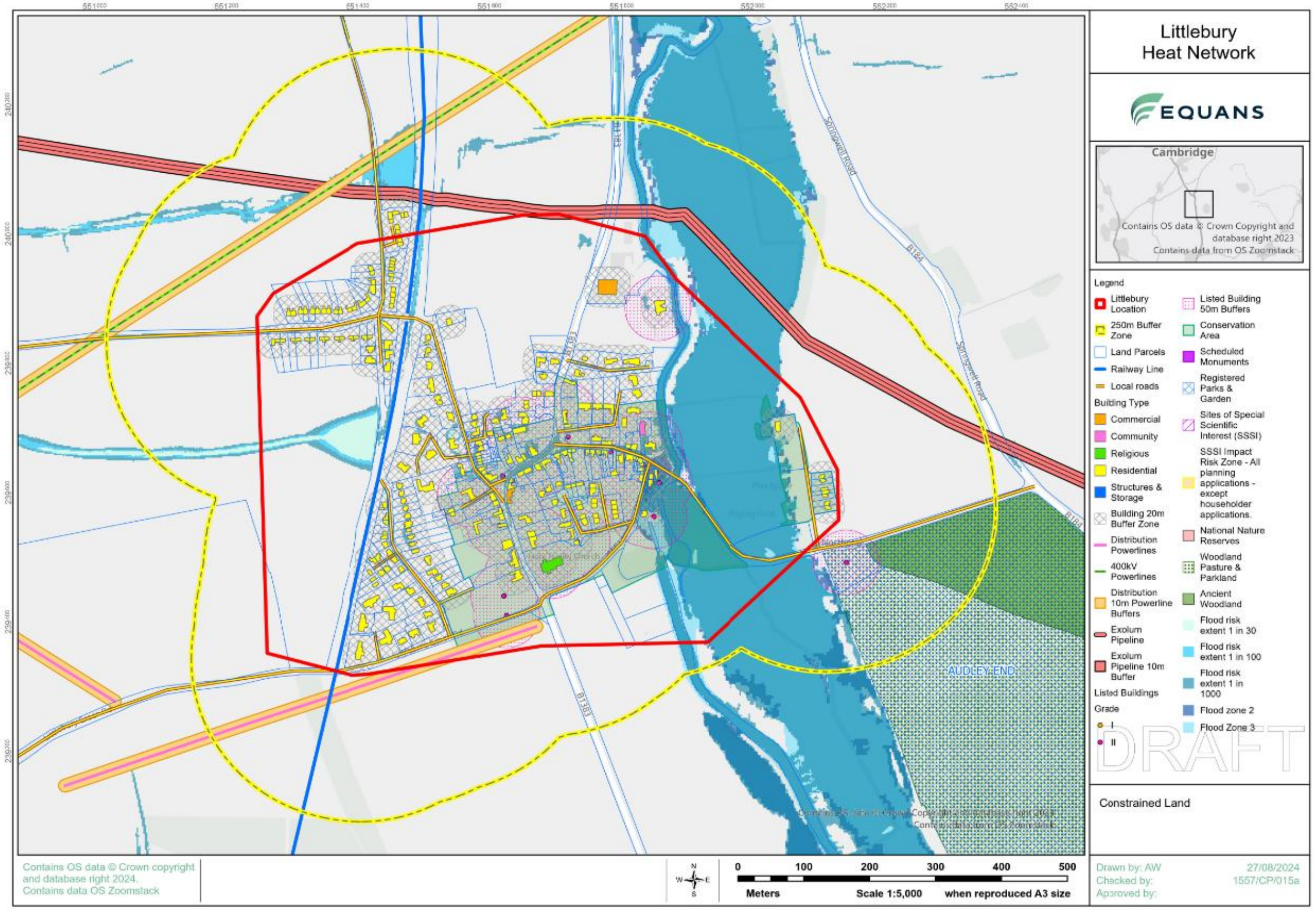
The principal objective of the GIS mapping exercise has been to develop a detailed understanding of how land within (and surrounding) the village boundary is currently utilised to inform the identification of potential sites for a centralised heat network solution, and for locating renewable electricity generation sources which may form part of the centralised solution. We note that this may be potentially technically and economically viable for only part of the village, and not all properties - for reference, this is referred to as the 'hybrid' solution throughout this report.

Several different maps have been produced, not all of which have been included in the report (although all will be made available as appendices), however it is much easier to interpret this information if it can be collated into one overall detailed overview. This work has resulted in the Constrained Land map as shown to the right.

The key shows all the individual constraints that have been included, from individual buildings and land parcels, to the flood risk, any SSSI's, roads and railway lines, and utilities such as the existing oil pipeline and 400kV high voltage power lines.

The objective is to identify land areas (shown in grey) where there are no known constraints and are therefore may be preferred locations for consideration of heating and renewable generation infrastructure associated with the centralised and hybrid solutions.

This is considered further in the following Options Appraisal section 3.



2. Littlebury Context

2.1 The Site

Constrained Land – Renewable Electricity Generation

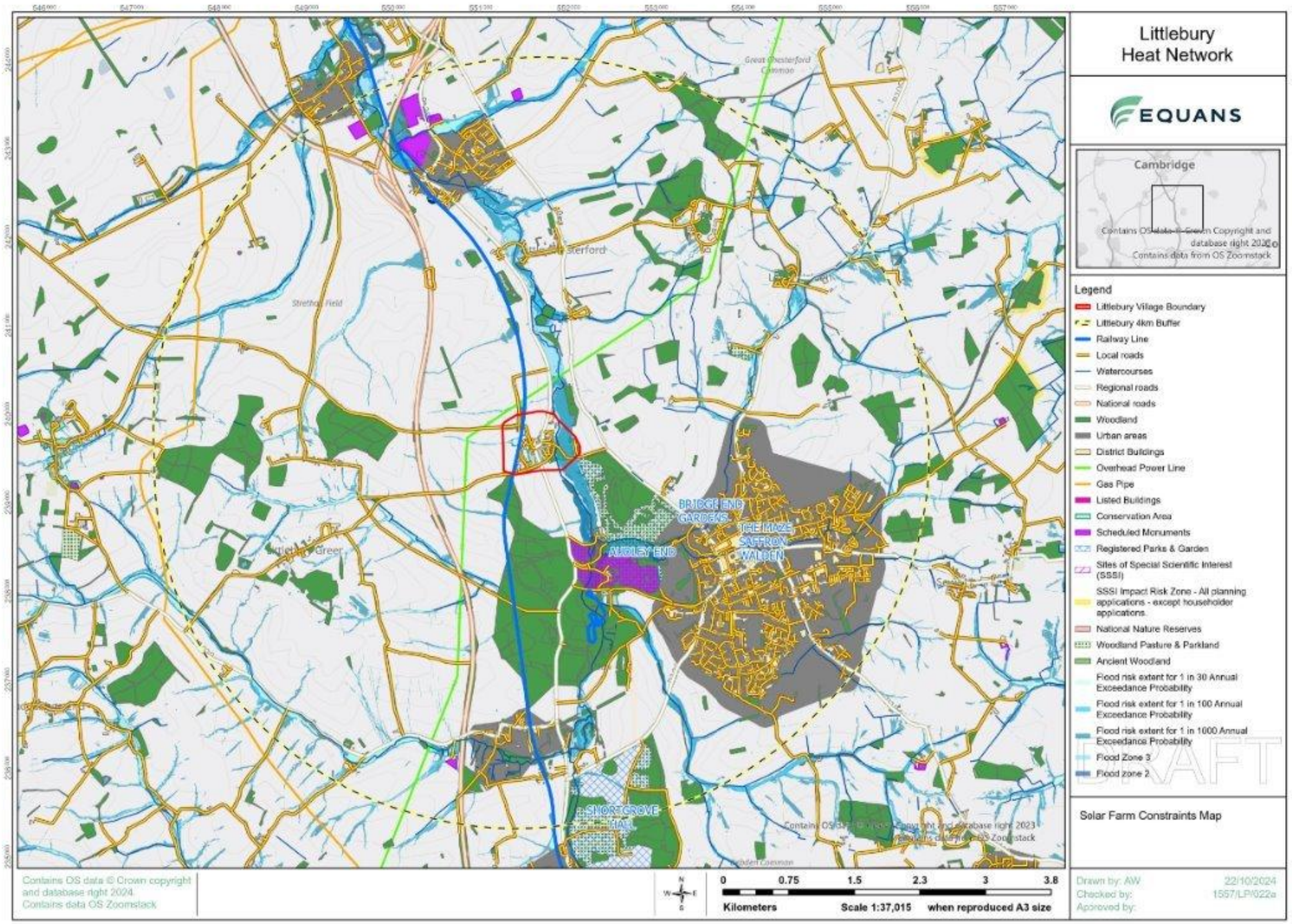
As noted on the previous page, GIS mapping tools have been utilised to develop an understanding of how land within (and surrounding) the village boundary is currently utilised. This has also led to the development of a 'Solar farm constraints map' as shown on the right.

The purpose of this map is to inform the identification of potential sites for locating renewable electricity generation sources, which may form part of the centralised solution (or potentially as an independent community energy scheme in future).

The key shows all the relevant constraints that have been taken into account, including all registered parks and gardens, flood risk, SSSI's, roads and railway lines, conservation areas, woodland areas and overhead power lines.

Land areas (shown in grey) indicate areas where there are no known constraints and are therefore may present an opportunity for renewable generation infrastructure – principally a solar PV farm, which, if connected to the energy centre (in the centralised or hybrid solutions), could help to support the project's goal for zero-carbon and aid economic outcomes.

The locations of any prospective solar arrays, indicative sizing and areas involved are considered further in the following section 3.



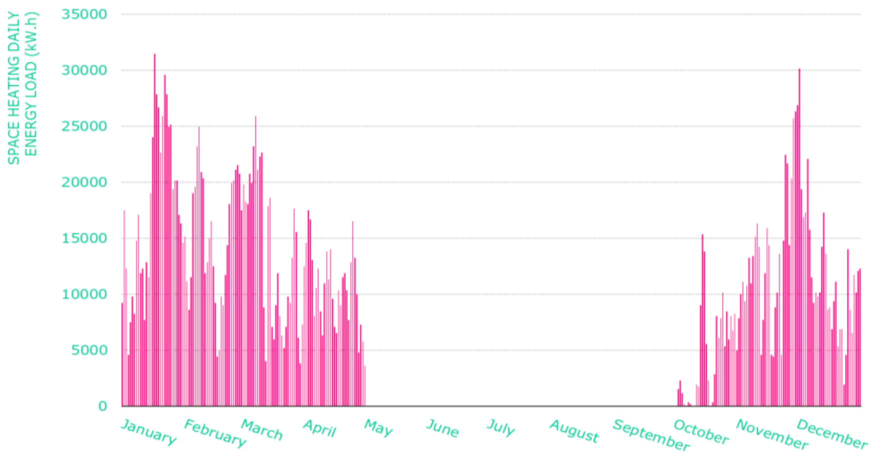
2. Littlebury context
2.2 Village Heat Demand

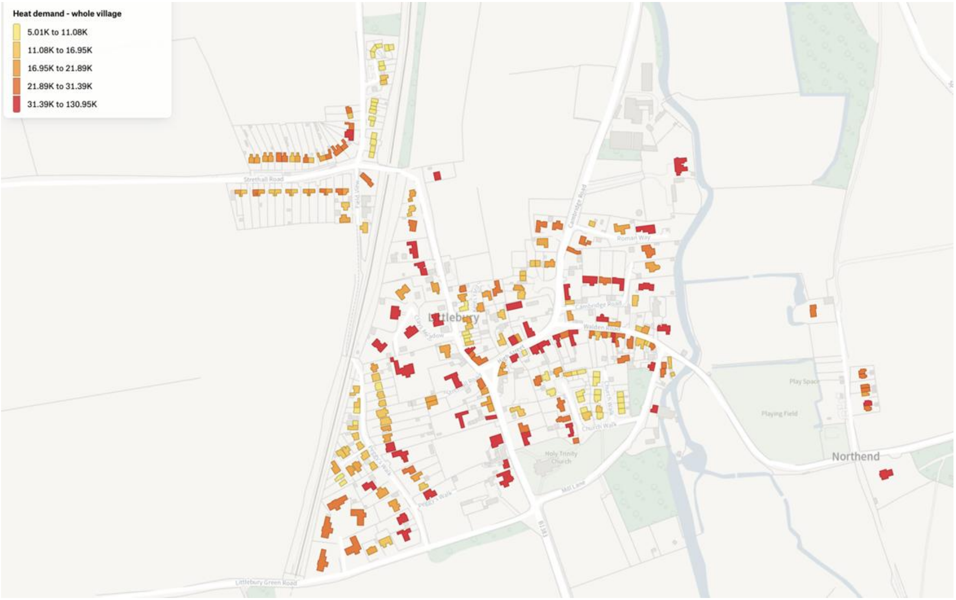
Methodology

Bioregional has developed a bespoke approach to estimating heat demand within rural villages. Establishing the amount of heat required from an area is the first step in researching feasible interventions and later informs sizing exercises for testing various system configurations. Experience studying the metered gas and electricity usage of many client estates has shown that there are a few key variables which influence home heating demand:

1. **Building age** – through the 18th to 20th centuries, there are specific periods of building development with often distinctive architectural forms and distinctive heating footprints. Through the mid-late 20th century in particular, the development of national building regulations in the 1960's with steadily improving energy performance, has had a consistent impact on heating demand. Hence, our first step with estimating village heat demand relies on categorising the age of buildings within the village.
2. **Building form** – Larger buildings, with larger heat loss areas, have higher absolute heating energy demands. However, this effect is non-linear. Larger buildings tend to have a lower occupancy density (per m2), and hence less energy relatively is used for providing hot water. Additionally, in large buildings, less regularly occupied areas are often allowed by the occupants to be cooler – or more infrequently heated. Hence, the average internal temperatures are lower than for smaller buildings.
3. **Resident socio-economics** – heating homes is an expensive endeavour, and particularly over the previous 2 years, where heating costs have approximately doubled, many households have tried to cut back – or been forced to reduce heating energy use. There is a strong relationship between a household's ability to pay, and the amount of energy use ultimately used for home heating.

To develop a picture of home heating across Littlebury, building age and building form have been accessed from sources including Ordnance Survey GIS data and local listed building records. For resident socio-economics, we relied on survey data from 2023, where around 40 residents provided estimates of their expenditure on oil deliveries within a year. These results were matched the relevant homes, and then using the statistical relation, a mapping of whole village heat demand was produced.





3. Options appraisal

3. Options Appraisal

3.1 Decentralised heat

Overview

The primary objective of this study is to identify and recommend an economically viable method of decarbonising the village of Littlebury whilst providing affordable heating for all the residents.

Whilst a centralised heat network has been considered as one potential technical solution, it is important to recognise that this solution may not be able to decarbonise the entire village due to technical and geographical constraints. Moreover, some dwellings may not want to or be able to connect to a heat network. Therefore, a decentralised approach involving individual low carbon heating solutions has also been assessed. The wider community may also wish to focus on delivering individual retrofit solutions as an alternative means of facilitating the transition towards decarbonisation. To ensure that all properties in Littlebury can benefit from decarbonised heating and reduced energy consumption, several retrofit options have been identified across different property archetypes.

This section of the report explores possible retrofit options for residents, discusses the benefits of retrofitting, and examines the barriers to implementation within the area. We note that the economic analysis supporting the feasibility study has by necessity used average costs for prospective decentralised heating installations.

In addition, the assumptions were drawn by analysing the different types of homes and the information available about existing heating systems to develop a realistic assumption for the number of homes that might require high temperature heat pumps (potentially with a low level of intervention/modification to existing heating distribution systems) and low temperature heat pumps (potentially with a high level of intervention and cost outlay to ensure compatibility).

Two types of retrofit options have been assessed:

- Light measures - which can typically be installed by homeowners without requiring additional professional work, and,
- Deeper retrofit options - which will necessitate the expertise of professionals for installation.

A key factor in our appraisal has been the diversity of house types and their ages. The images on the right illustrate three housing typologies within Littlebury.

Retrofit options have been provided to address a typical property in the village, but it is important to note that a significant proportion of the village consists of Listed buildings or properties located within a conservation area. As such, we have also endeavoured to identify suitable measures for these properties.

Typical Littlebury Housing Typologies

Source: Google maps

3. Options Appraisal

3.1 Decentralised heat

3.1.1 Constraints

Listed buildings

Littlebury is a historic village within the District of Uttlesford, containing 44 listed buildings and a conservation area. The map to the right displays the conservation area in green and listed buildings as purple (Grade 2) and yellow (Grade 1) dots. Under the Planning (Listed Buildings and Conservation Areas) Act 1990, historic buildings can be designated as listed affording them statutory protections. The majority of listed buildings within Littlebury are Grade 2 listed or buildings of a special interest.

The protections require that where alterations would impact the special or historic interest of a listed building, listed building consent is applied for, even if the alterations do not require planning permission. Listed building consent is applied for through the Local Planning Authority(LPA), Uttlesford District Council.

Where works are proposed that would not interact with the special or historic interest of a listed building, such works may not require listed building consent. A Certificate of Lawfulness of Proposed Works can be applied for to the LPA to confirm that the works do not require listed building consent. It may be advisable to seek such a certificate if there is any doubt as to whether listed building consent is required.

Conservation areas

The Littlebury conservation area was designated in 1977 and covers the majority of the village. The conservation area has been designated by Uttlesford District Council and restricts development that would impact the exterior of a building or that could impact the character of the development. Additionally, the conservation designation adds some minor restrictions related to works to buildings that are classed as 'permitted development' and would not usually require planning permission, including roof-mounted solar panels and heat pump installation. Resources that may be of value include:
https://www.legislation.gov.uk/uksi/2015/596/schedule/2/part/14 (solar panels)
https://www.legislation.gov.uk/uksi/2015/596/schedule/2/part/14/crossheading/class-g-installation-or-alteration-etc-of-air-source-heat-pumps-on-domestic-premises (ASHP)

Within Uttlesford District Council's Conservation area appraisal, the council has stated that it is good practice for applicants to engage with the Council before applying within a Conservation area.

3. Options Appraisal

3.1 Decentralised heat

3.1.1 Constraints - continued

Within Uttlesford District Councils Conservation Area Appraisal the council has stated their intention to apply an 'Article 4 direction' to the Littlebury Conservation area which would more heavily restrict what would be classified as permitted development. However, a review of Uttlesford District Councils Constraints Map shows that Littlebury is not currently beholden to an 'Article 4 direction' and as such some retrofit actions will likely be allowable.

It is recommended that those wishing to undertake retrofit works within the Littlebury Conservation area contact Saffron Walden Community Energy and the council to understand planning requirements before applying for planning consent or installing retrofit measures, in line with council recommendations. Residents should demonstrate that works will not impact the exterior of the property, limiting or eliminating the visual impact of the retrofit works.

Retrofit works that do not impact the visual appearance of a property should be allowable in line with the Uttlesford Local Plan policy ENV1. Covering planning restrictions within the conservation area.

Policy ENV1 states 'Development will be permitted where it preserves or enhances the character and appearance of the essential features of a Conservation Area'

Recommendations for measures that should be allowable in conservation areas in line with policy ENV1 have been identified within section 3.1.7 of this report, along with commentary from the Historic England report 'Adapting Historic Buildings for Energy and Carbon Efficiency'.

Uttlesford District Council, Constraints Map

3.1 Decentralised heat

3.1.2 Benefits

Health

Enhancing energy efficiency in homes brings substantial benefits, especially for health. In England and Wales, a staggering 8,500 excess deaths in 2018/2019 were directly linked to cold housing. By improving energy efficiency, residents can effectively heat their homes more efficiently and for longer periods, significantly mitigating these health risks.

Moreover, the government's September 2023 guidance on damp and mould clearly indicates that inadequately insulated homes are highly susceptible to moisture problems. The rising cost of living has made it increasingly challenging for households to heat their homes properly, elevating the risk of damp and mould.

While boosting energy efficiency reduces heating costs and ensures a comfortable indoor environment, it's crucial to prioritise ventilation. Some improvements may unintentionally increase humidity levels. Therefore, it's essential to integrate ventilation solutions, such as Mechanical Ventilation with Heat Recovery, during deeper retrofits to guarantee optimal air circulation and prevent potential issues.

Cost

Improving energy efficiency and heating systems through retrofitting has significant benefits, especially in reducing operational costs. Upgrading homes makes them lose less heat, which means they need less energy to stay warm. This lower energy demand can reduce costs or provide more comfort for the same price.

While these interventions can reduce the operational costs from heating and electricity use, a full deep retrofit of a dwelling requires significant upfront investment in the tens of thousands of pounds. As such, retrofit measures often have long payback periods before the true savings are realised. For example, across the UK it can take anywhere between 5-7 years to repay the initial investment. For retrofit to take place at scale across Littlebury, appropriate funding is required.

It should be noted that many measures will be installed externally and therefore may not be appropriate for buildings that are either Listed or within the Littlebury conservation area, as it may be deemed that these systems will significantly alter or impact the character of the dwelling. Section 3.1.6 provides additional detail about retrofit options for listed buildings.

3.1 Decentralised heat

3.1.2 Benefits - continued

Carbon emissions reductions

Retrofitting dwellings within Littlebury will significantly reduce home heating carbon emissions. In 2023 the Climate Change Committee (CCC), a government advisory committee on reaching net zero, released a progress report to Parliament assessing the UK's progress in reaching net zero. This report identified that, in 2022, 17% of total UK carbon emissions were associated with buildings. The CCC identified that retrofitting existing homes by installing low-carbon heat sources, such as heat pumps, and energy efficiency upgrades will be key methods of decarbonising buildings.

Energy efficiency upgrades reduce the amount of energy that residents of Littlebury will need to use to heat their homes to a comfortable temperature. This reduces the fuel needed to produce heat and thus carbon emissions from heating. This impact is further compounded by the fact that 73.75% of Littlebury residents who responded to an engagement survey as part of this feasibility study stated they utilised oil boilers for heating.

According to the Government Standard Assessment Procedure 10.2, the burning of oil suitable for domestic uses produced 300-400g Co_{2e} /kWh as compared to the 2023 grid electricity carbon intensity of 162g Co_{2e} /kWh.

Further analysis of the survey showed that on average a home in Littlebury used ~2475 litres of oil per year (based on the cost of bills and oil prices). As such, the average Littlebury home that used an oil boiler produced 7633.64kg Co_{2e} direct emissions from heating their homes annually. Even a small reduction in oil use because of energy efficiency upgrades can result in a significant carbon emissions reduction.

Switching from an oil heating system to an electric panel heating system that converts 1 kWh of electricity to 1 kWh of heat could reduce carbon emissions by ~15%. However, highly efficient electric systems such as air source heat pumps can produce between 3 and 4 kWh of heat for every kWh of electricity used (although this can vary significantly according to variances in outside temperature).

The efficiency of these electric systems compounds the carbon emissions savings as heat pump systems will use significantly less energy (kWh) than electric wall heating systems. As such, a home heat pump could reduce carbon emissions compared to an oil boiler by up to 80%. This could result in an annual carbon emissions reduction of 5-6 tonnes per household.

Efficient heat pumps are integral to household decarbonisation and retrofit. Whilst the systems can be expensive, funding is available to replace fossil fuel heating systems with electric systems. Funding options are expanded upon within section 5.3.

It should be noted that to gain maximum efficiency from heat pump systems dwellings will require some level of insulation to reduce heat losses. Each home will need to be surveyed by a professional to determine the specifications that are right for the home. Homeowners are also urged to develop a good understanding for the cost impacts of running a heat pump, where air tightness and low levels of insulation may interfere with retaining heat. The table on page 23 evaluates three forms of electric heating against key decision criteria.

Additionally, data from the resident's survey completed as part of this feasibility study showed over half of respondents (42) indicated reducing their personal carbon footprint was the most important factor for them. A further 29 respondents indicated that reducing their carbon footprint was important to them. These results indicate that retrofit measures to reduce carbon emissions would be supported at a community level. See section 7.1. Appendices for a summary report of the resident's survey.

3. Options Appraisal

3.1 Decentralised heat

3.1.3 Retrofit Opportunities

Opportunities

As stated previously, there may be some restrictions on retrofit options for listed buildings and buildings within the Littlebury conservation area. However, this report presents retrofit options that should not impact the historic or special interest of a listed building or impact the character of a conservation area.

These options are the light retrofit options explored later in this section and will provide energy efficiency improvements without significantly impacting the character or historic interest of a building. Some deeper retrofit measures may be available to listed buildings or buildings within conservation areas.

A list of measures that may be available for listed buildings and buildings within conservation areas has been provided within section 3.1.6 and 3.1.7.

Additionally, in July 2024 Historic England, the statutory body for the historic environment produced a report on how to retrofit historic and listed buildings. The report recognises the importance of improving energy efficiency in historic buildings and provides advice on the permissions needed to implement retrofit measures. Whilst the planning restrictions that can limit retrofit in listed buildings and in conservation areas has been summarised on the previous page, it is recommended that this document is reviewed before seeking approval to install retrofit measures in listed buildings or conservation areas.

The release of the Historic England Advice indicates that there is broad national support for retrofitting historic buildings in a way that does not impact the building's historical importance.

3. Options Appraisal
3.1 Decentralised heat
3.1.4 Retrofit measures to achieve heat decarbonisation

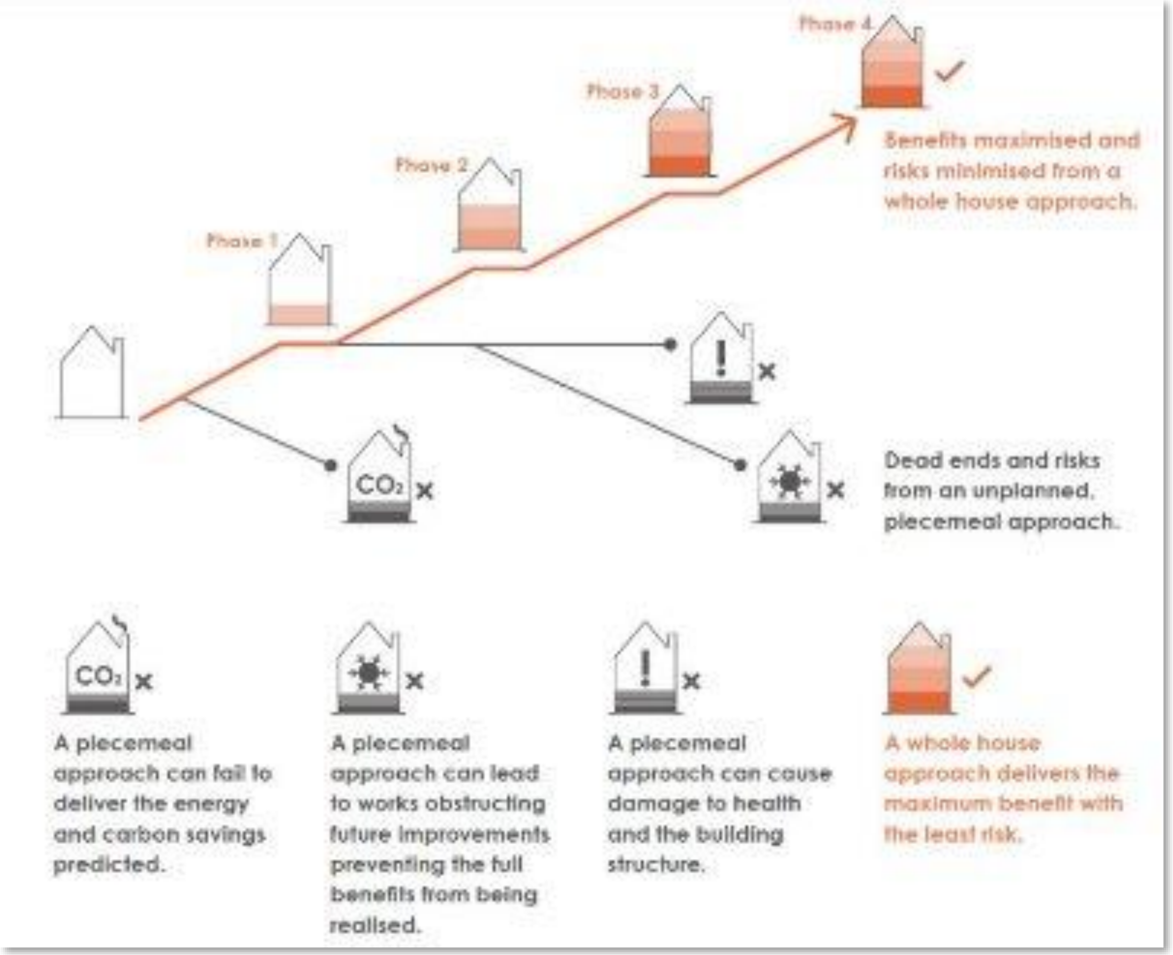
This section identifies retrofit options appropriate for typical houses within Littlebury, based on Bioregional's experience producing retrofit guides.

The retrofit options presented within this report can work individually, however, to optimise energy efficiency savings, it is recommended residents of Littlebury pursue a 'whole-house approach' to retrofit. As shown in the image to the right, the whole-house approach considers and implements a full suite of retrofit measures at one time. This allows for the optimisation of all retrofit measures. If an incremental approach is taken, certain measures may not work at full efficiency – relating to either operational cost or energy savings.

Retrofit options have been designated as **light** if they can be installed without professional assistance and will have minimal visual impact on a building. It is recommended that some light measures are installed by professionals to ensure performance. As such, light retrofit options should be suitable for buildings within a conservation area or listed buildings.

Deep retrofit options will require professional installation and will result in alterations to an existing building that may not be allowable for listed buildings or buildings within a conservation area.

Retrofit options are labelled either fabric or service options. Fabric options refer to building elements that are externally facing such as walls, doors, windows and roofs. Service options refer to upgrades to building elements that provide a service such as heating, lighting and ventilation systems.



Cambridge City Retrofit Guide

3. Options Appraisal

3.1 Decentralised heat

3.1.4 Retrofit measures to achieve heat decarbonisation

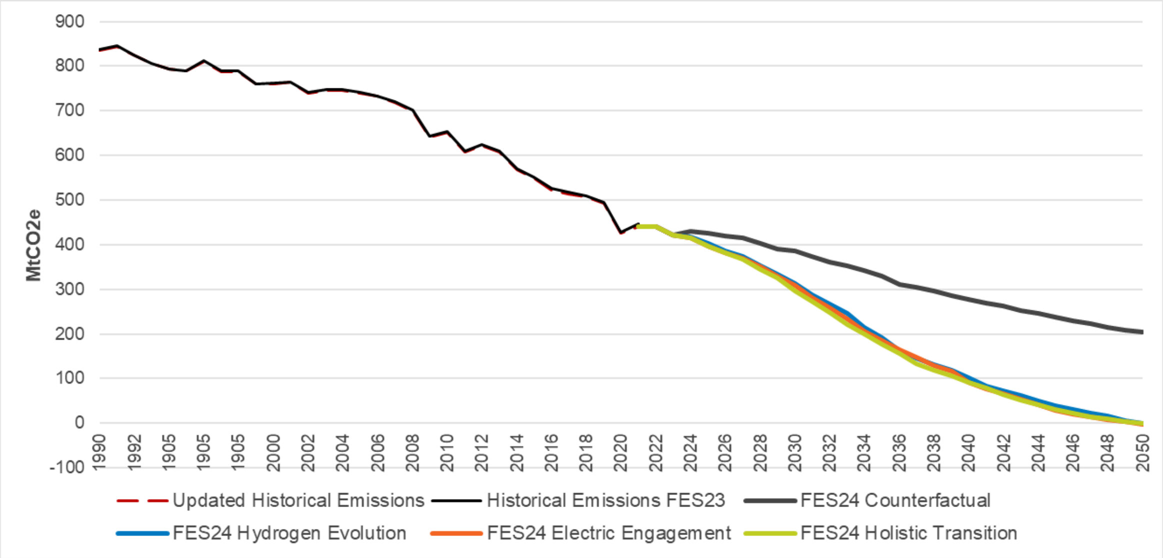
Current carbon intensity of village heat

Oil boilers are the dominant heating system within Littlebury homes – serving around 80% of the stock. Among the heritage and listed buildings in the village core, oil boilers are the most common heating system with a couple of exceptions. Electrically heated properties tend to be more modern buildings, to the west edge of the village. Several electrically heated properties already utilise heat pumps, with the balance utilising electric storage heaters.

The burning of oil emits around 298gCO2/kWh of heat released, regardless of where and how the oil is sourced. Given the efficiency of oil boilers is often between 70-80%, this means the carbon intensity of delivered heat is around 400gCO2/kWh. Historically the electrical grid was even more carbon intensive per unit of power – around 520 gCO2/kWh of electricity delivered in 2012. Today however, thanks to the collapse of coal power generation and the large increase in wind power generation in particular, the grid carbon intensity has reduced to 162gCO2/kWh of electricity delivered in 2023. Around 45% lower than oil on a per unit basis.

The grid is expected to decarbonise further. The national grid ESO, the electricity systems operator and "guiding mind" produces future energy scenarios each year to map how the electricity system is expected to decarbonise. The figure at right shows the carbon intensity of electricity generation and its predicted decarbonisation to 2050, produced as part of the Future Energy Scenarios 2024.

The challenge then, for decarbonisation, is to transition home heating systems from fossil-oil based systems, to an electrical solution which will allow them to decarbonise alongside the grid.



3.1 Decentralised heat

3.1.4 Retrofit measures – heat technologies

Electric heating technologies

Properties have had electric heating installed since the mid-20th century, with many council blocks from the period installing "electric storage heaters" during the 1960s and 70s, to increase grid demand to facilitate nuclear power stations. Today, however, we have a significant array of electrical technologies available which can be used to generate heat for domestic purposes. These broadly fall into three categories:

- Heat pumps
- Electric storage heating systems
- Direct electric heaters

The table on the right provides a comparison of technology types and their considered benefits and drawbacks.

Technology category	Different technological forms within category	Energy efficiency	Carbon emission reductions	Installation cost	Operational cost-benefit	Disruption
Heat pumps	• Low temperature air-water systems • High temperature air-water systems • Air-conditioning (air-air) systems	Heat pumps move heat from one location to another, delivering more heat to the home than energy input. Efficiencies: • Low temp HP – ScoP – 3.6 • High temp HP – ScoP – 2.8 • Air-air – 4.5 (but excludes hot water generation)	Greatest emission reductions when installed today – achieving at least 65% reductions compared to a gas boiler baseline, but up to 78% for an efficient low temperature system.	Government is currently providing a supportive grant of £7,500 to air-water installs. However, heat-pump installation costs (pre-grant) average around £12,000, and in complex older buildings, this will likely be higher.	Low temperature heat pumps will achieve price parity under standard tariffs to a gas boiler. On a SMART tariff, such as Octopus Cosy, savings of over 20% can be achieved. Higher temperature heat pumps tend to cost marginally more than oil boilers to run, even on a SMART tariff.	Heat pump units are installed outside the property in a suitable location. Internal disruption will revolve around radiator replacement (larger sizes may be required) and finding a suitable cupboard for a hot water cylinder if one isn't currently available.
Electric storage heating systems	• High-heat retention room storage heaters • Central heaters with storage cores (e.g. ZEB) • Microwave / immersion tank heaters	Storage heaters generate heat at an efficiency of 1 – due to direct heat generation. But losses occur in the storage system. Delivery efficiency of around 85% could be expected depending on the system.	Storage systems can be controlled to charge during periods of higher wind generation, or overnight, when renewables make up a greater grid fraction. This can save 20% on grid carbon emission – leading to a total saving of around 35% on a gas boiler.	Storage systems are cheaper to install, depending on the existing home system. Where there are existing old storage heaters, new higher heat retention heaters can be installed for around £500-1000 / unit.	Electric storage systems can run on night-time tariffs, such as through the protected Economy-7 tariff structure. Overnight electricity is currently 12p/kWh, compared to 5.5p/kWh for Gas. Hence, you could expect energy bills to roughly double in a best-case scenario – more likely bills would triple.	Low disruption with either direct replacement of units, or installation of a central ZEB in place of a boiler.
Direct electric heaters	• Panel heaters • Electric underfloor heating • Radiant panels	Direct heaters have an efficiency of 1, directly generating heat into the space. *	No capacity to shift loads, so we are utilising full power whenever occupants need the energy. Carbon savings against gas will still occur, around 20% due to grid carbon intensity.	Direct systems are the cheapest option to install, often only a few £100's per panel with comparable installation costs to the storage heaters.	Direct electric systems rely on standard tariff electricity to provide heat. If the home is heated to the same comfort level as for a gas boiler, energy bills would be around 4 times higher than for a gas system.	Low disruption with a quick install.

3. Options Appraisal
3.1 Decentralised heat
3.1.5 Retrofit measures – heat pump readiness

When is a property heat pump ready?

There are many myths which have circulated within the media around heat pumps. The most unfortunate is that heat pumps only really work in modern highly insulated dwellings and are not suitable for older properties. This is false – there are many great examples of heat pumps operating at extremely high-performance levels in heritage properties. But like all myths, there is an element of truth – and home insulation levels do have an impact on heat pump operation. Here, we outline the steps to consider installing a heat pump in a home, while addressing some of the most persistent misunderstandings of the technology.

Step 1 – heating system survey
At the beginning of the heat pump installation process, an installer will visit your house and perform a technical survey, which will include an assessment of:

Heat loss – they will estimate the heat loss from each of your rooms using a standardised survey methodology developed by Microgeneration Certification Scheme (MCS). This is used to assess the radiator size in each room.

Radiator output – this will be calculated on a room-by-room basis and compared to the heat loss calculation. Crucially, heat pumps like to run at lower temperatures than oil boilers – and the lower the water temperature, the higher the efficiency and the cheaper to run. But at lower temperatures, your radiators will emit less heat.

If you can meet the heat loss from your home with radiator temperatures below 45C, your home is suitable for a low-temperature heat pump, and you will see bill savings with the heat pump installation.

The installer will assess your radiators and work out which ones might need upgrading to be suitable. The survey may reveal your radiator system is undersized and only suitable for a high-temperature heat pump unless heat loss through the fabric is reduced.

Heating system pipe size review – Heating system pipework connects your boiler and future heat pump to the radiators. Heat pumps however want to use this pipe work very differently from how your gas boiler would.

Oil boilers pump water at a slow flow rate and a high temperature (60C +) to the radiators and ideally receive water back at a relatively low temperature (< 40C). Low return temperatures are required for a boiler's "condensing" functionality to work properly to achieve good boiler efficiency.

Heat pumps however pump water at a high flow rate, and a relatively low temperature (c. 45C), and ideally receive water back only a small amount cooler (c. 37-40C). Hence, for a heat pump to work in your existing system, the pipework needs to be sufficiently large to handle the higher flow-rates. If it is too narrow, replacement pipework may be needed in certain areas, which requires significant disruption and additional cost.

Electrical connections - a heat pump adds a significant extra electrical load onto your existing electrical system. To facilitate this, you may require additional circuits on your consumer unit, your main fuse may need upgrading – or you may need to upgrade your entire connection. The installer will assess this.

It is generally free to upgrade your existing connection to an 80-amp connection on a single phase. From this 80-amp single phase, you can generally power up to a 14kW heat pump, without requiring further upgrades to your electrical connection.

3. Options Appraisal
3.1 Decentralised heat
3.1.5 Retrofit measures – heat pump readiness

Step 2 – Assessing impacts and benefit

Following the survey, the installer may provide a quote – including the specification of heat pump and any upgrades or changes to the existing heating system. Ultimately, if an installer can install a heat pump in your property – this will deliver deep carbon emission reductions, but it may not always be the optimum choice.

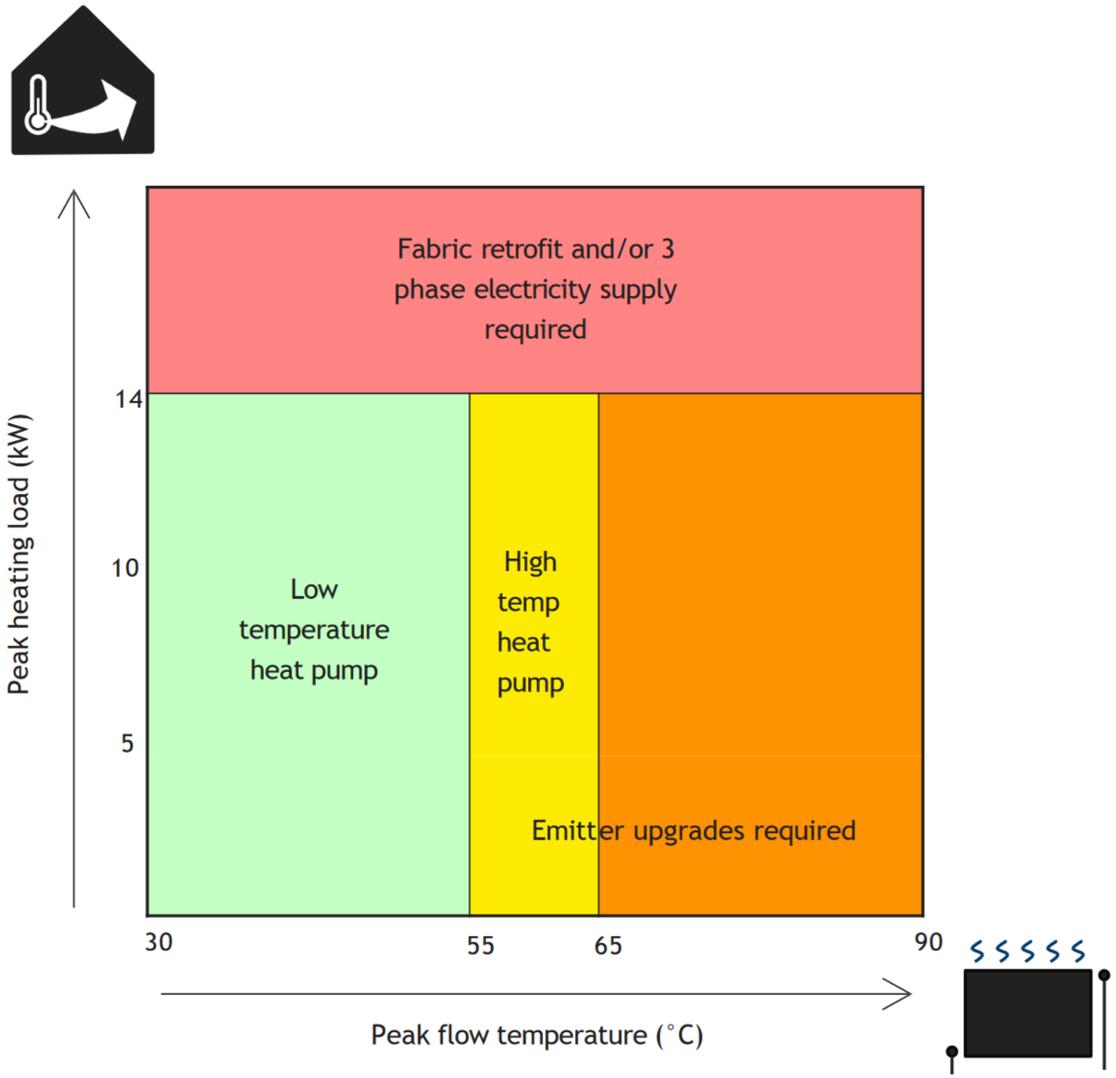
If you are quoted a high-temperature heat pump, your running costs may be higher than a lower-temperature option, by as much as a factor of 25%. If a relatively low-cost fabric upgrade is first installed – such as loft insulation, cavity wall insulation or secondary glazing – this enables a low-temperature heat pump and significantly lowers running costs and likely reduces the cost of installation.

If significant radiator replacement is required – this may require extensive internal works. In this case, it may be more cost-effective to install an insulation measure beforehand, to reduce the need for radiator replacements.

Ultimately, the choice of which route to take sits with the homeowner, depending on priorities at the time.

Implications for Littlebury

With many properties running off oil boilers and of heritage construction, it is likely that some properties will have peak heating loads above 14kW – for these properties, exploring at a minimum the light retrofit package will be required, and possibly additional measures from the deep package. For other properties, we would expect the existing heating systems to require high-temperature heat pump systems.



3.1 Decentralised heat

3.1.6 Retrofit measures – listed buildings

Listed buildings

As mentioned in section 5.1 of this report, listed buildings have statutory protections to preserve their historic or special interest. Most light measures are generally acceptable for listed buildings, as they are unlikely to affect the building's historic significance. However, it is advisable to consult the Local Planning Authority (LPA), Uttlesford District Council, before implementing any significant retrofit work to ensure that the measures are permissible. In certain situations, some deep measures may also be acceptable for listed buildings, particularly if they only affect the interior. However, it is crucial to consult the LPA before undertaking any deep retrofit options. Table 3 below summarises the measures that are typically permitted for listed buildings.

Retrofit measure	Measure type	Historic England Guidance*
Draft excluder strips, for windows and doors	Light, Fabric	Section 79 states draft proofing of windows will almost always be acceptable and that listed building consent is not required.
Internal loft hatch/ loft insulation	Light, Fabric	Section 85 states that loft insulation will typically be acceptable and that listed building consent is not often needed.
Secondary glazing	Light, Fabric	Section 80 states that secondary glazing will generally be acceptable and that listed building consent may not be required.
Air Source Heat Pump	Service	Section 94. covers heating systems and states systems such as heat pumps will generally be acceptable for listed buildings.

* https://historicengland.org.uk/images-books/publications/adapting-historic-buildings-energy-carbon-efficiency-advice-note-18/

Table 3. Retrofit options in the context of listed building.

3. Options Appraisal

3.1 Decentralised heat

3.1.7 Retrofit measures – conservation areas

Conservation area

Conservation areas are designed to protect the character of an area. This usually results in restrictions on measures that would impact the visual characteristics of a location. Specifically for conservation areas within Uttlesford, policy ENV1 states "Development will be permitted where it preserves or enhances the character and appearance of the essential features of a Conservation Area."

Therefore, it is likely that retrofit measures will be allowable for non-listed buildings within a conservation area where they do not impact the character of a building. Table 4 below outlines retrofit measures that are likely to be allowable for buildings within a conservation area.

Retrofit measure	Measure type	Historic England Guidance
Draft excluder strips, for windows and doors	Light, Fabric	As described in Table 3. Internal measures are likely to be allowable in non-listed buildings within conservation areas as they will not impact the external character of a building.
Internal loft hatch/loft insulation	Light, Fabric	
Secondary glazing	Light, Fabric	
Internal/thin internal wall insulation/ floor insulation.	Deep, Fabric	For listed buildings internal wall/floor insulation almost always requires listed building consent and will not be allowable for some buildings. However, for non-listed buildings, this insulation will not impact the external character of a building and may be allowable.
Air Source Heat Pump	Service	As with Table 3. Heat pump, dependant on make and model, can be discrete and hidden from street view. This may result in heat pumps being allowable for conservation areas, however, this should be confirmed with the LPA.
Mechanical Ventilation with Heat recovery(MVHR)	Service	Section 94 states MVHR may be allowable in some cases and with careful ductwork, the impacts can be discreet. For listed buildings MHVR is unlikely to be allowable for buildings with historic interiors and listed building consent will most likely be required. However, for buildings within conservation areas, this may be allowable should the visual impact be minimised. This should be confirmed with the LPA.

Table 4. Retrofit options for non-listed buildings within conservation areas.

3.1.8 Retrofit measures – summary

While a heat network is being explored to provide low carbon and affordable heating for all residents within Littlebury, it may be that some or all dwellings will not connect to a heat network. To ensure that every dwelling within Littlebury can benefit from lower carbon heating and reduced energy use, several retrofit options have been identified. This section of the feasibility study explored retrofit options available to residents within Littlebury, given the historic nature of some buildings in the village, the benefits of retrofits, and the barriers to retrofit. All retrofit options examined in this study include the installation of an air source heat pump to decarbonise heating systems, and this section described the process to become "heat pump ready."

We studied two scales of retrofit:

- Light measures, which can be usually installed by homeowners and will require no additional work, and
- Deeper retrofit options that will require professional installation – and in some cases permissions from the local authority.

Noting the character or appearance of a conservation area is protected, retrofit works that would alter the external appearance of buildings within it may limit retrofit options.

Conservation	Listed	Measure
✓	✓	Draft excluder strips, for windows and doors
✓	✓	Internal loft hatch / loft insulation
✓	✓	Secondary glazing / Double glazing where allowed*
✓	✓	Air Source Heat Pump*
✓		Mechanical Ventilation with Heat recovery(MVHR)
✓		Cavity / internal / floor insulation.

"With 20% of total UK carbon emissions coming from our 29 million existing households there is an urgent need to reduce carbon emissions in all housing stock including Conservation Areas."

Architects Climate Action Network, Conservation Area Toolkit

**seek advice from the Local Planning Authority for Listed buildings to avoid unexpected challenges with these measures*

3. Options Appraisal
3.1 Decentralised heat
3.1.9 An alternative exploring a community owned solar array

During report collation, the SWCE Littlebury Energy Project working group asked the team to explore the potential to develop a proximate, **large-scale solar array** to provide renewable energy to individual homes – in combination with retrofit and decarbonisation. This solution may reduce energy costs, support energy independence and enable community decarbonisation. However, the alternative is challenging to model and compare with other alternatives because there are no community demonstrators, and the variables and unknowns are too great to offer meaningful insight at this phase of feasibility. Below are some key considerations to address in further study by SWCE, and case studies for review.

The primary barriers identified by the project team include:

1) Technically complex delivery – this alternative would require what is known as a "private wire" between the solar farm and the point of use; in this case, multiple homes. Designing and implementing a private wire system requires expertise, tenacity and an appetite for risk. This arrangement is typically more applicable and deliverable for a single user of the energy supply.
2) High initial investment – the first cost of both the solar array and the private wire system will be high. Metering and billing systems need to be considered. The scale of costs is beyond the scope of this study, but it should be considered a primary challenge to overcome in any further exploration of this solution.
3) Complex regulatory interface – the combination of grid connection uncertainties, shifting national policy and local planning regulations all must be considered and addressed diligently during future phases of feasibility to explore this model.

Resources for further research

Private wire

Energy Systems Catapult has summarised the business model for private wire:
https://www.netzerogo.org.uk/s/article/Business-Model-Private-Wire

Community energy ownership of solar farms

Southill Community Energy developed and operates Southill Solar, which has been generating renewable electricity since 2016. Surpluses are invested locally to support low-carbon projects.
https://southillcommunityenergy.coop/

3. Options appraisal

3.2 Centralised heat solution

3. Options Appraisal
3.2 Centralised heat

Overview

- Our approach to assessing a centralised heat solution has focused on three distinct areas, each aimed at identifying if a centralised heat solution would be feasible. Statutory, regulatory, planning, and land ownership considerations have not been addressed in detail here but are noted in later sections of the report. These three areas are outlined opposite.
- A hybrid or centralised heat network solution, serving a majority or all properties, could offer Littlebury a way to significantly reduce the environmental impact of fossil fuel use by delivering heat and hot water to multiple buildings simultaneously.
- Although complex and requiring careful planning, design, and development, this solution allows all connected properties to transition to a decarbonised system by eliminating reliance on fossil fuels once connected to the heat network.
- While the capital investment is likely to be significant, it must be weighed against the overall cost of implementing separate, decentralised solutions for each building. Details of this financial modelling are included in the following section.

Data Analysis

A village-wide heat demand profile has been determined using energy usage data, publicly available EPCs and standard property benchmarks for typical property archetypes. GIS mapping data for the village (outlined in section 2) has also been developed and reviewed.

Qualitative Optioneering

Qualitative appraisal is an important and useful technique which can aid in option selection. Although subjective, this in essence uses multi-criteria decision analysis to review the options against set criteria. We have used this approach to aid the decision-making process for both energy centre location, and appropriate heat source technologies.

Simulation Modelling

We have used proprietary energy simulation modelling software to perform detailed systems modelling of the centralised solution. By running multiple simulations based upon an hourly energy demand profile, we have been able to carry out iterative testing of multiple configurations of heat sources, thermal storage and renewable generation, in order to select preferred combinations.

3. Options Appraisal

3.2 Centralised heat

3.2.1 Energy Centre Location

Constraints Analysis

Through evolution of the constraints map (shown in Section 2.1), we identified four potential land parcels that may be potentially suitable to site an energy centre. However, given the preliminary nature of this study, the viability of these sites would be subject to more detailed investigations and stakeholder engagement. Land ownership and acquisition considerations have not been addressed at this early stage.

Site Selection

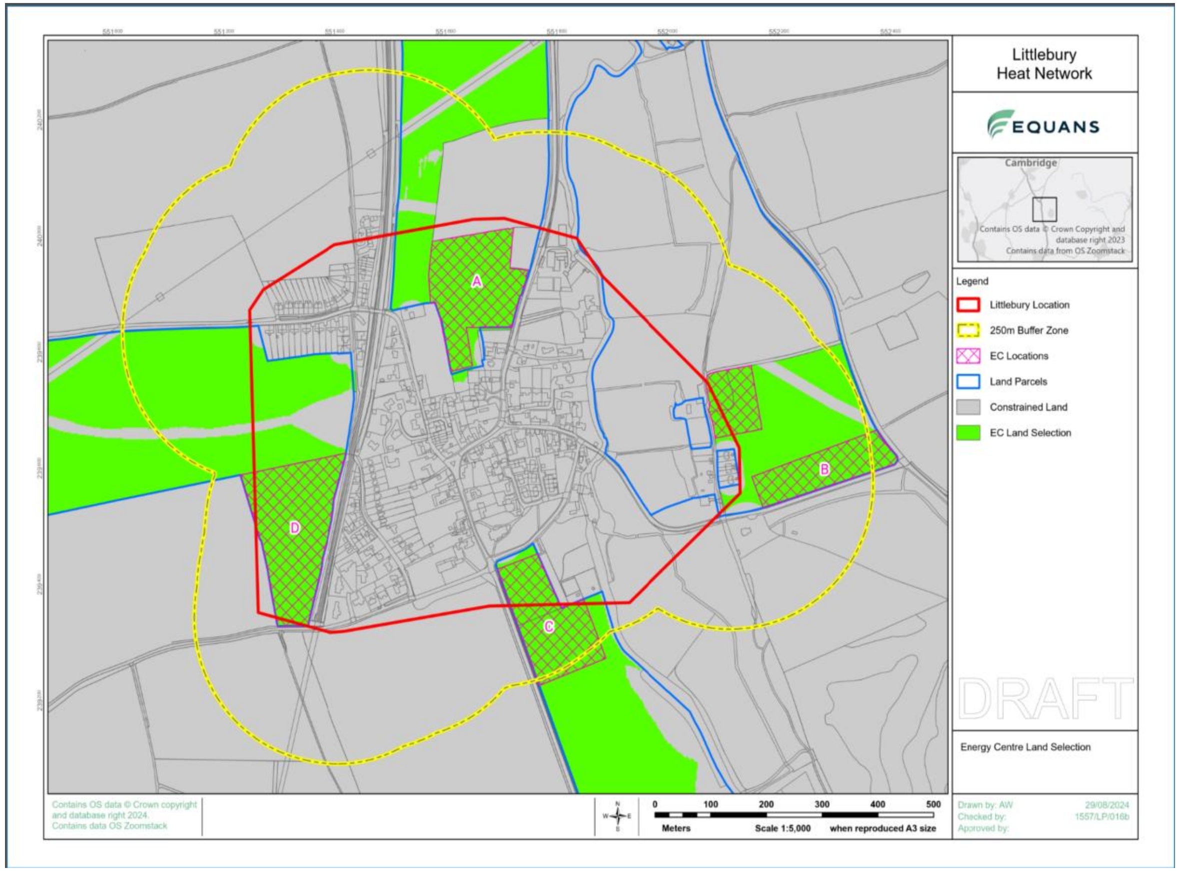
The identified parcels, labelled A–D, are shown on the adjacent map. These have been selected following the constraints mapping exercise and for clarity, the areas in grey are 'constrained' areas as previously identified, and the areas in green are 'unconstrained' areas.

Space and Suitability

The hatched areas show where an energy centre could potentially be located. This is approximate at this stage and the total area (in m2) in each location is substantially more than the area that could be required by the energy centre itself.

Options Appraisal and Preferred Sites

To this end, we have carried out a qualitative options appraisal to assist with the prioritisation of these areas against several subjective criteria. We have identified two preferred land area options (A and C) that have been deemed worthy of further consideration as part of the centralised solution design. These could be taken forward in subsequent detailed feasibility studies (including, potentially, a more detailed investigation into ownership and exploratory conversations with the landowner as to whether this may be a viable option for further design development).



3. Options Appraisal

3.2 Centralised heat

3.2.1 Energy centre location – site A

Site A is located approximately 200 meters from the village centre and the area in its full extent can be seen on the right. This location presents several advantages and, following our desktop assessment, our decision matrix identifies Site A as one the foremost options, with strong benefits in terms of proximity to potentially connected properties (and therefore optimising heat network efficiency through reduced network length), accessibility and minimal flood risk. However, possible ecological and environmental impacts would be subject to more detailed investigation.

Benefits

- The proximity to major roads B1383 & Strethall Road ensures easy accessibility during construction and ongoing operation & maintenance activities post-implementation.
- The site appears to be used for agricultural purposes, with no evidence of any other prospective / competing use options (subject to confirmation).
- Its distance from residential properties mitigates noise concerns, while visual impact may be mitigated by existing hedges and trees, providing natural screening.
- Additionally, the site is not designated as protected land and is unaffected by flooding.
- There are no known utilities crossing the property

Challenges

- The potential for housing development plans in this area.
- Potential complaints from nearby property owners.
- Potential ecological and environmental impacts, due to the site's natural habitat.

3. Options Appraisal

3.2 Centralised heat

3.2.1 Energy centre location – site B

Site B is situated approximately 400 meters from the village centre, is located on unconstrainted land. It appears to present a promising location for an energy centre since it is not too close to the village. In contrast however this distance from the village centre is likely to detract from the overall system efficiency and lead to increased capital cost and ongoing energy costs (due to heat lost in network pipes).

Other key characteristics of this land area are:

Benefits

- Proximity to the main road, B184, could help to mask potential noise disturbances.
- The rural and arable character at this location, coupled with its location offers potential for mitigating the visual impact (of the energy centre) with the surrounding environment
- The absence of protected land designations or flooding risks, combined with the lack of utility crossings, may simplify the development and consenting process

Challenges

- The site's current agricultural use and potential for local opposition should be carefully considered.
- Environmental assessments are considered essential in this area to ensure compatibility with any protected habitats or ecological features.

3. Options Appraisal

3.2 Centralised heat

3.2.1 Energy centre location – site C

Site C is located between 200 and 350 meters from the village centre and the area in its full extent can be seen opposite.

Following our desktop assessment, our decision matrix identifies Site C as the second-best option (below Site A), with potential benefits in terms of the lesser visual and noise impact once in operation, and potential flood risk, but potential disadvantages (compared to site A) in terms of the proximity to designated/protected land parcels, and the more significant distance from the centre of Littlebury.

Benefits

- The proximity to the main road B184, would help to mask potential noise disturbances, and ensure ensures good accessibility during construction and ongoing operation & maintenance activities post-implementation.
- The site is utilised for a mix of rural and arable farmland, with few nearby residential properties
- Additionally, the absence of protected land designations or flooding risks, simplifies the development process.

Challenges

- The land's proximity to Audley End estate's registered parks and gardens.
- Potential for community objections due to potential visual impacts on the Holy Trinity Church and listed buildings.

3. Options Appraisal

3.2 Centralised heat

3.2.1 Energy centre location – site D

Located between 200 and 360 meters from the village centre Site D is also based upon unconstrained land; the area in its full extent can be seen on the right.

The main identifier for this site would be its location on the other side of the railway line from the village itself. This location has some advantages principally around access, albeit with numerous potentially significant disadvantages. Following our desktop assessment, our decision matrix identifies Site D as the least preferred option - with relatively high scores across all the main selection criteria.

Benefits

- Proximity to Littlebury Green Road, would ensure reasonable access during construction and ongoing operation & maintenance activities post-implementation.
- The site utilises a mix of rural and arable farmland, with few nearby residential properties
- The absence of protected land designations or flooding risks, simplifies the development process.

Challenges

- Potential for flooding.
- Possibility of conflicts with other utilities.
- The railway tunnel beneath Littlebury Green Road may pose an obstacle for the installation of new district heating pipework.
- Limited demand for a district heating connection to the nearest properties many of which are more modern in construction and have efficient individual heating systems such as air source heat pumps.

3. Options Appraisal

3.2 Centralised heat

3.2.2 Energy centre location appraisal

The graphic opposite details the results of our Qualitative Appraisal of potential Energy Centre Locations. We have appraised each location in terms of its perceived advantages and disadvantages, and used a decision matrix to provide a subjective score from 1 to 4 for five specific criteria:

- Distance: The approximate distance from the proposed land area (noting the areas shown are quite large in some cases at this stage).
- Future development: An assessment of whether the land area is considered suitable for further development.
- Visual impact: Of the Energy Centre in this location on other properties (essentially those located closest to the land area).
- Flood risk potential: – if an Energy Centre was built in this location and this therefore became a single location for heat generation for all connected properties, what is the risk of flooding occurring and therefore the potential for heat generation being curtailed.
- Proximity to protected land: In other words, land with designations such scheduled monuments, SSSIs etc.

✓✓✓✓ preferred / ✓ least preferred

LITTEBURY POTENTIAL ENERGY CENTRE LOCATIONS – DECISION MATRIX

	Site A 1	Site B 3	Site C 2	Site D 4
Distance from centre of village	✓✓✓✓	✓✓	✓✓✓	✓
Land suitable for development	✓✓✓✓	✓✓✓	✓✓	✓
Visual impact on village	✓✓	✓	✓✓✓✓	✓✓✓
Potential Flood Risk	✓✓✓✓	✓✓✓	✓	✓✓
Proximity to Protected Land	✓✓✓✓	✓	✓✓✓	✓✓

Following the ranking exercise, and acknowledging the subjective nature of this appraisal, Site A is the preferred option with the highest score in terms of shortest distance from the village centre (benefit in terms of network/system efficiency), minimal flood risk and proximity to protected land.

Site C has been ranked a close second and offers several advantages including its location to the south of the Church which would lessen the visual impact of the energy centre on villagers (once operational) and by also being in an area which may offer potential for a solar PV array to be in proximity.

3. Options Appraisal

3.2 Centralised heat

3.2.3 Heat source technologies

To determine the most appropriate low carbon technology, or combination of technologies that may offer greatest feasibility as part of a hybrid or centralised heat network solution, a qualitative appraisal of potential heat sources has been performed. This is shown in the graphic below.

The below decision matrix has been used to present scoring for five specific criteria relative to each heat source / technology option:

✓✓✓✓ preferred / ✓ least preferred

LITTEBURY POTENTIAL HEAT SOURCES – DECISION MATRIX

	ASHP	CL GSHP	OL GSHP	Elec. Blr	RSHP
	1	4	5	2	3
Benefits / Highlights	✓✓✓✓	✓✓✓ ✓✓	✓✓	✓	✓ ✓✓
Interdependencies	✓✓✓✓ ✓	✓	✓✓	✓✓✓✓	✓ ✓✓
Suitability to location	✓✓✓✓ ✓	✓✓	✓	✓✓✓✓	✓ ✓✓
Technical Risks	✓✓✓✓ ✓	✓ ✓✓	✓	✓✓✓✓	✓✓
CAPEX / Economics	✓✓✓ ✓	✓	✓✓	✓✓✓✓ ✓	✓ ✓✓

Qualitative Assessment Categories:

- Overall benefits of utilising the heat source - considering factors such as efficiency, complexity, network temperatures and integration with properties etc.
- Interdependencies – what other aspects are likely to be critical to successful implementation, such as potentially upgraded electrical capacity, secondary distribution temperatures, thermal storage and auxiliary heating sources required etc.
- Suitability to the location – spatial considerations, land availability, noise and visual impacts.
- Technical risks – level of technical risk associated with heat source, for example ground freezing due to borehole arrays
- CAPEX / Economics – the likelihood of the heat source requiring a level of investment to implement, considering not just the heat generating plant but all of the associated infrastructure (i.e., excavation and civils costs when developing boreholes under the GSHP & indirect RSHP solutions.

3. Options Appraisal

3.2 Centralised heat

3.2.3 Heat source technologies

- Air source heat pumps (ASHP) have been ranked as the preferred technology as out of the considered options, in terms of its overall capital cost / economic viability, interdependencies and overall suitability to both sites A and C as the preferred alternative energy centre locations.
- The ground source heat pump (GSHP) options (CL is closed loop, and OL is open loop) would provide low operational energy costs due to higher system efficiencies however would have disadvantages with regards to high system complexity, capital costs, land requirements and technical risks particularly in terms of long-term performance (due to thermal degradation in the ground).
- Electrode boilers offer an efficiency of up to ~100% (compared to circa 200-300% for heat pumps) but are substantially cheaper to buy with limited infrastructure and spatial requirements – although are potentially more suited for operation in tandem with heat pumps rather than as the 'lead' heat source.
- River source heat pumps (RSHP) - The River Cam runs to the east of the village and potentially offers a heat source since rivers have average annual temperatures generally in excess of the average air temperature, and usefully higher temperatures in winter months when the ambient temperature is at its lowest. This all combines to provide slightly higher seasonal coefficient of performance values relative to ASHPs - and similar to GSHPS. However, the benefit is small, in the region of 10-15%, and is outweighed by the economic penalty since is too small and slow flowing to support a water source heat pump solution.

Air Source Heat Pump

Electric Boilers

Ground Source Heat Pump

River Source Heat Pump

3. Options Appraisal

3.2 Centralised heat

3.2.4 Heat network

- There are three core components to a heat network; the heat generation source, an energy centre which is used to locate the heat generation plant, and the heat network itself – a network of pipes transporting thermal energy to all connected properties
- An energy centre is any central plant location that can be utilised to house heat sources. At Littlebury, this is likely to take the form of a single external plant room housing one or more heat sources.
- This would require a significant area of land (in the region of 400-700m2) including area dedicated for associated but externally located plant such as thermal stores and fan beds (if air source heat pumps are used).

Swaffham Prior Heat Network – Energy Centre (Equans)

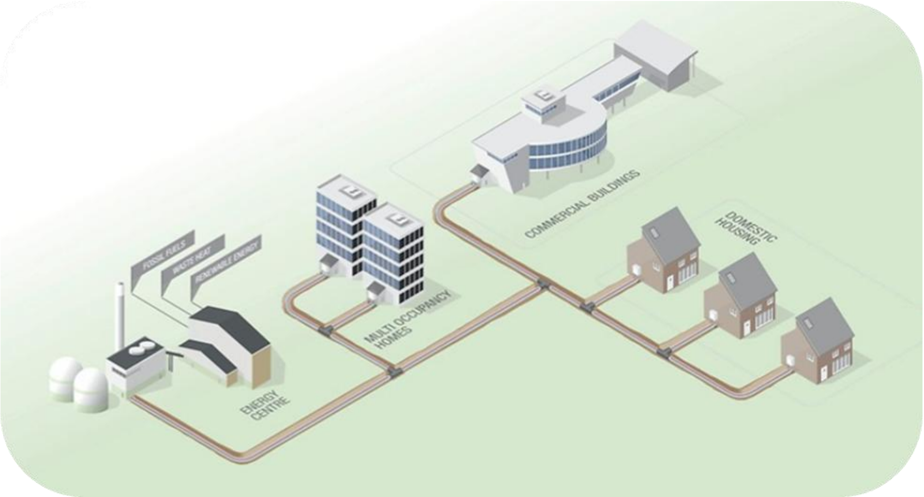


Image courtesy of Energy.nl

What is a heat network?

- *Distribution of heat through a network of pipes to serve multiple properties*
- *Typically comprises centralised heat production (the energy centre)*
- *Typically relies on the sale of heat by the generator to the properties*
- *Typically suited to areas with high heat densities*

3. Options Appraisal

3.2 Centralised heat

3.2.5 Heat network route options

For the heat network route, the goal is to balance installation efficiency with disruption to the community. We assessed both soft-dig (verges, fields, gardens etc.) and hard-dig (carriageways, footpaths etc.) options. A hard-dig route along the main road from Site A, the preferred energy centre location, is considered as the preferred approach.

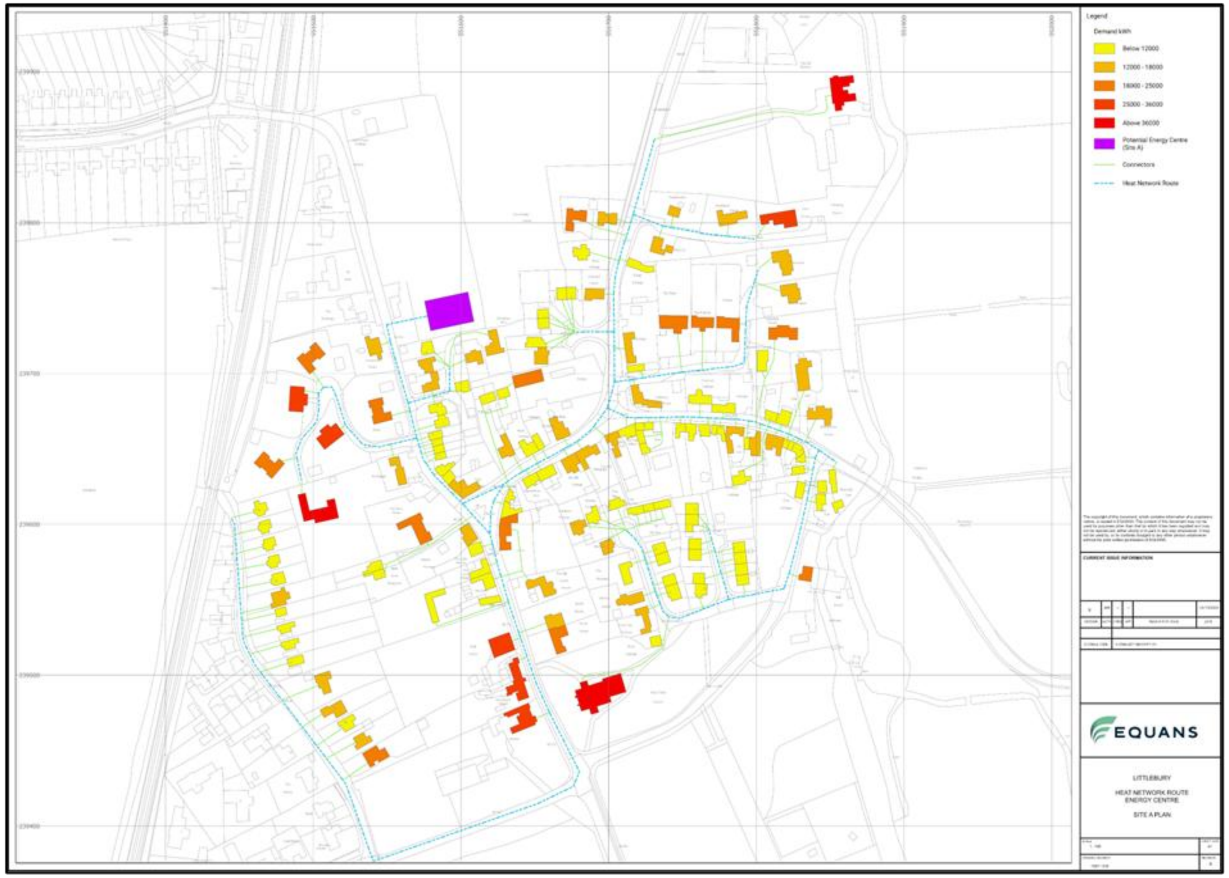
Key factors influencing this decision include:

Road and Traffic Management
Using the road allows for controlled traffic flow, especially at peak times. This would involve planned diversions and signal-controlled, single-lane access to minimise congestion and maximise safety for residents and workers.

Trench Work and Utility Coordination
Running the trench along roads minimises interference with private land, though it requires detailed planning to coordinate with existing utilities, such as water, communications, and electricity lines.

Preservation of Heritage Buildings
Littlebury is home to many listed and historic buildings. Installation beneath the public highway would preserve the village's character.

Property Connections and Landowner Permissions
Connection to properties to the network would require close engagement with landowners to secure permissions, respect land boundaries, ensure connections are convenient and minimally invasive for each property owner.



3. Options appraisal

3.3 Centralised components

- Heat network
- Energy centre
- Renewable electricity generation

3. Options Appraisal
3.3 Centralised ASHP – the network

Heat Network

A 'core' group of buildings within Littlebury Village has been identified as potential priorities for a ‘hybrid’ centralised heat network. This includes all the buildings shaded yellow, orange or red in the drawing opposite. For the other properties (not assumed to be future connections) it has been assumed that a decentralised approach would be adopted several fully decarbonise (i.e. individual ASHP / retrofit efficiency).

This includes all properties around, or in the village centre . This represents approximately 140 properties or 60% of all the properties in the village.

The following properties are omitted from the ‘hybrid’ centralized heat network:

- To the west of the railway line, along Strethall Road & Merton Place – due to the increased network cost due to the requirement for the network pipes to cross the railway line.
- To the east of the River Cam, along north end – also due to the increased network cost due to the requirement for the network pipes to cross the River Cam.
- Properties accessible from the ‘Peggy’s Walk’ access road – due to a combination of additional network pipe length and reduced collective heat density of the properties along this road. It is also noted that several properties in Peggy’s Walk already have individual ASHPs installed – and as such there is a reduced decarbonisation requirement.

The total network length would need to be optimized during future detailed design alongside analysis of network temperatures.

The design objective would be to reduce the capital and operational costs (of the heat network) by minimizing the total pipe length, and reducing the primary flow and return temperatures as much as possible (without requiring modifications to the distribution systems inside each property to ensure adequate comfort levels). The drawing below shows the proposed pipe network route from the preferred Energy Centre location (Site A).

3. Options Appraisal
3.3 Centralised ASHP – the network

Heat Network

The extent of the proposed heat network has been modelled using the two preferred energy centre locations, Site A and Site C. The intention of this was to model the total pipe length and ascertain the proportional difference, if any.

Although the potential energy centre sites are only approximate at this early stage, the intent would be to locate the energy centre buildings close to the road for access and heat network route, but also far enough away from residential properties to mitigate environmental impacts during both construction and operational stages.

The drawing on the right shows an indicative heat network route serving all the properties in Littlebury, and connected to an energy centre in Site C.

The relative difference in heat network lengths between Sites A and C, assuming the core village (as shown) properties are connected only is in the order of 10% - with Site C requiring marginally the longer route.

3.3 Centralised ASHP – system temperatures

System Temperatures

In designing an efficient heat network, operating temperatures should be minimised to reduce heat losses and system operating costs. The efficiency of heat sources, particularly heat pumps, typically increase at lower operating temperatures. It is however important to derive network operating temperatures that are compatible with existing building tertiary heating and hot water systems. To reduce system temperatures for the hybrid solution at Littlebury, significant effort would need to be made at ensuing design stages.

This would require consideration of the return temperatures likely from the properties after heat interface units have been installed (these provide instantaneous space heating and hot water via integral plate heat exchangers) as the return temperature will largely depend upon the performance of the existing tertiary space heating (heat emitters) and hot water systems.

3.3 Centralised ASHP – energy centre

Energy Centre

An energy centre (also referred to as a ‘central plant location’ or ‘plant compound’) houses the heat generation and distribution plant equipment. Complex heat network systems may have multiple energy centres at different locations connecting to a heat network, each of which may be capable of delivering heat to the network or taking heat from the network. For flexibility, and to maximise the use of low carbon heat, energy centres may be designed to supply heat from multiple heat sources. Typically, the heat sources can be categorised as either low-grade (supply heat at <60C), or high-grade (supply heat >60C) with no loss in operating efficiency at the higher temperatures.

For the centralised and hybrid options, we have previously appraised the most appropriate heat sources in section 3.2.3, which whilst qualitative in nature, has identified air-source heat pumps as the preferred option in terms of several subjective criteria, potentially with electrode boilers operating in a supporting role. Heat sources need to be considered in terms of how they are likely to be required to operate, either as the 'lead' source – which starts first when there is a heat demand and remains on to satisfy that demand; or as a 'top-up' heat source – which operates when the lead source is unable to cope with demand; or finally, as a 'back-up' source – that operates when the lead or top-up sources are unavailable.

For this project, it is recommended that multiple ASHPs operate as the lead source to provide resilience and that one or more electrode boilers are potentially included as top-up, with a secondary role as back-up source in the unlikely situation that all the heat pumps are off-line together.

Several iterative energy simulation models have been prepared, using different configurations of heat source including ASHPs only, ASHPs & different volumes of thermal storage, and ASHPs, storage & electric boilers. This quantitative assessment has been applied to determine the optimum economic option, considering capital costs, replacement costs, energy costs and operational costs.

3. Options Appraisal
3.3 Centralised ASHP – renewable electricity

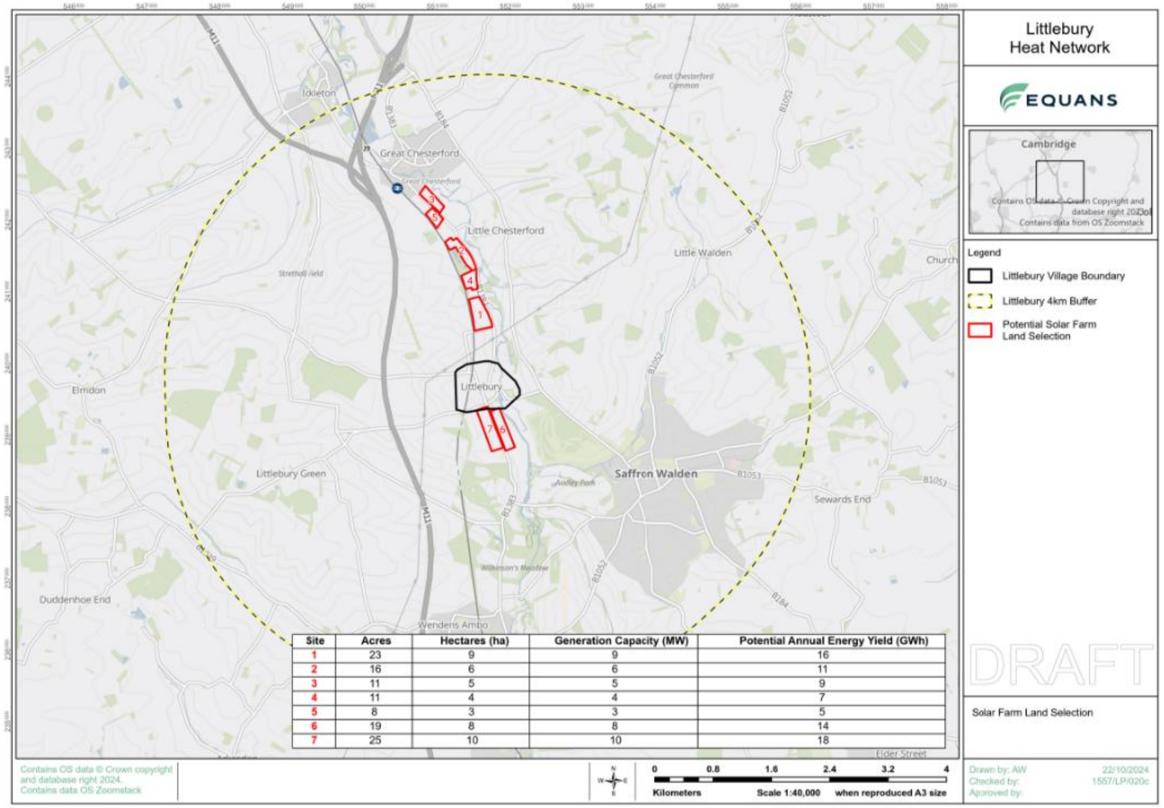
Renewable Electricity Generation

Renewable electricity generation is likely to be a core component of any centralised or hybrid approach to decarbonising heat at Littlebury – when twinned with electrified heat sources (heat pumps, electrode boilers etc.), renewable electricity can directly offset a proportion of grid-based electricity, reducing both cost and carbon emissions.

Centralised heat pumps or electrode boilers (if these are employed) would need substantial amounts of electricity to operate across the course of a typical year. Although there is a clear mismatch between the ‘generation profile’ of solar photovoltaics (PV) and the ‘demand profile’ for heating, a PV array can be sized to meet the energy centre demands in winter, whilst the surplus electricity generated in summer months may be exported to the electricity grid. This can be sold, providing a secondary revenue e.g. during peak generation periods during summer months.

Seven potential solar farm sites have been identified through a preliminary assessment, as shown in the table below.

Site	Acres	Hectares (ha)	Generation Capacity (MW)	Potential Annual Energy Yield (GWh)
1	23	9	9	16
2	16	6	6	11
3	11	5	5	9
4	11	4	4	7
5	8	3	3	5
6	19	8	8	14
7	25	10	10	18

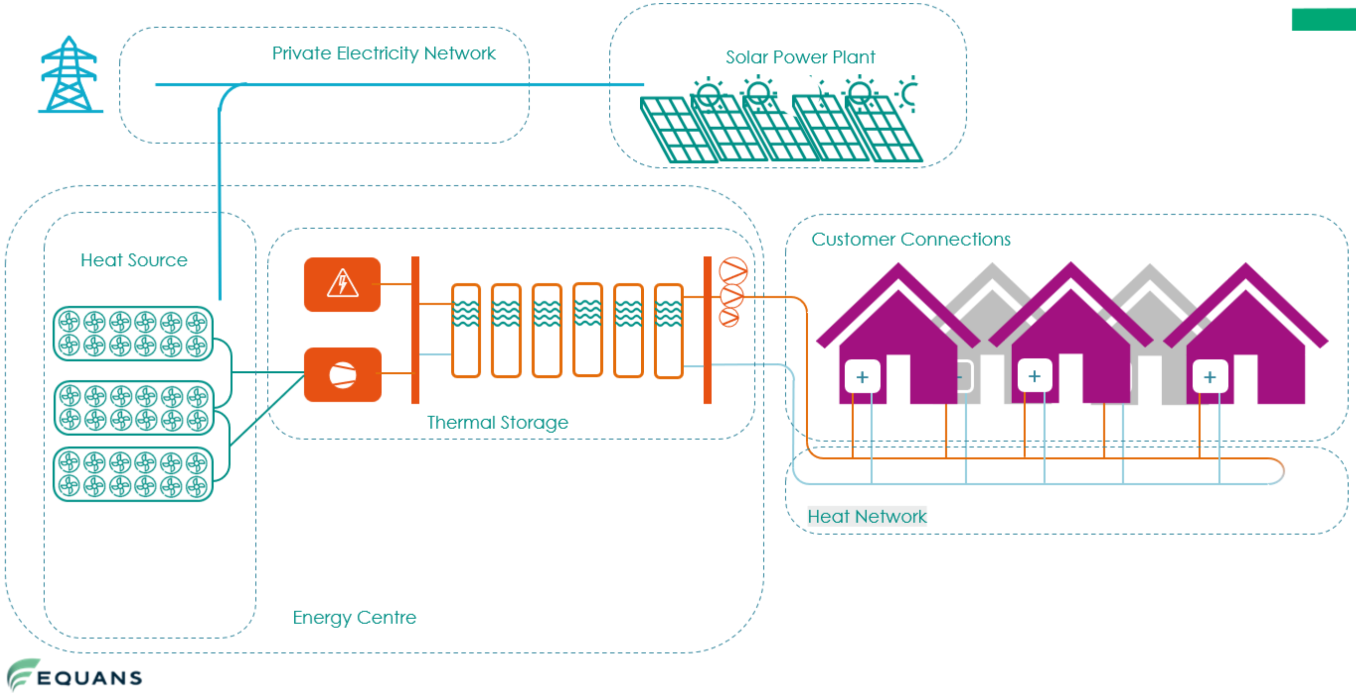


3. Options Appraisal
3.3 Centralised ASHP - system design

Air-source heat pumps
These extract heat from the outside air through the refrigeration process and transfer this to hot water which is then circulated through the heat network to all connected buildings.

Efficiency will vary; performance is lowest during the winter (so highest consumption) and highest during the summer.

Energy Centre
- **Peak Load:** 2.4 MW (full village peak heat demand)
- **Air-source heat pump capacity:** 3 x 500kW (1.5 MW in total)
- **Land Footprint :** approx 700m2



Solar Photovoltaics
- 10MW array
- Approx 18GWh annual energy yield
- Circa 25 acres of land required

A large ground-mounted solar PV array utilizing a private wire connection to the Energy Centre and used directly to operate the ASHPs and Electrode Boiler.

Thermal storage
Thermal Stores: 6 x 50m3 (50,000 litres) 300m3 in total
Used to provide additional capacity to deal with daily heating peaks and allows the heat pumps to operate for reduced hours and enables smaller heat pumps to be used.

Heat Network
Potential operating temperature regime: 70 degC flow and 45degC return (primary heat network)

3. Options appraisal

3.4 Hybrid solution

3.4 Hybrid system - configuration

Potential Configuration

The hybrid approach would consist of a blend of the three different routes to decarbonisation: improving the building fabric and decarbonising the heating system by a) connecting to a heat network or b) installing an individual low carbon heat system. Many properties will be suitable for a low level or a deeper retrofit involving thermal performance upgrades to reduce heating demand, but this will depend upon the individual property construction, current thermal performance, and the willingness of the property occupant to deal with potential disruption and the limited benefit in fuel bill savings relative to the capital outlay required.

This approach on its own would generate only a marginal impact upon the decarbonisation of heating & hot water systems in properties and has a relatively high capital outlay per tonne of CO2 saved (£/tCO2). Properties with existing fossil fuel heating systems or electric heaters (heating types that use electricity on or off-peak but are not air source heat pumps), would need to switch to either a heat network (centralised solution) where heat is supplied from a suitable location close to the village by large heat pumps, or an individual (decentralised) heat pump system to fully decarbonise.

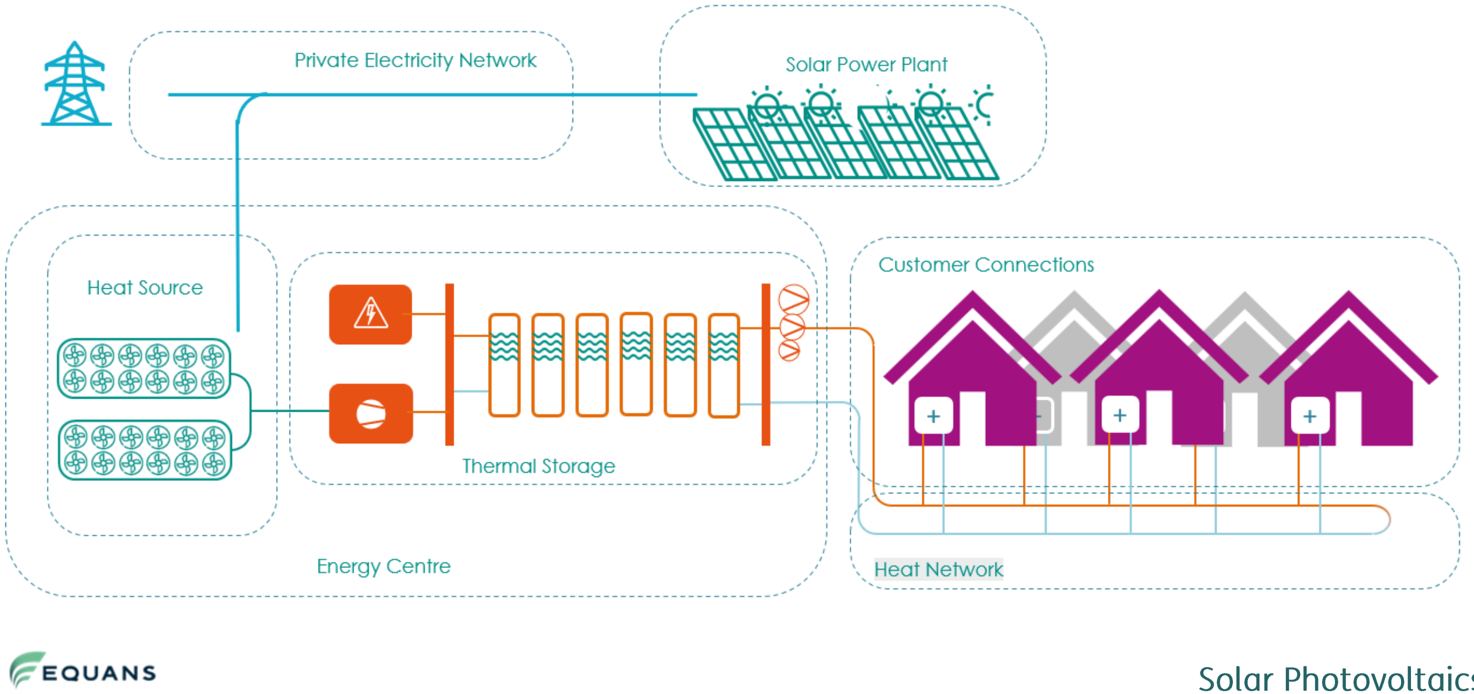
It is acknowledged that for some properties, connecting to the heat network will not be feasible possibly for technical, or economic reasons, or both. Whilst not exclusively, an individual ASHP is likely to be the most suitable retrofit for existing oil-fired or LPG boilers in the majority of cases.

Where the property owner has significant land available, the possibility of implementing a ground source heat pump with boreholes may be available. A GSHP might provide a slight improvement in coefficient of performance (efficiency) and therefore reduced operational energy cost. However, we would consider this saving to be relatively minor (in the region of 10%) compared to an ASHP, and with a substantial capital cost outlay (installed cost typically 2-3 times the cost of an individual property ASHP).

3. Options Appraisal
3.4 Hybrid system - design

Key Changes in hybrid design:
- Only 2 x ASHP (1 MW total)
- Much shorter heat network
- 101 decentralised heat pumps (thus 101 less heat interfaces / network connection points)

Air-source heat pumps extract heat from the outside air through the refrigeration process and transfer this to hot water which is then circulated through the heat network to all connected buildings. Efficiency will be lowest during the winter and highest during the summer.



Energy Centre
- **Peak Load:** 2 MW
- **Air-source heat pump capacity:** 2 x 500kW (1 MW in total)
- **Land Footprint :** approx 700m2

Thermal storage
Thermal Stores: 6 x 50m3 (50,000 litres) 300m3 in total
Used to provide additional capacity to deal with daily heating peaks and allows the heat pumps to operate for reduced hours and enables smaller heat pumps to be used.

Heat Network
Potential operating temperature regime: 70 degC flow and 45degC return (primary heat network)

Solar Photovoltaics
- 10 MW peak solar PV array
- Approx 18GWh annual energy yield
- Circa 25 acres of land required

A large ground-mounted solar PV array generates electricity to run the ASHPs and/or electrode boilers in the energy centre.

3. Options appraisal

3.5 Summary of emerging solution

3.5 Summary: Comparision of emerging solutions

1 Decentralised (Individual) retrofit

Benefits

- Efficient heating systems and fabric improvements mean reduced heating bills and emissions
- Reduced implementation time (relative to a centralised heat network) – bringing benefits immediately
- Grant funding potentially available to offset capital cost for eligible residents

Challenges

- Installation costs vary widely. A deep retrofit may cost tens of thousands of pounds. The cost to electrify the heating system (through an ASHP) still needs to be accounted for on top of fabric upgrades
- Significant complexity in retrofitting historic buildings
- Some properties will require high level of intervention to existing heating to accommodate an ASHP

2 Decentralised + Community Solar

Benefits

- Costs: significantly lower overall capital cost to decarbonise heating across village compared to a fully centralized or hybrid (heat network) solution
- Economies of scale: provides the potential for community to act as a separate entity to procure and deliver decentralized heating, with more advantageous terms relative to individual procurement

Challenges

- Effectiveness of solution is dependent upon the village
- High capital and operational cost overall (including solar)
- Benefit of Solar PV revenue is not directly impacted onto the property owner (unlike Centralised/Hybrid solutions)
- Independent from individual properties; 3rd party investor likely to be required

The decentralised with community solar option is preferred by the community working group. If this option is to be taken forward, the consultancy team recommends further feasibility study with specialists in Private Wire development to understand the costs, appetite and opportunity for investment and delivery.

Summary: Options to decarbonise heating in Littlebury

3 Centralised Heat Network solution

Benefits

- Flexible: A method of decarbonizing heat (than individual) to multiple properties via one project
- Economies of scale: potential to select and install technologies such as heat pumps which are most cost-effective at larger thermal outputs
- Future-proofing: more efficient heat sources can be implemented in the future and the impact felt across the full network
- Economics positively impacted by direct connection of renewable electricity generation

Challenges

- Substantial cost: four key areas, the heat network pipes the Energy Centre, property connections and solar PV array
- Timescales for implementation
- Disruption to village residents and road users during construction

The centralised heat network generates the most favourable economic outcomes in the techno-economic assessment (section 4), though falls short of achieving commercial viability.

If this option were to be pursued, it is recommended further feasibility study to identify full costs of development and overall investment appetite and potential.

4 Hybrid (Centralised and Decentralised) solution

Benefits

- Flexible: Would not require all properties to connect to the centralized / heat network
- Future-proofing: more efficient heat sources can be implemented in the future at the Energy Centre and individually to achieve enhanced operational cost savings (higher system efficiency)
- Economies of scale: Larger heat pumps utilized for network connected properties which are most cost-effective at larger thermal outputs
- Properties on network positively impacted by connected renewable electricity generation

Challenges

- Substantial cost: five key areas: heat network pipes, Energy Centre, property connections. solar PV array and individual heating upgrades
- Timescales for implementation
- Disruption to village residents and road users during construction

4. Techno-Economic Assessment

4. Techno-Economic Assessment
4.1 Objective & Scope

Objective

The overarching objective to the Techno-Economic Assessment is to compare the economic and carbon outcomes of the different project scenarios (central, hybrid and decentralised) through quantitative analysis. The goals of this exercise are to establish the best available option, as well as evaluate the likelihood of commercial viability.

Though this is based on high-level conceptual information, it is hoped that this impartial assessment will be of sufficient rigor to determine which option to proceed with and to aid in establishing funding and development pathways.

Scope

The scope of this exercise comprises the collation and analysis of energy simulation results, whole-life costs and revenues to quantify core economic indices and generate carbon emissions projections.

The assessment provides capital (CAPEX), operational (OPEX), replacement (REPEX) cost projections for each of the three options, as well as energy costs and revenues (ENEX). It considers future inflationary cost impacts, providing both inflated and real-terms economic outcomes.

The assessment also considers a notional 'do nothing' scenario, assuming that no changes are made to the current heating provision and energy demand to the village. Whilst this is of course unlikely (given the assumption that decarbonisation will occur 'at some point in the future'), it provides a yardstick from which each decarbonisation scenario can be compared.

The Techno-Economic Assessment Model

The Techno-Economic Assessment model comprises an advanced excel model, capable of undertaking the necessary analysis to quantify key outcomes. The "TEA" is structured in a clear and logical arrangement, with the objective of being traceable, transparent and replicable.

The model comprises a series of 'project' tabs, each of which contains key cost and energy information for the respective project element. A 'baseline' tab contains the relevant information for the 'do nothing' scenario. A 'universal inputs' tab provides key variables that apply to all projects, such as energy tariffs, carbon emissions factors and inflation assumptions. The 'TEA' tab collates the information from the relevant projects and performs economic and carbon analysis functions. Various graphs and charts have been produced to aid in the appraisal of the modelling outcomes.

A copy of the TEA model is provided as an appendix to this report.

Energy tariff assumptions:

The Treasury Green Book has been used to develop assumptions for energy tariffs that underly the techno-economic assessment model. The Green Book is a guide for government departments on how to appraise and evaluate public policy proposals. It does not predict energy tariffs. The figures in the Green Book are based on the best available evidence and are not influenced by political considerations. It is important to note that energy price projections are just that – projections. They are not guaranteed to be accurate, and prices can change at any time due to a number of external factors.

Using this set of figures allows the model to be replicable and comparable to other projects of its kind.

4.2 Method

Project Scenarios

As discussed in the above sections, there are three fundamental strategic approaches for the decarbonisation of heat in Littlebury, namely decentralised (individual retrofit), centralised (heat network) and hybrid (smaller centralised network and some decentralised properties). Iterative energy simulation and techno-economic modelling has been performed to inform conceptual design and establish optimum cases for both centralised and hybrid project scenarios (whilst individual retrofit has comparatively little scope for iteration).

P1, P2 and P3 of the TEA model presents the whole-life costs (CAPEX, OPEX, REPEX and ENEX (as explained on the following page) for the resultant centralised, decentralised and hybrid Project Scenarios.

An additional scenario has been considered as part of the Techno-Economic Assessment, combining a decentralised / individual retrofit with a community scale renewable electricity generation source (solar PV).

The additional analysis has been performed in order to provide a comparator to the heat network scenarios, which include a solar PV array to provide a proportion of the energy centre's electricity demands.

Whilst the model has been developed to capture this option, the below section does not describe the results, as the scale and funding model for community investment cannot be predicted. The model can however be used by the stakeholders of Littlebury to appraise such an option in future.

Economic Analysis Method

The first stage of analysis the establishment and comparison of 'whole life cost' of each Project Scenario over a 40-year project term (aligned to RCEF and GHNF guidance). Whilst this is devoid of any project financing costs or heat sales, it provides an understanding of the Net Present Value of each Project Scenario, thus an understanding of which scenario is likely to offer best value for money in the short, medium and long-term future. This includes a comparison with the notional 'do nothing' scenario.

Having quantified the whole-life cost, the second stage of analysis comprises an assessment of commercial viability, both to the residents of Littlebury and a notional 'investor'. This analysis includes the sale of heat generated by the centralised and hybrid solution. The tariff and standing charge associated with the heat sale is compared with both the decentralised Project Scenario and 'do nothing' approach. Basic investment metrics, such as Internal Rate of Return and Payback are used as indicators of commercial viability (acknowledging that this is comparatively primitive at this early stage).

4.2 Method

Project Scenarios continued

Overview of Key Modelling Inputs

CAPEX: A capital cost budget has been established for each Project Scenario. This is formed using actual costs from similar projects that Equans has recently delivered (where possible), industry benchmarks and reasonable estimations. The CAPEX includes for all expected costs associated in the design, development and implementation of the project. Though the model includes an option for accounting for VAT, it is assumed that VAT will be recoverable for the centralised and hybrid project scenarios.

OPEX: An annual operational cost budget has been established for each Project Scenario. This comprises all regular costs associated with the maintenance of the assets, licensing and service functions. It is formed from O&M contract costs on similar projects. Likewise, it is assumed that VAT will be recoverable for the centralised and hybrid project scenarios.

REPEX: The REPEX function comprises a forecast of non-routine costs associated with lifecycle replacement of the assets. Such costs are incurred on the year of the forecasted replacement, as opposed to annualised averages (to realise a more accurate Net Present Value projection). These are largely based on estimates, assuming a similar asset cost as the capital cost, with reasonable allowance for installation and commissioning.

ENEX: Energy cost forecasts are derived through multiplication of each annual energy volume output (from the simulation model) by the respective energy tariff (as above). Note that this also includes revenues associated with the export of surplus energy.

Grant CAPEX Offset: Where applicable, a reasonable allowance has been made to capture the potential offset of capital costs through government grants. It is accepted that the level of grant funding awarded to each project cannot be accurately quantified at this early stage in the project's development and should therefore be considered as a key point of sensitivity to be analysed.

Price Inflation: As noted, analysis has been performed in both 'real-terms' and 'inflationary-terms'. For the latter, we have assumed an 'average' general price inflation of 3% and an energy price inflation of 2%. This can be altered, accepting the subjective nature of this variable.

4. Techno-Economic Assessment
4.3 Whole life cost analysis

Cumulative Cash Flow

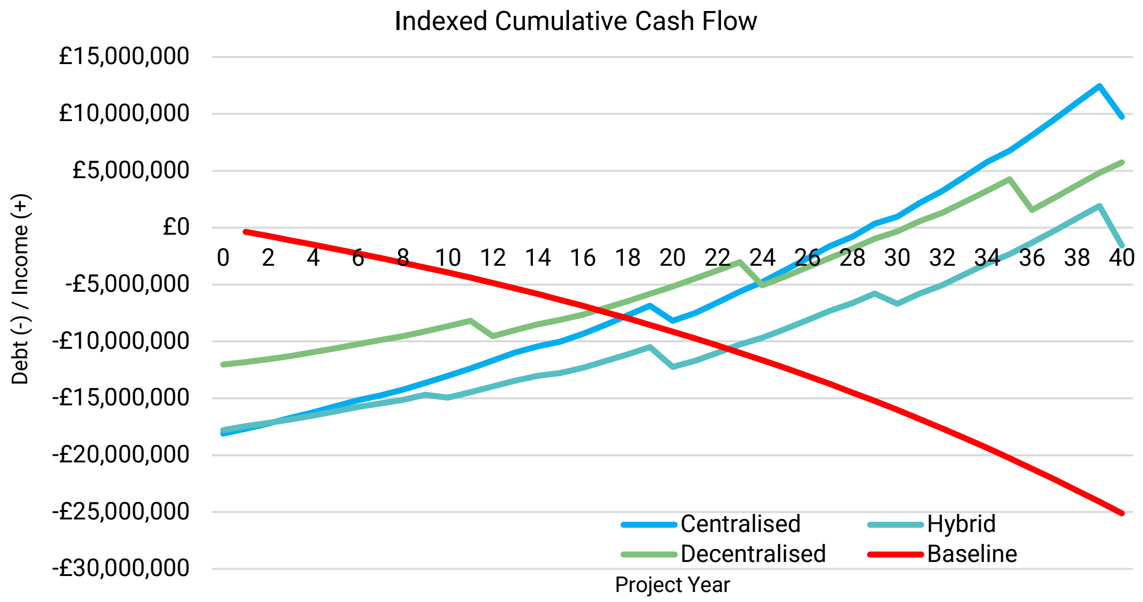
As discussed above, Whole Life Cost Analysis has been performed for the Centralised, Hybrid and Decentralised + Community Solar project scenario's relative to a notional 'do nothing' approach (this is shown as 'baseline' in the accompanying charts).

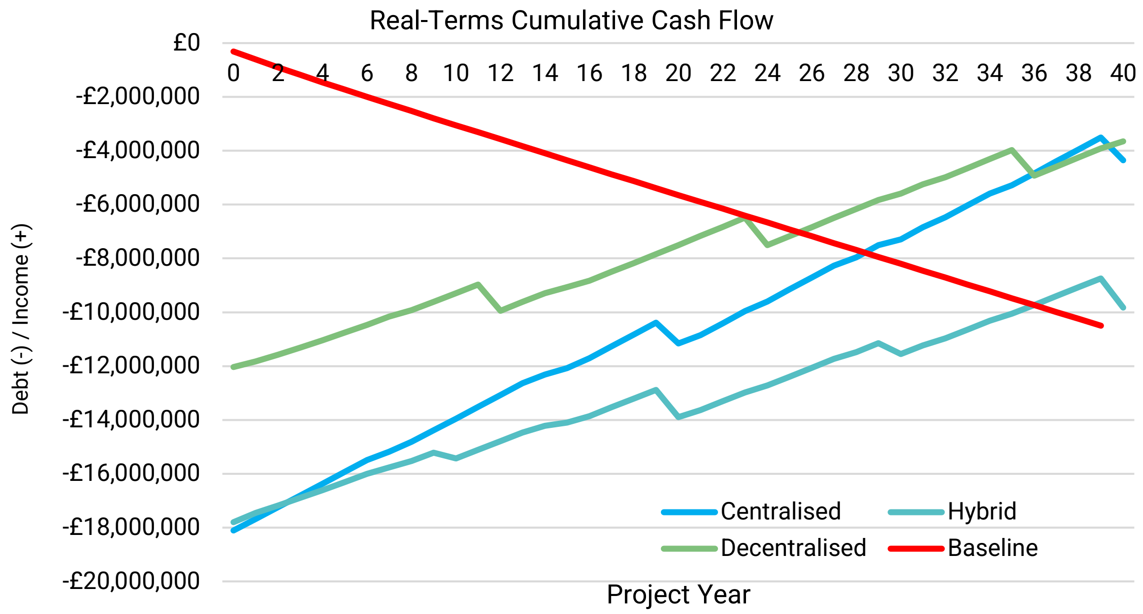
The figures opposite presents line graphs of the cumulative cash flow of each scenario in both indexed and real-terms (over 40-years) respectively. Although not shown directly here (for reasons of simplicity) we have also modelled the core decentralised option – but without the revenue benefit from renewable generation, this would have the highest whole-life cost of all scenarios, and a net operational cost, and as such would appear on the graph as a similar trend-line to the baseline, indicating increasing debt with time.

The revenue generated by the export of surplus electricity offsets the operating cost of the centralised, hybrid and decentralised + solar scenarios resulting in a net operational revenue. This helps to offset the significantly higher capital costs associated with these project scenarios over the long-term future.

This indicates that there would be a theoretical real-terms 'payback' of the additional capital investment of the centralised, hybrid scenarios of approximately 27 years, and 32 years respectively. The indexed 'payback' occurs in years 18 and 21 respectively. For the decentralised + solar scenario, the indexed payback is 30 years but there is no payback in real-terms within the project lifetime

The centralised solution is shown as having a marginally lower whole-life-cost than the decentralised + solar solution with the hybrid solution higher than both.





4.3 Whole life cost analysis

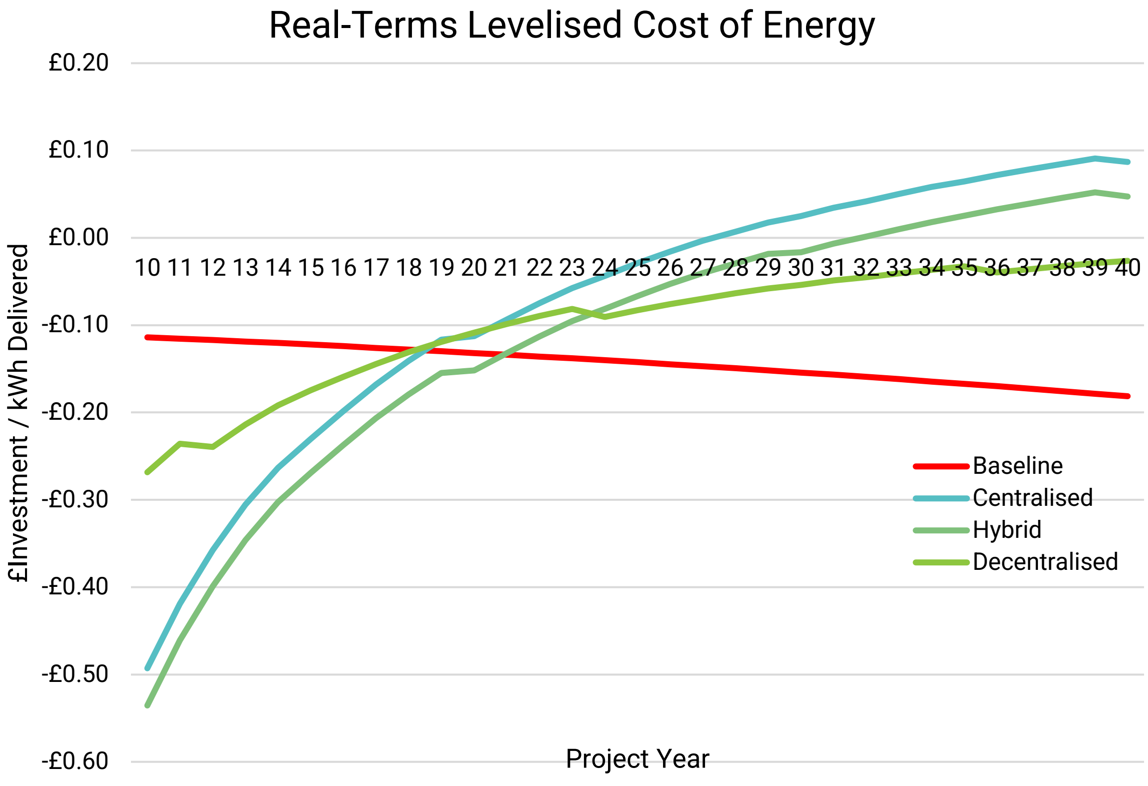
Levelised Cost of Energy

The Levelised Cost of Energy (LCOE) is the summation of all costs associated with an energy generation project divided by the total volume of delivered energy over its lifetime. It is a useful indicator in comparing the economic viability of options, as it normalises the scale of investment and return and offers an understanding of the true cost energy delivered by a system.

LCOE assessments (both real-terms and indexed) of each Project Scenario have been performed. Whilst the project life is deemed to be 40 years, the LCOE has been performed on an annual incremental basis, to understand the 'curve' over time – the total volume of energy delivered over time increases, as does the proportionate impact of OPEX, REPEX and ENEX, whilst the proportionate impact of capital cost diminishes, thus typically resulting in a gradual reduction in LCOE.

Consistent with the whole-life-cost assessment above, this reveals the LCOE of the decentralised option as being higher than the two other scenarios over the long-term. This is to be expected, as whilst the decentralised option yields an operational 'cost', the two other options yield operational 'revenue', thanks to the income from surplus electricity export.

The LCOE of the notional 'do nothing' scenario is of key importance, as it provides a benchmark from which all project scenarios can be compared. This could be used to inform a notional 'heat tariff' for either a centralised or hybrid solution – simplistically, if the 'heat tariff' is set at a higher rate than the 'do nothing' LCOE, the long-term cost of heat to the consumer would proportionately increase and vice versa. Similarly, if the 'heat tariff' of either centralised or hybrid options was set at a lower rate than the decentralised project scenario LCOE, this would represent a saving to the consumer compared with the decentralised option.



Real-terms LCOE at Years 10, 20, 30 and 40

Year	Centralised	Hybrid	Decentralised + Solar
10	£0.49	£0.54	£0.27
20	£0.11	£0.15	£0.11
30	£0.03	£0.00	£0.05
40	-£0.09	-£0.05	£0.00

4.3 Whole life cost analysis

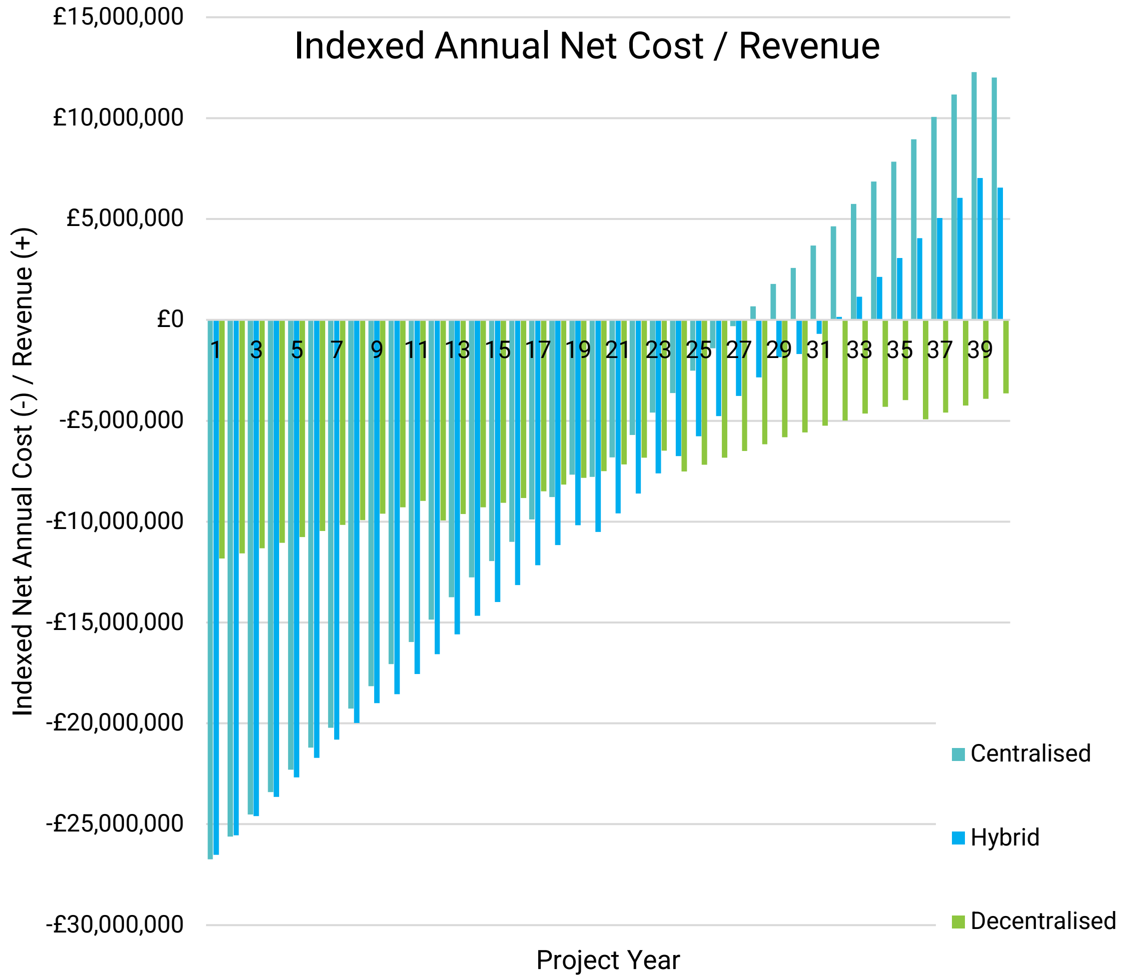
Net Present Value

Net Present Value (NPV) is a financial metric used to evaluate the profitability of an investment or project. It represents the difference between the present value of cash inflows and the present value of cash outflows over a specific time period. NPV helps investors understand the value of future cash flows in today's terms, considering the time value of money (the idea that money today is worth more than the same amount in the future due to its earning potential).

This is a useful metric in comparing projects of this nature, as it accounts for the future depreciation in the value of money over time. Given the term over which the projects are being appraised and the significant differences in financial outlays, NPV may yield a different conclusion to the above LCOE and CCF assessments. Note that a notional discount rate (the rate of depreciation of currency over time) is set at 3%. This variable can be adjusted within the TEA model for further sensitivity analysis.

The figure on the right shows the NPV of the Centralised, Hybrid and Decentralised + Solar scenarios on an annual basis over the 40year project life. As can be seen, this shows that the net present value of all three Project Scenarios remains negative up until year 28, when the Centralised scenario becomes positive. The NPV of the decentralised option remains lower for the first 20 years, consistent with the whole-life-cost analysis. However, both the hybrid and centralised options have a significantly lower NPV over the 40-year term, with both of these breaking even around years 28 and 32 respectively.

It is reminded that this does not consider any revenue associated with heat sale, which is performed in the following step.



4.4 Heat sale

Basis of Analysis

As may be expected, the commercial viability of a heat network of this nature relies upon the sale of heat to offtakers (in this case, the residents). The energy tariff to be paid by the offtaker must be sufficiently competitive when compared with alternative options in order for the offtaker to be willing to connect and in order to comply with relevant codes of practice and standards, as well as the Energy Act (2023) and Heat Networks Technical Assurance Scheme.

The above analysis concludes that both the centralised and hybrid project scenarios have a lower LCOE and whole-life-cost than either decentralised scenario. Indeed, they also have a lower LCOE than a notional 'do nothing' scenario. This is important, as it provides indication of the tariff level that could be set for the sale of heat, which of course must be higher than the LCOE of the heat network in order to achieve a return on investment (though must also be lower than the LCOE for the counterfactual options to the offtaker).

The financial viability or 'investability' of a project of this nature is driven by financial market conditions and individual investor requirements, thus cannot be objectively assessed. However, it is of course clear that key metrics, such as Internal Rates of Return, Net Present Value and Return on Investment must be 'positive', in order to be potentially 'investable'. The returns are of course highly dependent on the income from heat sale, which is a product of (a) the volume of heat delivered and (b) the tariff at which the heat is sold.

An initial series of heat tariff scenarios have been performed to gain an understanding of the likelihood of being both competitive to the consumer and commercially viable for the investor.

These scenarios include the following:

1) Tariff set at 40yr LCOE of 'do nothing' – this means there's no long-term additional cost to the consumer compared with continuing without change

2) Tariff set at 40yr decentralised scenario – this means there's no long-term additional cost to the centralised / hybrid solution over the decentralised option

3) Tariff set at annual LCOE of 'do nothing' – this is similar to option 1, though instead of considering the long-term LCOE, the effective 'cost per kWh of heat delivered' during that year is equal to that of the 'do nothing'. This means that there is literally no additional cost to the consumer in moving to the heat network.

Analysis of these heat tariff scenarios have been performed in both 'real-terms' and 'indexed' to provide an understanding of the impact of inflation on the economic outcomes.

The outcomes of these scenarios are presented on subsequent pages.

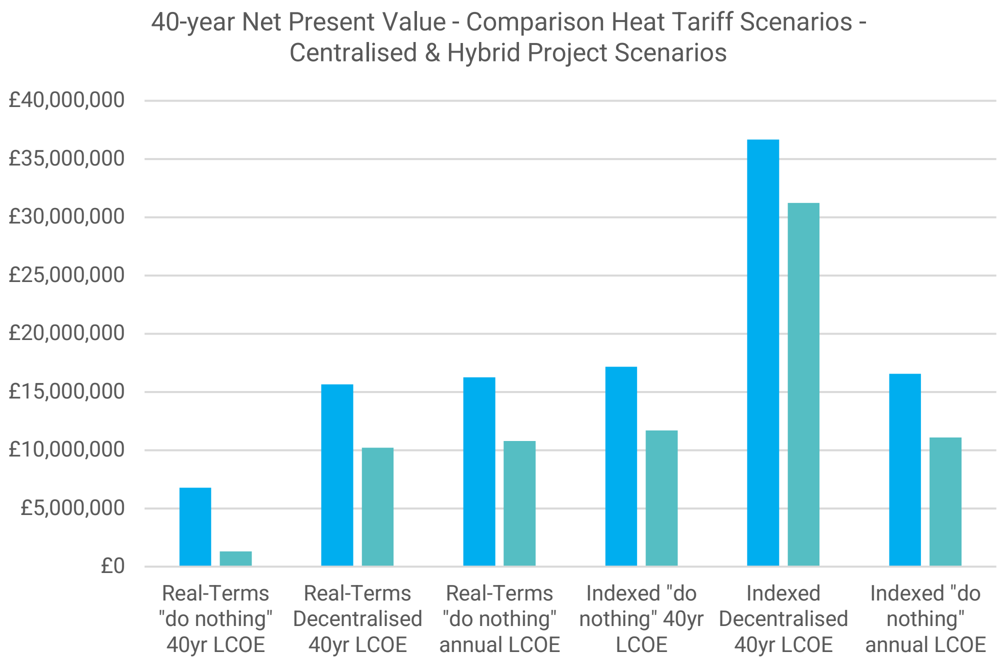
4.4 Heat sale

Net Present Value

As can be observed, the Net Present Value of both centralised and hybrid Project Scenarios is positive across all heat tariff scenarios, though the centralised project scenario's NPV is consistently higher.

As may be expected, the 'indexed' heat tariff scenario consistently yields a higher NPV result, owing to the fact that this accounts for the inflationary increase in heat tariff and other operating costs and revenues over the project life. However, whilst inclusion of indexation is viable for some economic metrics, this contravenes the purpose of NPV and may be challenged. Notwithstanding, the real-terms NPV on both the decentralised and "do nothing" annual LCOE are relatively substantial.

	Net Present Value	
Heat Tariff Scenario	**Centralised**	**Hybrid**
Real-Terms "do nothing" 40yr LCOE	£6,769,143	£1,302,854
Real-Terms Decentralised 40yr LCOE	£15,664,347	£10,198,108
Real-Terms "do nothing" annual LCOE	£16,262,958	£10,796,720
Indexed "do nothing" 40yr LCOE	£17,163,568	£11,697,362
Indexed Decentralised 40yr LCOE	£36,684,143	£31,218,068
Indexed "do nothing" annual LCOE	£16,549,663	£11,083,451



4.4 Heat sale

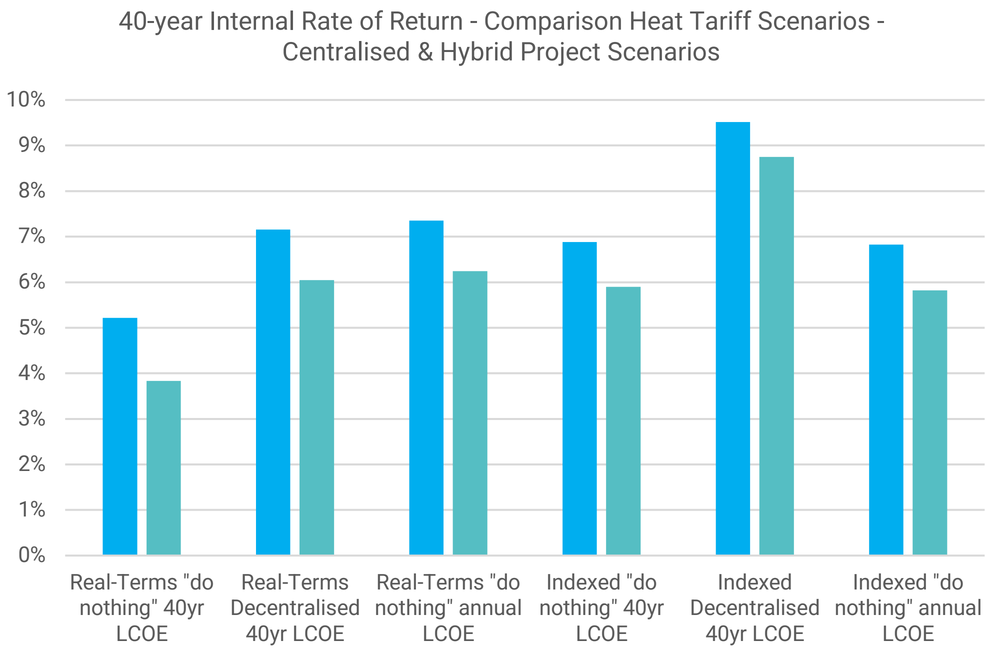
Internal Rate of Return

Consistent with the NPV, the indexed Internal Rate of Return of both centralised and hybrid Project Scenarios is positive across all heat tariff scenarios, though the centralised project scenario's NPV is consistently higher.

Likewise, consistent with the NPV, the IRR across decentralised LCOE and "do nothing" LCOE heat tariff scenarios are most positive, consistently yielding 7% and 6% across the centralised and hybrid project scenarios.

Whilst they are positive, it should be noted that funders might typically expect higher Internal Rates of Return on such a long-term investment. The IRR over shorter timescales will be significantly lower and may fall short of typical investment criteria – this should be appraised as a further modelling iteration, should a these options be pursued further.

	Indexed Internal Rate of Return	
Heat Tariff Scenario	**Centralised**	**Hybrid**
Real-Terms "do nothing" 40yr LCOE	5%	4%
Real-Terms Decentralised 40yr LCOE	7%	6%
Real-Terms "do nothing" annual LCOE	7%	6%
Indexed "do nothing" 40yr LCOE	7%	6%
Indexed Decentralised 40yr LCOE	10%	9%
Indexed "do nothing" annual LCOE	7%	6%

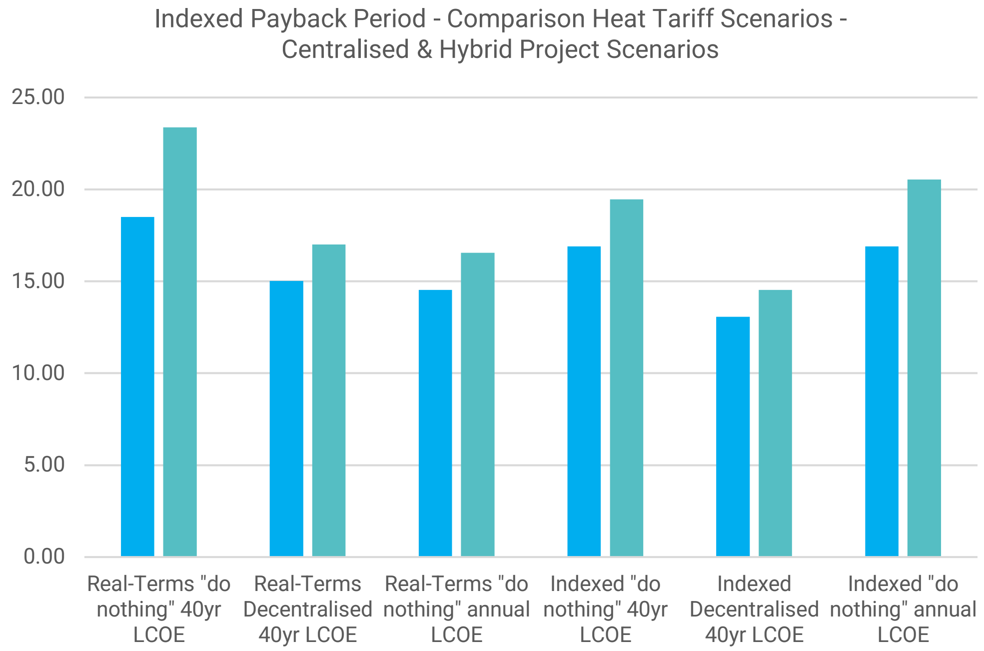


4.4 Heat sale

Payback Period

The indexed payback periods across all heat tariff options and on both centralised and hybrid project scenarios are 'reasonable', ranging between 13.07 years and 23.38 years. Generally, a payback period of less than 15 years for a project of this scale and type might be considered as a reasonable upper threshold.

	Payback Period (years)	
Heat Tariff Scenario	**Centralised**	**Hybrid**
Real-Terms "do nothing" 40yr LCOE	18.50	23.38
Real-Terms Decentralised 40yr LCOE	15.02	17.01
Real-Terms "do nothing" annual LCOE	14.53	16.56
Indexed "do nothing" 40yr LCOE	16.90	19.45
Indexed Decentralised 40yr LCOE	13.07	14.53
Indexed "do nothing" annual LCOE	16.89	20.53



Conclusive Remarks

Whilst both the centralised and hybrid heat network project scenarios appear to be more economically attractive than counterfactual options, the viability of these options depends wholly on the viability for commercial investment.

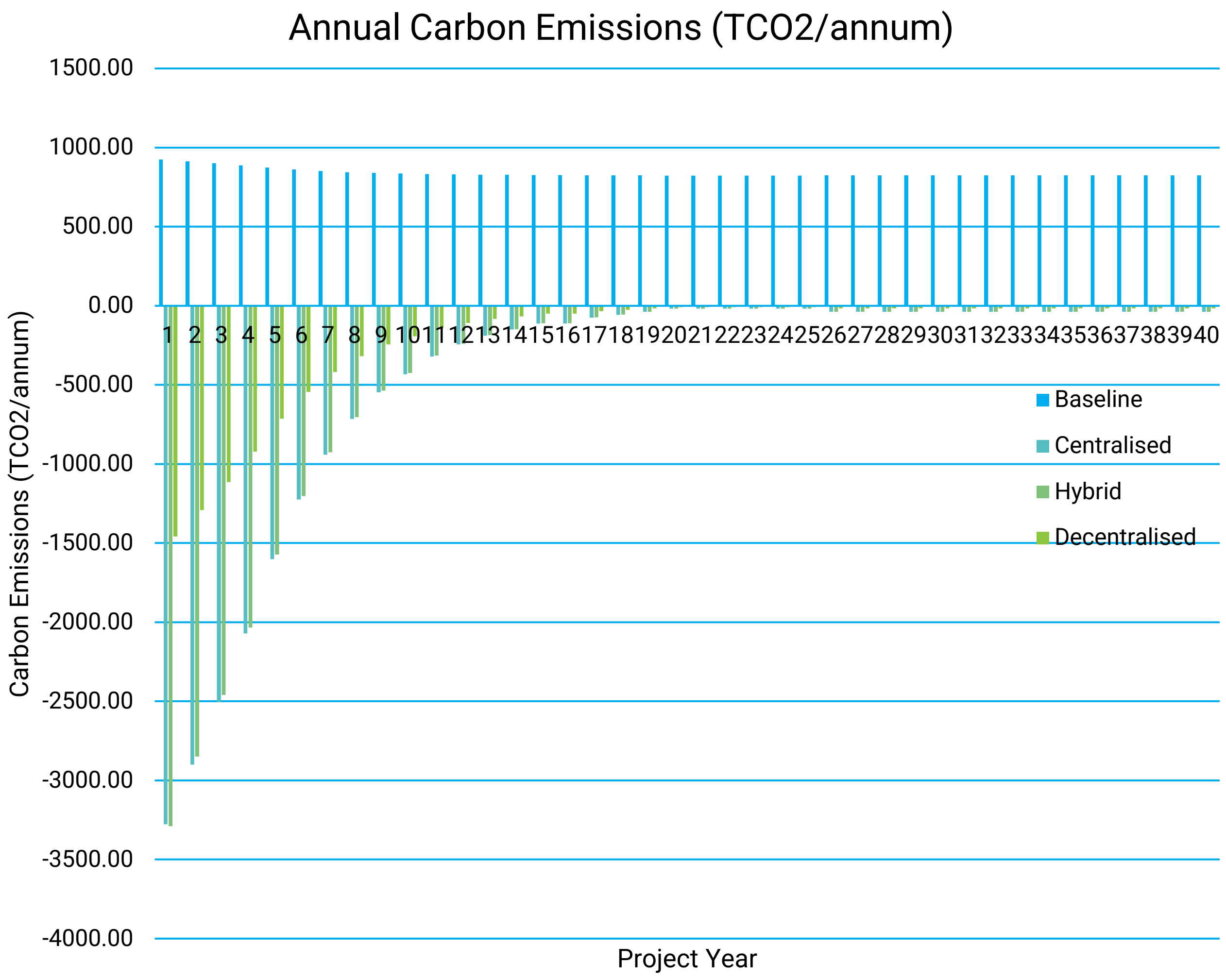
The initial outcomes of this Techno-Economic Assessment model suggest that there is a low probability that the project could achieve nominal investment thresholds. Achievement of nominal investment thresholds would rely upon optimisation and refinement of the design, detailed cost modelling and investment structuring, which is beyond the scope of this initial study. Further refinement of the engineering solution, sensitivity modelling and a more sophisticated economic assessment may be performed to improve viability.

4.5 Carbon abatement potential

Annual Carbon Emissions Forecast

The figure opposite provides a forecast of annual carbon emissions projections for each Project Scenario. As may be expected, the "do nothing" baseline scenario has significantly higher annual carbon emissions throughout the project life and remains consistent, whereas the decentralised project scenario shows a rapid decline in carbon emissions to 'near zero', thanks to the forecasted decarbonisation of the GB electricity grid.

Both the centralised and hybrid project scenarios have negative carbon emissions from year 1 and throughout the project life. This is due to the export of renewable electricity (zero-carbon) to the GB electricity grid, thus displacing carbon emissions born from fossil-based electricity generation sources. This too declines over the first few years, as the carbon intensity of the GB electricity grid falls (so does the displaced carbon emissions).



4. Techno-Economic Assessment

4.5 Carbon abatement potential

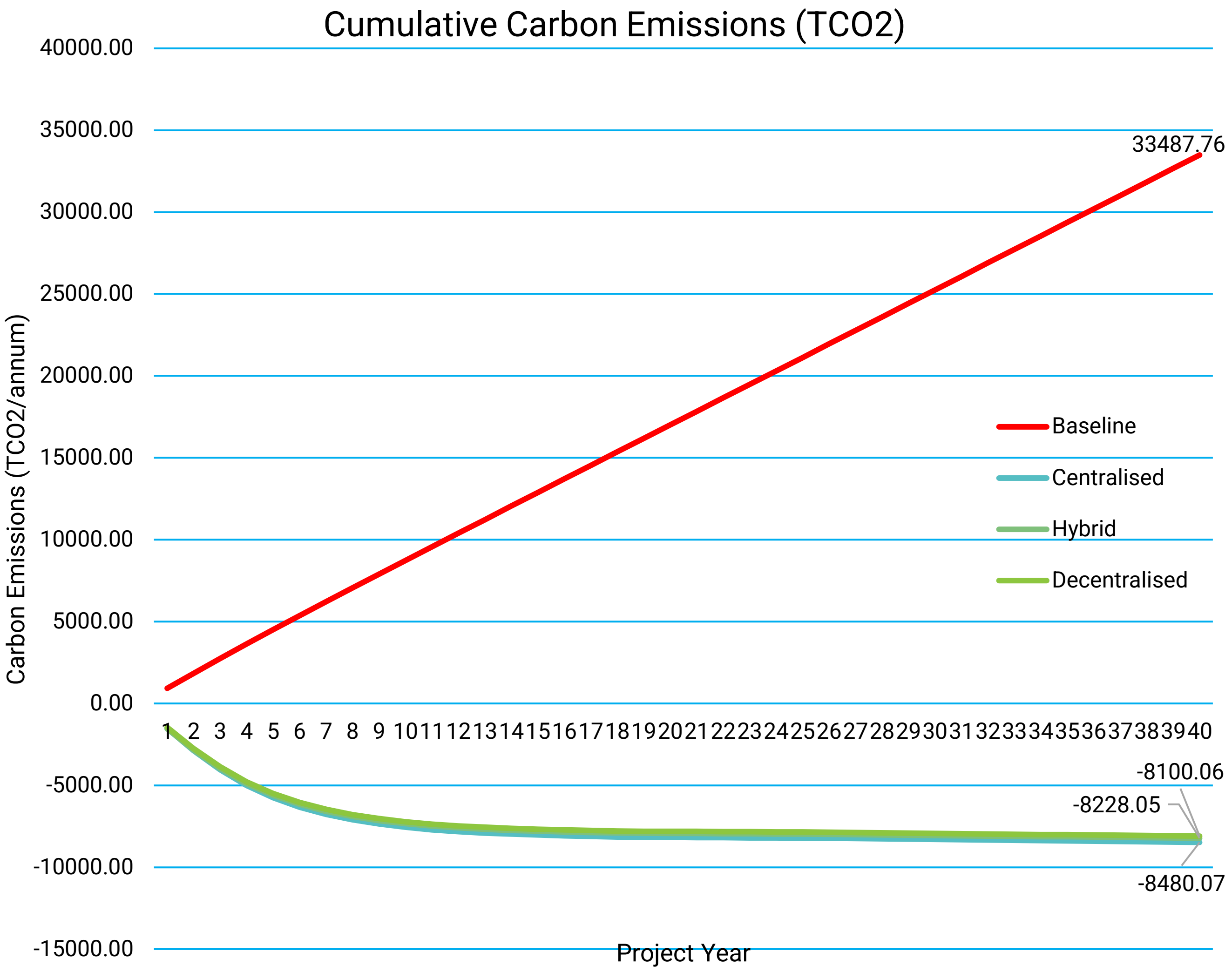
Cumulative Carbon Emissions Forecast

The figure opposite presents the cumulative carbon emissions of each project scenario over the project life. The results and observations are of course consistent with the annual forecast.

This analysis amplifies the significant differences between each project scenario over the long-term. A 'do nothing' (baseline) scenario results in carbon emissions totalling 33,488TCO_2, whereas the three scenarios provide broadly similar savings overall:

- Centralised: 8,480 TCO_2
- Hybrid: 8,480 TCO_2
- Decentralised (+ solar) : 8,100 TCO_2

Of course, the centralised and hybrid project scenarios generate over 100% saving, notionally at 125% and 126%!



5. Delivery considerations

5.1 Planning and permitting

5. Delivery considerations
5.1 Planning and permitting

Planning requirements

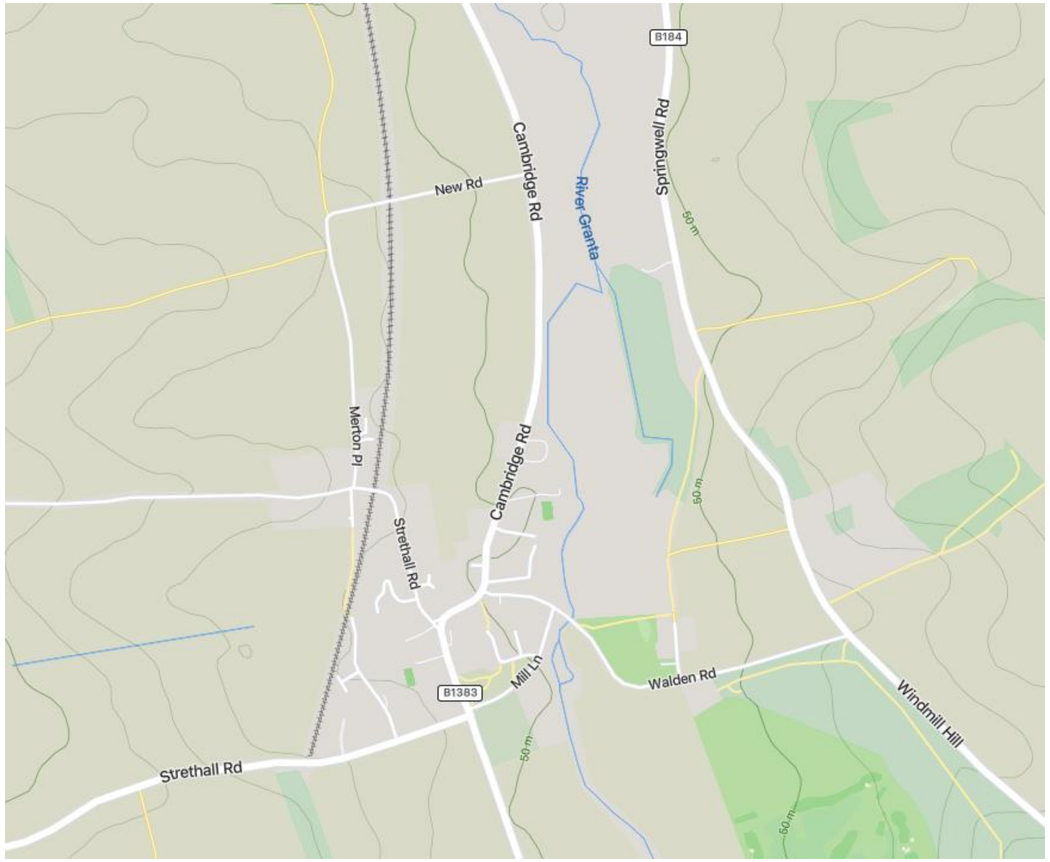
Determining if planning permission is required is a vital step for this feasibility study. Generally, local planning authorities are supportive of renewable and low carbon development and should support community-led initiatives. The local planning authority for Littlebury is Uttlesford District Council who will likely be supportive of a community renewable heating project. Uttlesford District Council have expressed an interest in providing a pre-application review in support of SWCE creating a scheme that achieves planning permission.

For this planning review, the Littlebury energy project is defined as being able to supply energy in the form of heat from either a centralised heat network or from individual packages of heat pumps and energy efficiency upgrades. Whilst Littlebury does have a river, the river Cam, is too small and slow flowing to support a water source heat pump solution. This project will aim to supply approximately 250 homes within Littlebury with renewable low carbon heating from centralised ASHPs.

An energy centre is a small building located based on the requirements of the energy source. As such, an energy centre will require planning permission. This report will outline factors that could influence the either the location of an energy centre or planning permission. Additional Planning considerations for individual home retrofits were discussed in section 3.1.

Planning history of Littlebury

A review of the Uttlesford District Council Planning Register showed that the Parish of Littlebury received 192 planning applications between June 2019 and August 2024. Most applications were extensions on minor alterations at a household level, 34 planning applications were for listed buildings. There were no Major planning applications within Littlebury during this time period.



Map of Littlebury Village. Source: Mapbox

5. Delivery considerations
5.1 Planning and permitting

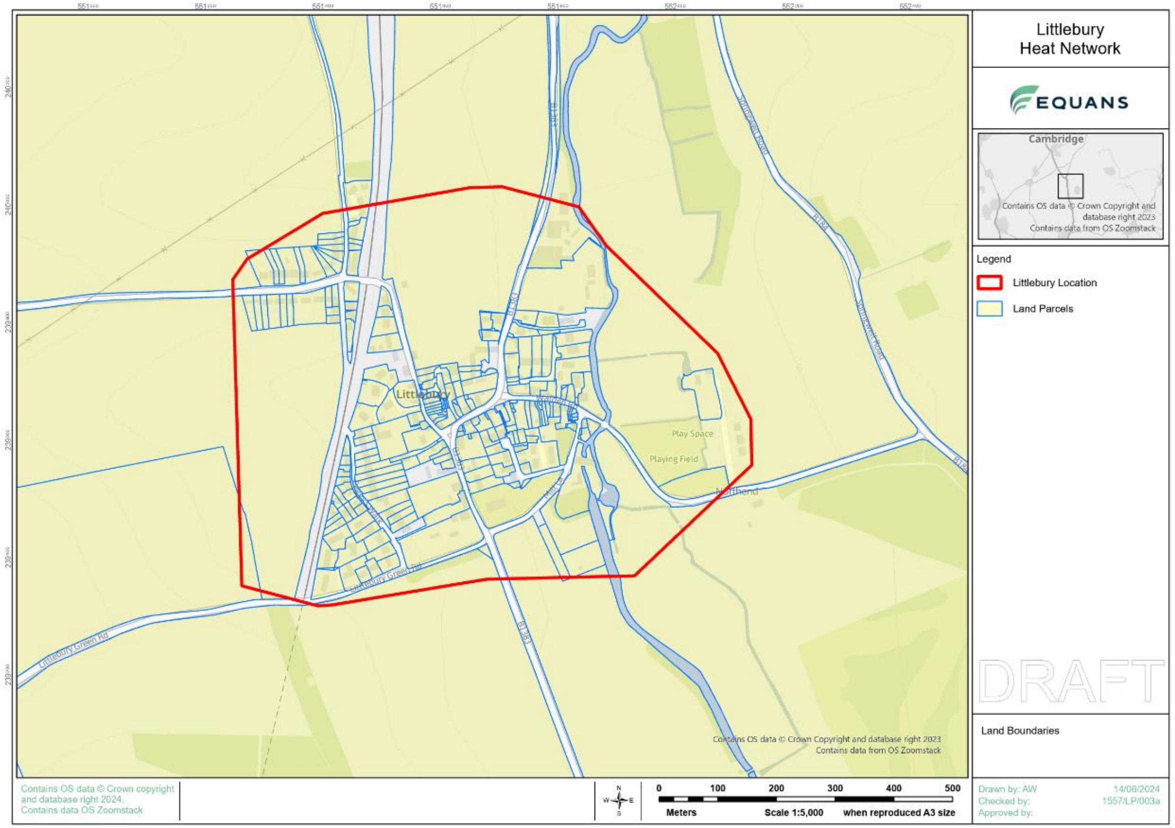
Local Planning Context

Littlebury, is located within Uttlesford District and Essex County. The district is governed by Uttlesford District Council and Littlebury Parish Council. The planning policies for this district are determined primarily by the Statutory Development Plan of which the Districts Local Plan is a key policy document. The latest version of the local plan was adopted in 2005. A new local plan is not likely to be adopted during the planning permission period, as the draft local plan is currently at Regulation 18 stage. Consequently, the current local plan will be an important policy document throughout the planning process for this feasibility study. However, the relevant policies of the emerging draft local plan and current adopted local plan have been assessed within this section to provide a thorough landscape level policy review.

The Localism Act 2011, aimed to empower local communities to shape planning in their neighbourhoods. This can be done through the creation of a Neighbourhood Plan. Littlebury does not currently have a Neighbourhood Plan designation. However, the local community are seriously considering producing a local plan with the aim of limiting development surrounding Littlebury.

In 2009 Littlebury Parish Council published a Parish Plan with an action to ensure local residents are aware of grants for installing/improving insulation. This project will aim to provide affordable and low carbon decentralised heating within Littlebury or provide individual packages of energy efficiency upgrades supported by air source heat pumps. The installation of individual energy efficiency packages would support the actions and needs identified within the Littlebury Parish Plan.

The map below shows Littlebury, outlined in red within the context of land parcels, shown by the blue lines, that are registered (with the UK Land Registry) within the village boundary. A scale is shown to the bottom right.



5. Delivery considerations
5.1 Planning and permitting

Essex Net Zero Policy Position

The Net Zero Policy Position was published in November 2023 and set out Essex County Council's position on net zero. The council aims for new development to be net zero in operation and for new developments to minimise embodied carbon emissions throughout the building's life cycle.

To achieve this two policies have been recommended for review and recommendation, policy NZC1 and NZC2.

NZC1 states 'All new buildings must be designed and built to be Net Zero Carbon in operation. They must be ultra-low energy buildings, fossil fuel free, and generate renewable energy on-site to at least match annual energy use.'. Additionally, the policy sets minimum targets of:

- Space heating demand 15 kWh/m2 GIA or 20 kWh/m2 GIA for bungalows.
- Developments are fossil fuel free.
- Energy use intensity of 35 kWh/m2 GIA for residential developments, 70 kWh/m2 GIA for offices, 65 kWh/m2 GIA for schools and 35 kWh/m2 GIA for light industrial buildings.
- Generate at least 80 kWh/m2 of renewable energy or 120 kWh/m2 for industrial buildings.

NZC2 which states proposals for new large-scale developments to submit a whole life carbon assessment and demonstrate applicable whole life carbon targets have been achieved.

NZC1 and NZC2 are set to become 'interim Placeholder Policy', as yet it is unclear if the policy will be achievable.

Whilst this policy would only apply to new developments it indicates Essex Country councils' commitment to achieving net zero housing in operation. As such, the retrofit of a large-scale energy efficiency and heating project within Littlebury should be supported at a County level.

Uttlesford Climate Change Strategy

The climate change strategy sets Uttlesford District Councils priority actions to address climate change and its associated impacts. The relevant priorities from the strategy are zero carbon buildings, reducing energy use from existing buildings and Energy conservation.

As a new heat network within Littlebury would help to reduce carbon emissions from heating, it will help to achieve the relevant priorities from the Climate Change Strategy. Individual home retrofit solutions will also support carbon emissions reductions and contribute to the realisation of this strategy.

Additionally, the reduction of energy consumption as a key priority within the Uttlesford Climate Change Strategy should support individual packages of energy efficiency and heating retrofitting to reduce energy demand and thus consumption.

5. Delivery considerations

5.1 Planning and permitting

Uttlesford Adopted Local Plan (adopted 2005)

The key policies relating to the construction of an energy centre within the Uttlesford Adopted Local Plan are:

GEN2 – Design

GEN3 – Flood protection

GEN4 – Good Neighbourliness

GEN5 – Light pollution

GEN7 – Nature conservation

ENV1 - Design of Development within Conservation Areas

ENV11 - Noise Generators

ENV12 – Protection of Water Resources

ENV15 - Renewable Energy

Policy support

Policy ENV15- Renewable energy states:

'Small scale renewable energy development schemes to meet local needs will be permitted if they do not adversely affect the character of sensitive landscapes, nature conservation interests or residential and recreational amenity.'

As the proposed heat network will service Littlebury on a small scale to reduce heating costs and carbon emissions from heating within the village policy ENV15 should support the creation of a heat network.

As Littlebury has a historic character and is partially protected by the designation of a conservation area a new energy centre may have to respect the character of Littlebury by being designed in keeping with the surrounding area.

Should the energy centre be located within the conservation area the Uttlesford Local Plan policy ENV1 states:

'Development will be permitted where it preserves or enhances the character and appearance of the essential features of a Conservation Area, including plan form, relationship between buildings, the arrangement of open areas and their enclosure, grain or significant natural or heritage features.'

As such should the energy centre be located within the conservation area and preserve or enhances the character of Littlebury it will be supported. However, we would recommend construction an energy centre outside of the conservation area as the shape and form of the energy centre may visually impact Littlebury.

5. Delivery considerations
5.1 Planning and permitting

Policy risks

The Uttlesford local plan sets general policy points that development within Uttlesford should comply with. The relevant policies for an energy centre are GEN2-7.

GEN2

Policy GEN2 sets standards of design for new developments to meet, new development should be in keeping with surrounding buildings, safeguard environmental features within its setting, meet the reasonable needs of the developments users, reduces the potential for crime, minimises water consumption, has regard to supplementary planning guidance, reduces waste production and encourages reuse and recycling, minimises environmental impacts, on neighbouring buildings, and a development would not impact the privacy, daylight views or overshadow existing buildings. Policy GEN2 also requires development to minimise energy consumption, therefore, the retrofitting of homes within Littlebury to improve energy efficiency should be supported as this will reduce energy use.

GEN3

Policy GEN3 relates to flood risk and stages that development will not be permitted within a floodplain unless exceptionally needed. The policy further states the where development is in an area of flood risk a flood risk assessment should be conducted, and the results of the FRA would impact planning permission being granted. The policy also states where outside of a flood risk area a development may not increase the flood risk in surrounding areas.

Additionally, paragraphs 165 and 167 of the National Planning Policy Framework states that development should be located away from areas of flood risk. However, paragraphs 169 and 170 state that where it is not possible for development to be re-located an exception test, informed by a site-specific flood risk assessment can be applied. Consequently, the development should be designed to pass both sections of an exemption test which are:

a) 'the development would provide wider sustainability benefits to the community that outweigh the flood risk; and'

b) 'the development will be safe for its lifetime taking account of the vulnerability of its users, without increasing flood risk elsewhere, and, where possible, will reduce flood risk overall.'

This development's use as an energy centre and impact that a loss of function could have on the health and wellbeing of Littlebury should the site flood is likely to be a significant consideration at planning.

Any proposal brought forward to planning within an area of flood risk should ensure there is significant flood mitigation measures as well as a flooding strategy to prevent system disruptions.

5. Delivery considerations
5.1 Planning and permitting

GEN4

Policy GEN4 relates to the impact a development could have on surrounding buildings. For an energy centre the key consideration is a) noise or vibrations generated. As such any new energy centre should consider the impact of noise and vibration on the surrounding area and mitigate any of these impacts.

GEN5

Policy GEN 5 relates to light pollution and states development that includes a lighting scheme will not be permitted unless:

a) The level of lighting and its period of use is the minimum necessary to achieve its purpose and

b) Glare and light spillage from the site is minimised.

GEN7

Policy GEN 7 states Development that would have a harmful effect on wildlife or geological features will not be permitted unless the need for the development outweighs the importance of the feature to nature conservation.

Any heat network development is not likely to have a negative impact on existing nature, however, should ground or water source heating be used to supply the heat network measures should be taken to minimise the impact on geology and the natural environment.

Should an energy centre comply with the General policies from the Uttlesford adopted Local Plan it should not be prohibited as policies ENV15 is supportive of the installation of small-scale renewable energy infrastructure and the GEN policies do not prohibit an energy centre's construction.

Further Policy opportunities

Whilst only policy ENV15 expressly supports renewable energy infrastructure within the adopted local plan, Core Policy 25 and Core policy 62 of the emerging local plan should be supportive of the development of a heat network within Littlebury.

Core Policy 25 supports renewable energy infrastructure stating:

'The Council supports proposals for renewable and low carbon energy generation and distribution networks. Particular encouragement will be given to community led schemes with evidence of community support along with local energy sharing schemes, and battery storage.'

Furthermore, paragraph 9.30 of core policy 22 states extensions and conversions will be built to minimum fabric standards to improve energy efficiency. Whilst not a policy paragraph 9.30 indicates the council intention to upgrade existing housing stock.

As the development of a heat network would be a community-led distribution network with energy efficiency upgrades, the District Council should be supportive of this proposal.

Additionally, policy 62 surrounds the historic environment, as Littlebury has a significant number of listed buildings that would need to be connected to a new network listed building protection could influence policy. However, within paragraph 11.69 the council have stated renewable energy infrastructure upgrades to historic buildings will be approached positively, limiting the potential number of buildings that could not be connected to a heat network.

5. Delivery considerations

5.1 Planning and permitting

Historic listed buildings

Littlebury is a historic village within Uttlesford District Council with 44 listed buildings and a protected Conservation area. The map to the right displays the conservation area in green and listed buildings as purple and yellow dots.

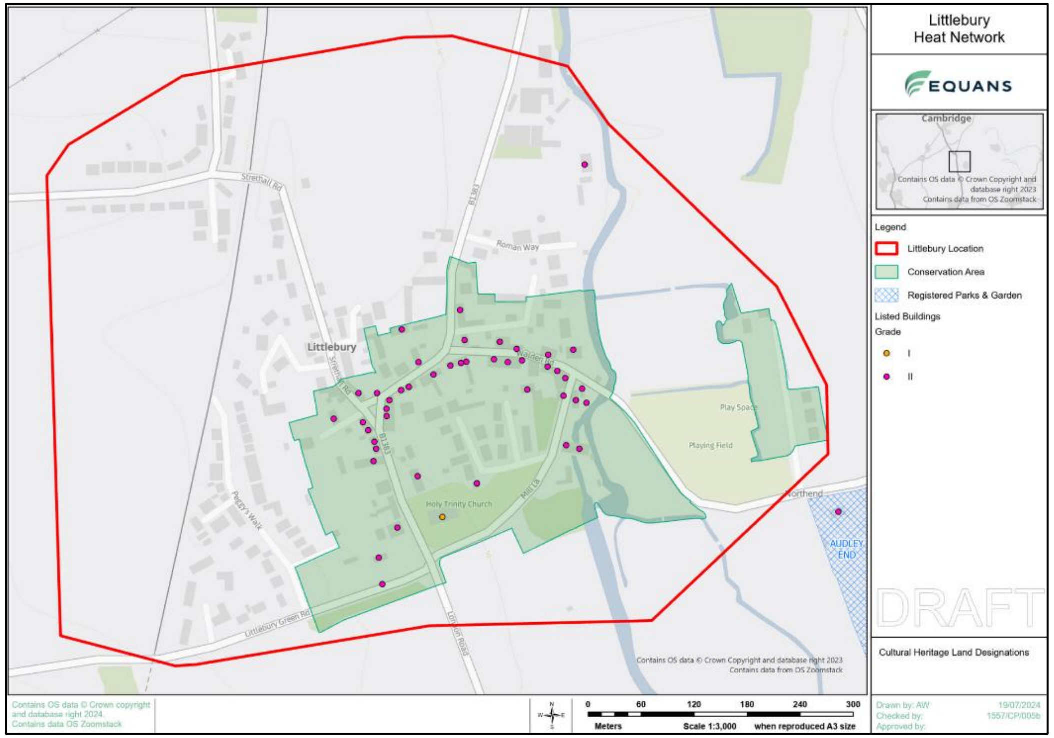
Listed buildings have statutory protections and there will be planning restrictions placed on any development forming part of a heat network. Consequently, the facade and visual impact of any new energy centre should be carefully considered to ensure it aligns with the character of Littlebury. The planning impact of the Littlebury conservation area and planning policies regarding landscape and riverfront character and explored further below.

Conservation area

The Littlebury conservation area was designated in 1977 and covers the majority of Littlebury. As such, the delivery of a heat network solution will require some development within the conservation area. Development within the conservation area will need to respect and reflect the local character of Littlebury. Buildings that form part of the conservation area may be of an age and character that require a bespoke approach to network connections, especially where new wall penetrations are required. SWCE has engaged with conservation officers from the District Council, and their continued engagement will be critical to the project.

In addition to listed buildings and buildings within a conservation area, there are seven buildings within Littlebury on the Uttlesford District Council's Local Heritage List. Buildings on a Local Heritage List are considered to be locally significant and contribute to the character of an area. Inclusion on this list will mean the council further considers the impact of any construction work.

Additional Planning considerations for individual home retrofits were discussed in section 3.1.



5. Delivery considerations
5.1 Planning and permitting

Flood risk

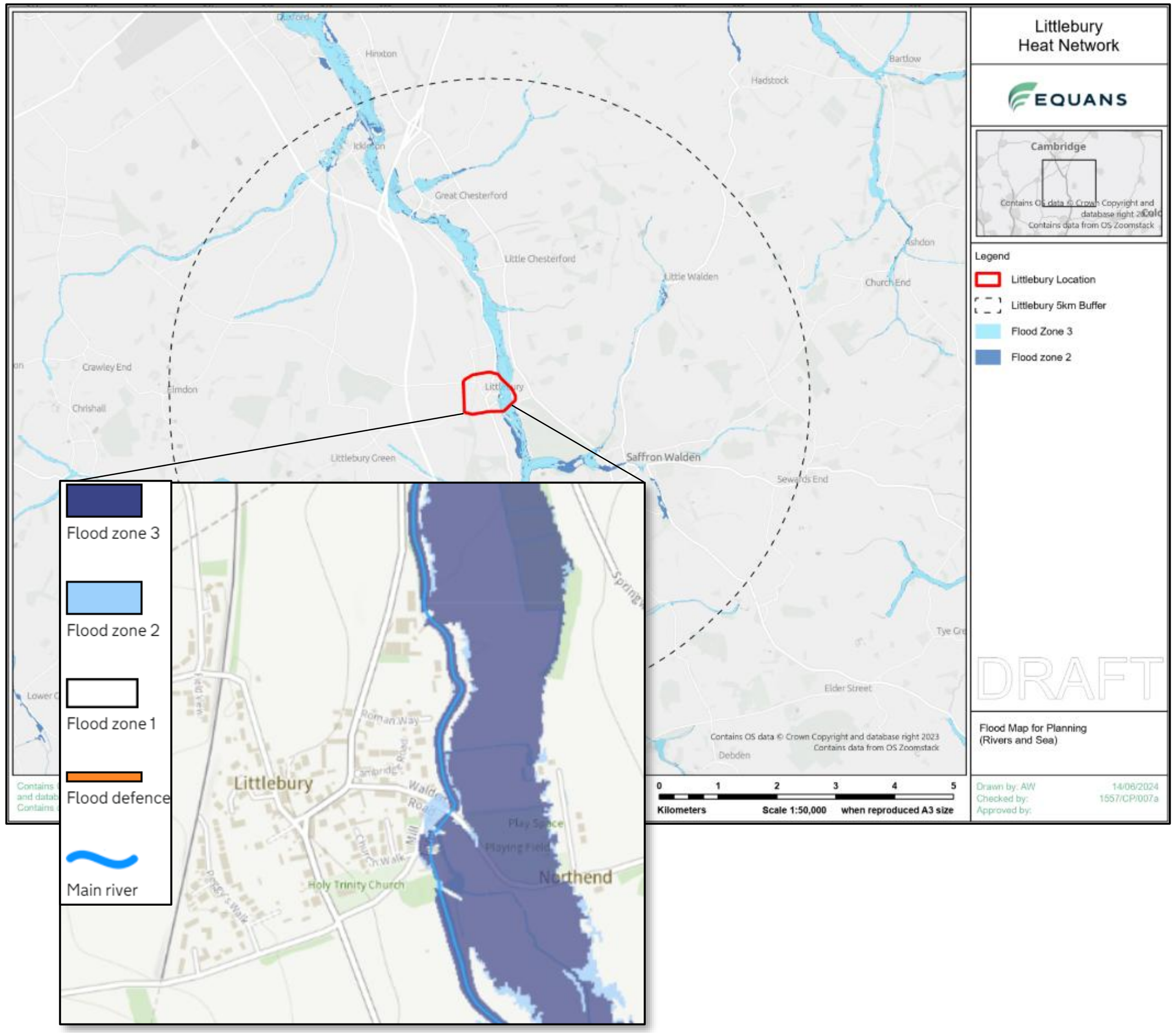
As can be seen from the maps to the right Littlebury has one main area of flood risk within flood zone 3 to the east of Littlebury. This area of flood risk tracks along the river Cam. Areas within Flood Zone 3 have a high probability of flooding from the adjacent river Cam. An energy centre located within the east of Littlebury within flood risk zone 3 is likely to require flood risk mitigation.

Any development within Flood Zone 3 may need to be complete and submit a site-specific flood risk assessment (FRA) with the planning application. A FRA would need to include design measures to mitigate flood risk, this could impact the cost of a planning application if a site-specific FRA has not been costed.

Flood risk is a particularly important risk to consider if siting the decentralised network energy centre because if the area suffers from a flooding event and cannot operate, Littlebury could be left without a primary heating source. Additionally, as explored within the local planning policy review Uttlesford District Council set policy to restrict development within flood areas.

As such, we would recommend that an energy centre is located away from flood risk zone 3, where feasible, and this has been considered in our qualitative appraisal of energy centre locations.

For individual retrofit solutions, flood risk would not pose additional risk already encountered by a home situated in a flood zone.



5. Delivery considerations

5.1 Planning and permitting

Landscape Designations

A review of all the potential areas for an energy centre across Littlebury showed there are several habitat and landscape designations that must be considered and protected. The habitat identified includes ancient and pastural wood and parkland, playing fields, the river Cam.

However, most of these designations are to the southeast of the built area of Littlebury. Within Littlebury there is a cemetery and three small areas of woodland, displayed below. The areas of woodland to the south and southeast of Littlebury are also within flood zone 3, as such we would recommend locating an energy centre away from these areas.

Natural England, Green infrastructure map, 2021

Individual home retrofit solutions are not considered a pressure on habitat and landscape designations.

5. Delivery considerations
5.1 Planning and permitting

Groundwater Source Protection Zones

The map to the right shows groundwater source protection zones. Littlebury is entirely within Groundwater Source Catchment Protection Zone 2 (Zone II). Zone 2 is defined as the district area around an abstraction point for domestic supply or for food production purposes that meets one of the following definitions.

1. The area within 250 metres of the abstraction point if the maximum allowable annual volume, divided by 365, is less than 2,000 cubic metres per day. This is when this is authorised by either:

- an abstraction licence under section 24 of the Water Resources Act 1991
- the right to abstract small quantities under section 27 of the Water Resources Act 1991

2. The area within 500 metres of the abstraction point if the maximum allowable annual volume, divided by 365, is equal to or greater than 2,000 cubic metres per day. This is when this is authorised by an abstraction licence under section 24 of the Water Resources Act 1991.

3. The area where it takes groundwater that is used to supply water for domestic or food production purposes up to 400 days to travel to the groundwater abstraction point.

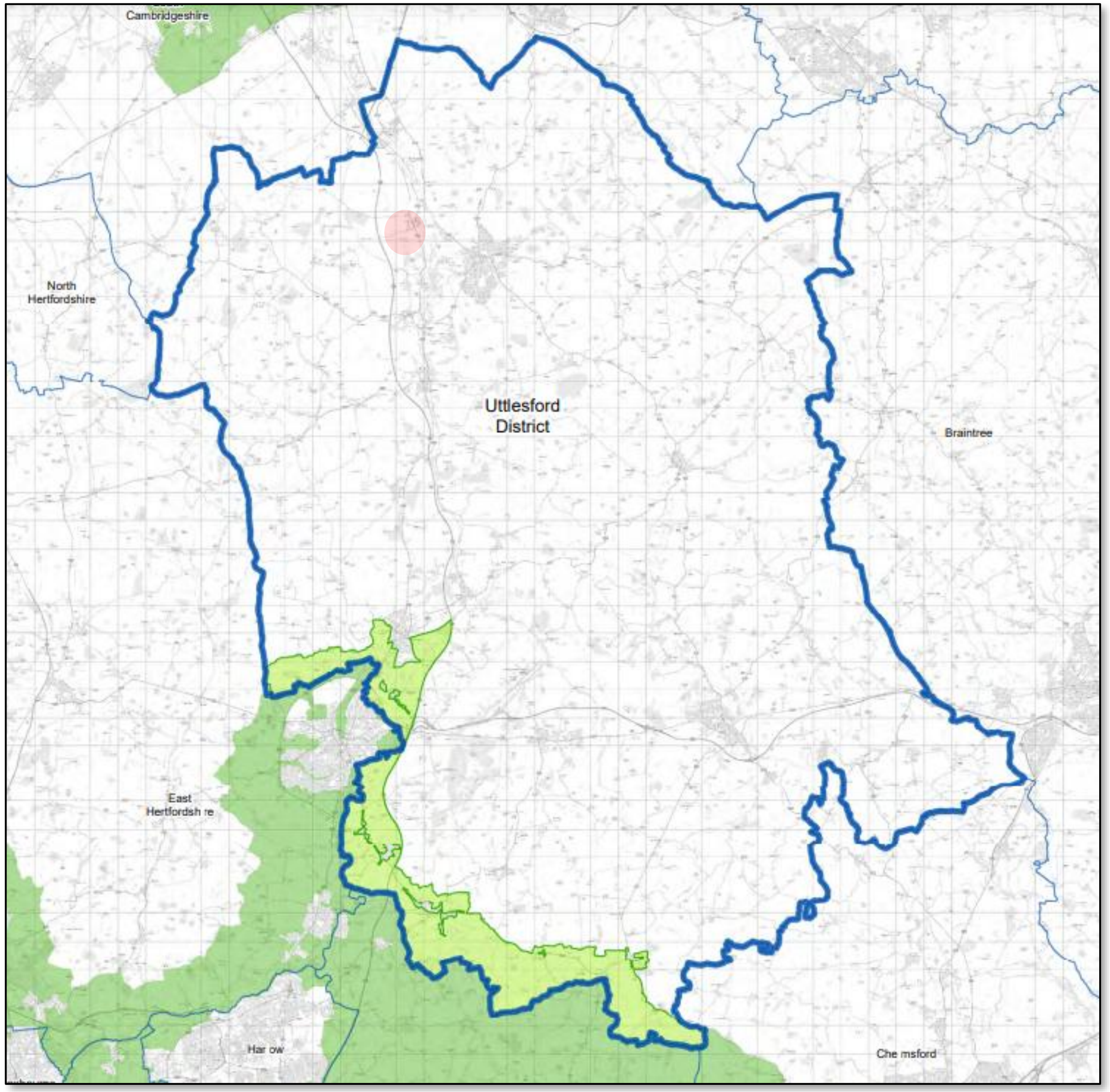
As the heating source for a district heating network solution is configured to be powered by ASHPs this is not likely to require additional documentation. However, it should be considered, and an impact assessment may be required or requested. Individual home retrofit solutions will not impact groundwater sources.

DEFRA, Magic Map, 2024

5. Delivery considerations
5.1 Planning and permitting

Greenbelt

Uttlesford contains the eastern edge of the Metropolitan green belt. There are statutory protections restricting development within the greenbelt. However, as can be seen from the map to the right Littlebury (approximate location in pink) is not located within the greenbelt. Therefore, greenbelt planning policies will not be applicable.



Uttlesford District Council, Greenbelt Review, 2016

5. Delivery considerations

5.1 Planning and permitting

Policy conclusions

Local policy broadly supports the development of heat network and energy centre and the implementation of home retrofit solutions. Both activities will support the priorities within the Uttlesford Climate change strategy.

A heat network solution will be supported primarily through the adopted local plan policy ENV15 which states ‘Small scale renewable energy development schemes to meet local needs will be permitted if they do not adversely affect the character of sensitive landscapes, nature conservation interests or residential and recreational amenity.’ As such, should an energy centre respect the local character of Littlebury it should be supported through planning.

Furthermore, the Essex County Council Net Zero Strategy sets the council ambition for new development to be net zero operational carbon. Whilst this policy is for new build developments, it indicates the County Council’s commitment to delivering net zero housing. As such a heat network to decarbonise Littlebury’s heating should be supported at County Council level.

Opportunities

Overall local planning policy is supportive of the construction of a heat network solution provided it respects the local character of Littlebury and complies with the General planning policies form the Uttlesford Adopted local plan.

Additionally, the reduction of energy consumption as a key priority within the Uttlesford Climate Change Strategy should support individual retrofit solutions to reduce energy demand and thus consumption.

The emerging Uttlesford local plan Core Policy 25 supports the development of local renewable energy infrastructure, especially where is it community led. This presents an opportunity to comply with emerging policy which should support the development of a local energy centre.

Risks

This report has identified two primary risks to either solution examined in this feasibility study, including the proximity to protected ground water sources and the Littlebury conservation area.

Areas to the east of Littlebury along the river Cam are within flood zone 3 any development in that area will require a site-specific flood risk assessment and may be denied.

Secondly, a significant portion of Littlebury is designated as a conservation area and as such there are restrictions on development. Additionally, Uttlesford local plan policies have a strong focus on ensuring that the development is in keeping with the existing local character. Any project taking place in this designated area, whether it be a heat network or individual retrofit solution, must ensure delivery is in keeping with the local character of Littlebury.

5. Delivery considerations

5.2 Governance (heat network)

5.2 Governance

Section 5.2 deals exclusively with the governance structures required to deliver a heat network.

Roles for heat network delivery

The development of a heat network is a complex process, involving many actors performing different functions or roles in relation to the project. It is important to clarify these roles and there requirements early in the project process and understand the implications of out-sourcing certain roles to 3rd parties outside of the community.

In this section, the core roles within a heat network are summarised and their main functions detailed.

Promotion

- Defining project
- Commissioning studies to establish the viability of the network
- Publicising the opportunity and communicating the benefits to key stakeholders
- Attracting developers, investors, operators and customers

Customer

- Agreeing terms of heat purchase agreement (e.g. price formula, service levels, carbon intensity)
- Paying an agreed price for the heat service
- Operating a secondary and/or tertiary network in accordance with the terms of the supply agreement

Governance

- Assigning roles and responsibilities
- Setting overall direction and objectives for the elements of the network within the remit of the governing body. It should be noted an ESCO has not yet been established and the governance system may be subject to changes.
- Taking high level commercial decisions
- Monitoring performance standards

Regulation

- Monitoring performance standards, including compliance with all future heat standards, including the newly introduced Heat Network Technical Assurance Scheme
- Resolving disputes between operators and customers. Should disputes escalate the energy ombudsman can be contacted by customers.
- Enforcing fair pricing

Funder

- Providing funding or arranging sources of finance
- Obtaining appropriate security from the beneficiaries of funding
- GHNF guidance for applicants states milestones and conditions of funding will be set once an applicant is successful and funding could be removed, reduced or a repayment could be required if recipients do not comply

Asset ownership

- Securing an income stream to match its responsibilities
- Insuring or procuring insurance for the assets
- Ensuring the assets are maintained through signing up to the Heat Trust Guidelines

5.2 Governance

Roles for heat network delivery, continued

Development of property

Delivering the completed site, including secondary and tertiary heat networks

Land ownership

- Granting leases for energy centres or substations
- Granting easements for routing of buried pipes
- Providing rights of access for installation

Landlords

- Ensuring building occupiers are connected to the heat network
- Controlling access to maintain the networks
- May include insuring some network assets.

Installation

- Installing a network which complies with the specification, the specification will require a fitness for purpose report to ensure suitability. This will form part of the design brief
- Connecting new customers, including the installation of the required pipework and HIU
- Installing network extensions

Operation

- Ensuring that heat of suitable quantity and quality (e.g. temperature) is delivered to customers
- Undertaking maintenance, repair and replacement works

Sale of heat

- Procuring heat delivery
- Metering, Billing and Collection of revenues to be set up as part of a 'smart' process
- Undertaking price reviews, liked to the RPI
- Attracting and securing new customers
- Managing customer debt

Supplier of last resort

- Ensuring residents have a heat supply in-case of system failure
- Monitoring system performance to maintain an accurate risk judgement of the supplier of last resort's responsibilities being triggered.
- Taking over operator and retailer responsibilities where required (including in some cases the purchasing of assets)

5.2 Governance

Community objectives

Depending on the ownership model adopted, revenue generated from community heat networks can be used by councils or community groups to improve local services, take tangible actions to reduce fuel poverty, and support local economic growth by creating employment. This is alongside the co-benefits of decarbonisation of heat, contribution towards a community's climate change commitments, and ensuring security of energy supply.

The diagram to the right describes some of the many drivers of community energy schemes, outlining local and national benefits, and positive environmental, economic and social impacts.

Successful development of a community energy scheme is dependent not only on technical feasibility, but also on creation of a delivery structure that meets the needs of the community, whilst managing risks and returns.

There are three key aspects to consider when assessing which delivery structure to use:

- The objectives of the scheme (e.g., maximise social and community benefit, reduce carbon emissions)
- The appetite for risk and the desired level of control over revenue and returns
- The availability of appropriate funding sources

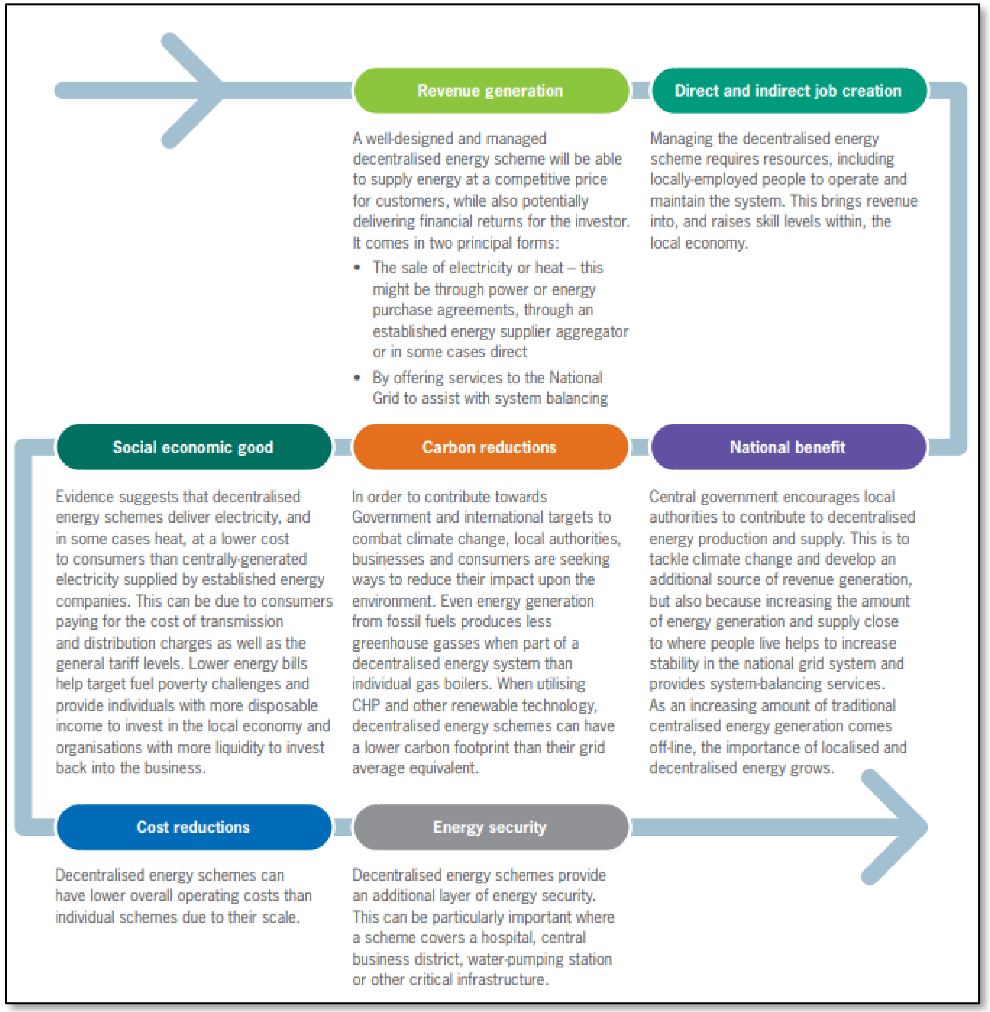


Figure 3: Your generation: Making decentralised energy happen, Grant Thornton, 2016, p.7

5.2 Governance

Scheme ownership

Ownership of community energy schemes exists on a spectrum from fully publicly owned to fully privately owned. Within private ownership this may vary from an existing company to a newly created community entity.

Stage 1 CEF funding forms part of the government's strategy to increase the number of heat networks in the UK. The image below offers a visual description of the process to create and finance a heat network scheme, and how a project owner might engage with different funding sources over time as a project develops. This is presented against the government's Heat Network Development Unit (HNDU) project timeline which many projects typically follow, with or without HNDU support.

Costs for development, commercialisation and delivery (CAPEX, OPEX and maintenance / replacement) stages must all be considered in financial planning and when making decisions on ownership, operation and governance.

The full report: 'Financing heat networks in the UK: Guidebook' is an invaluable resource developed to support heat network sponsors, developers and funders in understanding some of the issues, risks and opportunities around financing heat networks.

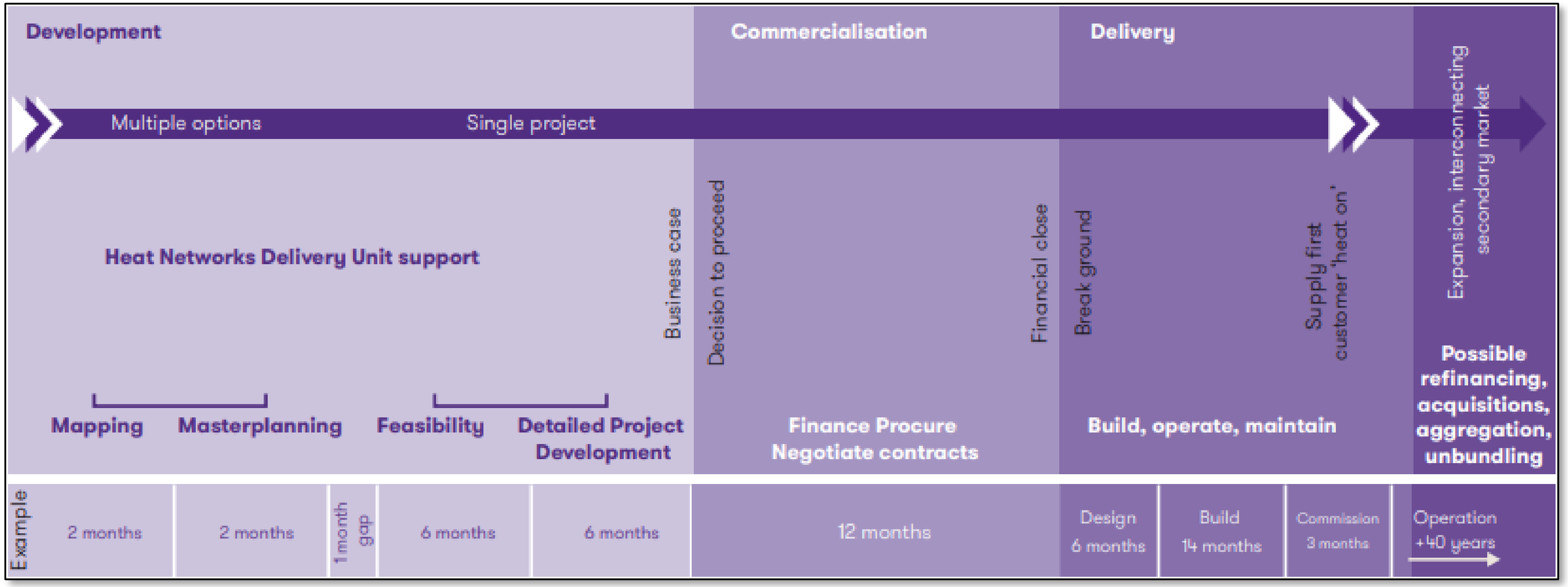


Figure 4: *Financing heat networks in the UK: Guidebook*, page 12.

5.2 Governance

Defining a delivery structure

Depending on the community's objectives, access to funds and appetite for risk, there are several commercial delivery structures that can be used to fund heat network development.

The Financing Heat Networks Guidebook includes a decision tree to determine the potential preferred delivery structure for your heat network project. The decision tree outlines some of the issues which need to be explored to help guide the choice of a delivery structure, and therefore which funding sources should be explored to deliver the project. If a funding source has already been identified, the decision tree helps identify which delivery structure would therefore be applicable.

Funding for the initial stages of heat network development is distinct from funding for project commercialisation and delivery. The initial development stages for Littlebury have been funded through the Community Energy Funding which will be used to deliver an initial feasibility study.

When moving towards the commercialisation stage, as the 'project sponsor', your community group must define the scheme's objectives, the appetite for risk, the desired level of control over revenue and returns, and the availability of appropriate funding sources.

The decision tree outlines how to understand this decision-making process. The creation of an investment-ready business plan was included in CEF Stage 2 funding; such plans are important to identify the most suitable delivery model for a heat network in your community.

Ownership of the heat network scheme may eventually lie with the project, or with an existing or new ESCo which may operate independently or in partnership with your group (options 1 – 4 as shown in the purple boxes in Figure 5 to the right).

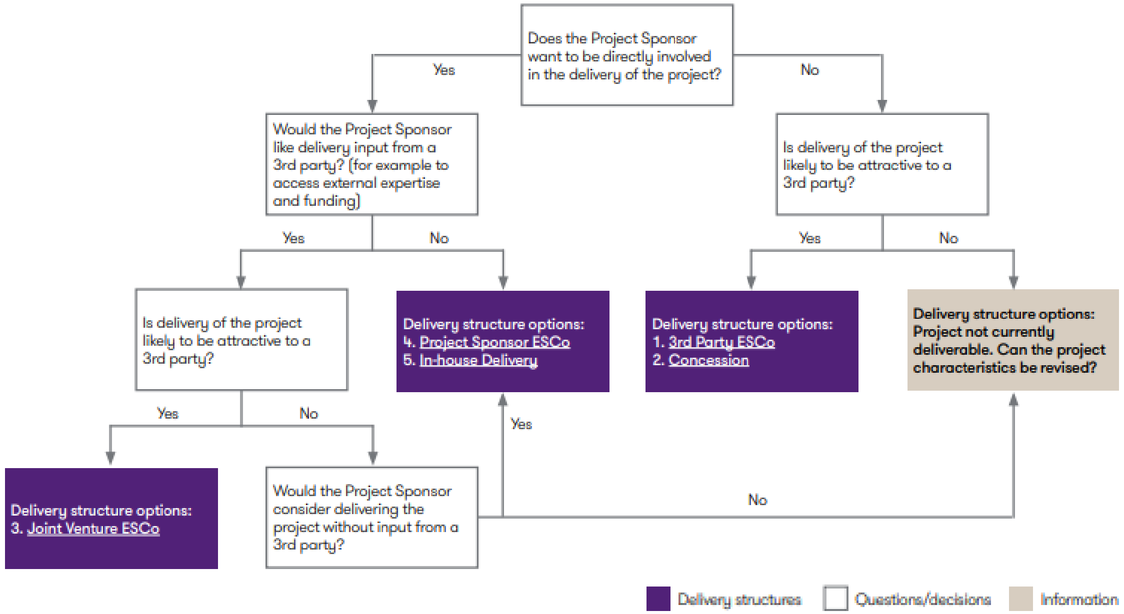


Figure 5: Financing heat networks in the UK, Grant Thornton / BEIS, (2018)

5.2 Governance

Roles for energy efficiency and individual heat pump delivery

Similarly to the development of a heat network, mass installation of energy efficiency upgrades and heat pump technology is a complex process. This process will involve many actors performing different functions or roles concerning the project. It is important to clarify these roles and their requirements early in the project and understand the implications of out-sourcing certain roles to 3rd parties outside of the community.

In this section, the core roles of delivering energy efficiency upgrades and heat pump technologies are summarised and their main functions are detailed.

Promotion

- The project promoter must define the scope of the project
- Commission studies to establish the viability of mass energy efficiency upgrades
- Publicising the opportunity and communicating the benefits to key stakeholders
- Attracting developers, investors, operators and customers
- Procuring insulation and heat pumps in a bulk purchase order or at a sub-market rate where feasible

Customer

- Agreeing terms of purchase and repayment for energy efficiency and heat pump installation, including potentially agreeing on specific EPC band uplifts
- Paying an agreed repayment price for the installation

Governance

- Assigning roles and responsibilities
- Setting overall direction and objectives for the elements of the project delivery. It should be noted an ESCO has not yet been established and the governance system may be subject to changes.
- Taking high-level commercial decisions
- Monitoring performance standards and addressing potential issues

Regulation

- Monitoring performance standards, including potentially facilitating updated EPCs
- Resolving disputes between installers, manufacturers and customers. Should disputes escalate the energy ombudsman can be contacted by customers.
- Enforcing fair pricing for repayment on energy efficiency and heat pump upgrades

Funder

- Providing funding or arranging sources of finance
- Obtaining appropriate security from the beneficiaries of funding

Asset ownership

- Securing an income stream to match its financial responsibilities
- Insuring or procuring insurance for the assets
- Ensuring the assets are maintained

5.2 Governance

Roles for energy efficiency and individual heat pump delivery, continued

Land ownership

- Providing rights of access for installation

Landlords

- Ensuring building occupiers can access energy efficiency and heat pump upgrades and managing the installation of upgrades.
- Controlling access to maintain the heating system
- May include insuring some assets

Installation

- Installing appropriate energy efficiency and heating upgrades that comply with the specification. The specification will require a fitness for purpose report to ensure suitability for each property type. This will form part of the design brief

Operation

- Ensuring that there has been a suitable reduction in energy demand, potentially through commissioning updated EPCs.
- Undertaking maintenance, repair and replacement works where necessary.

Repayment on energy efficiency and heating upgrades

- Metering, Billing and Collection of revenues to be set up as part of a ‘smart’ process with energy savings based on bill costs.
- Undertaking price reviews, liked to the RPI
- Attracting and securing new customers
- Managing customer debt

5. Delivery considerations

5.3 Funding

- Heat networks
- Individual solutions
- Collective options

5.3 Funding – heat networks

Section 5.3 examines possible funding opportunities for both heat networks and individual home retrofit solutions.

Community Energy Funding (CEF) Stage 2

This phase 1 feasibility study is being funded by CEF. As this project progresses into a detailed feasibility study there is an opportunity to apply for CEF stage 2 funding which can provide up to £100,000 in support.

To be eligible for CEF stage 2 funding applicants must be an eligible incorporated organisation, eligible organisations include non-profit organisations, community groups and education facilities. Additionally, applicants should provide evidence of community engagement which demonstrates local support, details of a feasibility study covering a minimum of the CEF Feasibility Study Template, evidence a project is technically feasible, receipt of advice from the Local Planning Authority demonstrating the project has a strong chance of receiving planning permission and evidence three quotes for work has been sought.

CEF round 2 funding can be used to make a project funding or construction ready. This includes support with:

- A detailed feasibility study
- A Landowner/lease agreement
- Surveys and profession planning permission support
- Additional community engagement
- Additional public body stakeholder engagement
- Planning applications
- Permits, licences and consents applications
- Development of a robust business case
- Project Management support.

Heat Network Development Unit (HNDU) funding can be applied for by Local authorities and as such Littlebury cannot apply directly for this funding.

Should Uttlesford District Council, the local planning authority for Littlebury, apply for and win funding through the HNDU, the Council could support the development of a heat network within Littlebury. The 14th round of HNDU funding recently closed, but further rounds are expected to open in 2025.

HNDU funding can be used to cover the costs of heat network feasibility studies. Furthermore, successful local authorities will be supported by the HNDU who will provide commercial and technical specialists. The HNDU will support feasibility studies in the identification of:

- Heat Demand
- Heat supply
- Heat and power Distribution
- Cash flow modelling
- Risk.

HNDU funding can be used to provide support through the detailed project development stages and to provide separate project management support.

Commercialisation is no longer supported by the HNDU, however, this is covered by the Green Heat Network Funding (GHNF). This will need to be applied for separately.

It should be noted that whilst HNDU funding provides a significant level of support, it must be applied for through the local authority. A review of previous rounds of HNDU funding shows Uttlesford District Council has never received HNDU funding.

5.3 Funding - heat networks

Another funding option for a heat network is the **Green Heat Network Funding (GHNF)**, administered by the Department for Energy Security and Net Zero. A key requirement of the GHNF is that it supports the development of a heat network that would not be delivered without government support.

The GHNF is open to a wider range of applicants than the HNDU and can be directly applied for by registered community investment companies, or other such community groups who submit their annual accounts.

Initially opened in Spring 2022 the 8th round of the GHNF closed on the 28th of June 2024. Round 9 was expected to be launched in autumn 2024, but application guidance and timing has been published at the time of writing.

The applicant can then use funding to cover up to but not including 50% of the commercialisation and construction costs of a new heat Network. The use of GHNF will require the applicant to provide the remaining 51% match funding to develop a heat network through a private or community impact investor.

Whilst an additional investor will be required, Saffron Walden Community Energy can apply for GHNF as a registered Community Benefit Society without needing to rely on the Local Authority to submit a funding request.

There are several other delivery models for the creation of a heat network. These models are explored further on the next page.

5. Delivery considerations
5.3 Funding – individual solutions

A household may apply for individual finance to cover the costs of retrofit works. Many individual finance options are funded through national government grants for specific improvements. These schemes have specific applicability requirements and only fund specific covered measures.

One funding options is the **Home Upgrade Grant** (HUG2). This grant is funded by the national government and can be used to help off-gas Littlebury residents improve the energy efficiency of their homes. Those eligible could see the following measures: cavity wall insulation, external wall insulation, loft insulation, underfloor insulation, ASHP, new windows and doors.

For a household to qualify for HUG2 their property must have an EPC of D or below and meet one of the three following criteria:

1. The property is situated in an 'auto-eligible' postcode, as indicated above, or
2. In receipt of means-tested benefits, or
3. Have an annual gross household income below £36,000.

Properties that are connected to the mains gas grid will not qualify for HUG2 funding. Should a household not have an EPC, an EPC assessment can be carried out as part of the funding, provided a household meets the income criteria above.

Another national funding option is the **Boiler Upgrade Scheme,** this scheme is specifically covers fossil fuel heating system and will fund a portion of what it would cost to upgrade a fossil fuel burning boiler to a heat pump or a biomass boiler.

To be eligible households must:

- have a valid EPC certificate
- own the property
- be replacing a heating system that uses fossil fuel
- install the heat pump within 120 days of applying for the grant
- for biomass boilers, you must off-grid, your property must be in a rural location, and the biomass boiler must have an emissions certificate showing pollution is at a minimum
- Social housing and new houses are not eligible to receive funding under the Boiler Upgrade Scheme.

5.3 Funding – individual solutions

Another funding option is the **Great British Insulation Scheme**, again this scheme is nationally funding. Residents of Littlebury may apply for this scheme if their property has an EPC of D or below and is in a council tax band of A-D. Homeowners, landlords or tenants may apply to the Great British Insulation Scheme. Tenants are advised by the national government to speak to their landlords before applying. Funding from the Great British Insulation Scheme can be used to fund loft, cavity or external wall insulation.

The **Energy Company Obligation (ECO)** requires energy providers to support households with energy efficiency upgrades. Applicable measures could include insulation work, for example to your loft or cavity walls, replacing or repairing your boiler - or other upgrades to your heating.

ECO4 will run until the 31st of March 2026, those who are living with someone or someone who is receiving benefits may be eligible for energy efficiency upgrades for social housing, or renting/owning private housing.

- If you own your house, it must have an energy efficiency rating of D, E, F or G to be eligible.
- If you rent from a private landlord, the house must have an energy efficiency rating of E, F or G to be eligible. You must have the owner's permission to do the work.
- If you live in social housing that has an energy efficiency rating of E, F or G you might be eligible for help with insulation or installing a heating system for the first time.

Whilst many homes within Littlebury may not be able to generate their own renewable energy, those that do can enter into a **Smart Export Guarantee**. The Smart Export Guarantee ensures individuals who produce their own electricity are compensated for the excess electricity they supply to the grid. It is necessary to sign up for the SEG tariff as this process does not occur automatically. All licensed energy companies serving 150,000 or more customers are required to offer at least one SEG tariff under this scheme. Smaller suppliers have the option to provide an export tariff if they choose to do so.

You may be eligible to apply if you have one of the following technologies that generate renewable electricity using solar panels, wind turbines, hydroelectricity,- anaerobic digestion, or a micro combined heat and power (micro-CHP).

Whilst not a direct funding option the **Energy Saving Trust** does provide advice on retrofit measures and can be contacted by householders. The advice covers heat pumps, boilers, electric heating, biomass, solar water heating, heating controls, thermal heating and micro combined heating and power.

The Energy Saving Trust also offer advice for reducing home heat loss which covers insulation (cavity wall, solid wall, floor, and loft) drought proofing, windows and doors, insulating tanks, pipes and radiators.

5. Delivery considerations
5.3 Funding – collective options

Whilst most grant funding can only be applied for by individual households, residents of Littlebury may want to explore collective opportunities to access capital or reduce costs. Note that many funding options for larger-scale group retrofit rely on leveraging debt. Any private group funding will require the development of a Community Interest Company (CIC) with a detailed organisational structure and attracts significantly more risk, as interest will be paid on any debt.

This section provides a brief overview of the most promising potential funding or group buying options, as a starting point for research. Options presented in this report should be fully researched and a financial expert should be approached should group funding be pursued.

Competitive Funds

With the formation of a Community Interest Company, Littlebury may be able to secure funding through the **Energy Redress Scheme.** This scheme provides funding to energy schemes with a focus on reducing the bills and the number of cold homes in England, Scotland and Wales.

https://energyredress.org.uk/apply-funding

The Social and Sustainable Community Investment Fund provides debt funding for community-based projects which 'developing the local economy and creating positive change for all individuals in the community.' As such, a community led social organisation could apply for funding to complete retrofit works. Though acceptance is not guaranteed.

www.socialandsustainable.com/community-investment-fund/

Ethical banks

Charity Bank debt funding of £50k to £2m for the Commercialisation and Delivery stages of projects with social benefits.

Triodos Bank debt funding of up to £15m where the loan will be used to make a positive cultural, social or environmental impact.

Ethex debt or equity funding of £120,000 to £5m for community organisations with ethical, social or environmental aims.

5. Delivery considerations
5.3 Funding – collective options continued

Private debt financing

Green bonds are a form of debt security which typically have lower fixed interest rates than loans and mortgages and can have payback periods over 30 years. However, unlike traditional loans, green bonds can only be spent on specific sustainability or ESG projects. Green bonds could be issued to fund energy efficiency or renewable heating retrofit measures. However, it should be noted that currently green bonds have high interest rates and there is still uncertainty in the markets which could impact current interest rates for new bonds.

Sustainability linked loans (SLL) are issued at preferable rates on the condition that certain sustainability or ESG targets are met. Typically, SLL will offer variable rates that may decrease for meeting the sustainability targets, however the interest rate on the loan could increase if the targets are not met. As such SLL offer a financial incentive to achieving sustainability targets but also a financial risk if targets cannot be met. The targets that need achieving for the debtor to access lower interest rates will be agreed before the load is issued.

Additionally, **third party ESCo funding** could also be pursued. This involves partnering with an existing ESCo which would enable a community organisation to access the ESCo's funding. This could be in the form of debt, equity or lease funding. The ESCo would charge an interest rate which could increase the risk for a community organisation.

Innovative buying solutions

Nesta, the UK's innovation agency for social good researched group buying in 2022. The primary points are summarised here:

- Group purchasing has had good success in the UK domestic solar market
- The equipment and labour costs of installations could be reduced by economies of scale
- Installers would feel that the reduced marketing costs for increasing orders in one area would outweigh the downside of offering a discount
- Providing some kind of forum for participants to share experiences, ask questions and help each other with troubleshooting might increase their confidence
- Group buying has real potential to drive the UK heat pump market and is most likely to appeal to less engaged customers who are happy to accept an off-the-shelf package

Their full research process and outcomes can be found here: www.nesta.org.uk/group-purchasing-for-heat-pumps/

Switch Together and Essex County Council

This group buying scheme ran in 2024, offering residents the opportunity to collectively procure bespoke heat pump installations, aiming to achieve economies of scale and quality installation: www.switchtogether.com/heat-pump/

Octopus energy

Octopus energy offers new customer packages that include cost effective heat pump installation and a special tariff: www.octopus.energy/order/heat-pump/

6. Key conclusions

6. Key conclusions

6.1 Option summary

This report has set out to identify the most economically feasible option for the Littlebury Community Energy Project to work with the community to decarbonise the village of Littlebury. To achieve this, we have carried out a systematic process comprising data analysis and assimilation, qualitative appraisal, simulation modelling and optioneering, and finally – a detailed techno-economic appraisal to help determine our preferred option.

The following options have been considered:

- Fully centralised heating solution – where an energy centre operating with fully decarbonised heat sources would supply heat and hot water via a buried heat network to all the properties in the village. Property owners would have a choice of whether to connect to the network or choose not to connect and carry on using, maintaining and eventually replacing their own heating system. These property owners could only be considered to have a decarbonised heating system however if any legacy fossil fuel systems were removed and an all-electric or individual heat pump system was installed instead – a decentralised air-source heat pump system is the most appropriate option in this scenario.

- Decentralised individual retrofit solution – where all properties in the village would convert their heating systems to an individual ASHP. This would decarbonise the heating and hot water generation. Operational energy costs could be reduced if the property underwent some additional fabric upgrades to reduce heat losses, and as a result require less imported electricity for the heat pump to meet the heating and hot water demand. We would also advocate solar photovoltaic systems being installed on property roof spaces to offset as much of the required annual electrical consumption of the ASHPs as possible.

- Hybrid solution – This approach essentially involves a blend of properties, some operating decentralised ASHPs, and others connecting into a centralised heat network solution as outlined above and described in Section 3.4.

- Decentralised individual retrofit and Solar PV solution – Although the majority of our efforts have been spent on assessing the above three core options, there is a fourth option where all properties would convert to an individual ASHP to provide heating and hot water – so no 'heat network' and the associated costs of implementing the community heat network would be avoided. Additionally, instead of individual property owners deciding independently whether to install a roof-mounted solar PV array to directly offset the energy cost of their individual ASHP, the community could, collectively seek to install a ground mounted solar PV farm.

6. Key conclusions

6.2 Economic Outcomes

This feasibility study falls short of identifying a clear preferred option for decarbonisation, insofar as, none of the options considered provide a strong investment case. The centralised and hybrid options would require significant third-party funding and grant support due to the scale of capital cost, though they fall short of normal criteria for commercial investment. For the decentralised option, government grants could help to offset a substantial proportion of capital cost – recovery of the residual capital investment made by the property owner may be expedited through selection of optimum electricity supply tariffs, though the standard tariffs applied in the techno-economic model result in a prolonged return on investment.

To complement the techno-economic assessment shown previously, it is useful to summarise the key 'differentiators' regarding economic viability between the four potential solutions as follows:

Fully centralised heating solution

- Assumes that there will be 'an investor' that owns and operates the heat network. The investor would pay for the electricity consumed and sell the heat to the consumer. The consumer would have no capital cost liability but will pay for the heat they take from the network to heat their property. This is the 'heat sale' and is typically set at a level close to or above the levelized cost of energy. This is a primary revenue stream for the owner of the heat network.
- To ensure the substantial whole life costs, particularly the upfront CAPEX of implementing a village scale heat network can be recovered to allow the project to break even, a solar PV generation plant of reasonable scale (our suggested size is 10MWp) would be required for the project to break even in an 'investable' timeframe

Decentralised individual retrofit solution

- The property owner would pay for any fabric efficiency improvements to reduce the thermal demand, ideally, prior to procuring an ASHP to decarbonise their overall heating requirement. The owner also pays for the electricity consumed and may have the option to offset this by installing their own solar PV system which they of course would see the full benefit from. Without a 'revenue', the levelized cost of energy for this solution is higher than with the centralised and hybrid solutions over the long-term, this is expected due to the operational 'cost' from such an approach compared to the operational 'revenue' available where an alternative approach is envisaged i.e., a heat network supplied by an energy centre, using renewable electricity to provide heat.

Hybrid solution

- Similar to the fully centralised heat network solution in terms of overall economics, although the higher energy costs of the individual ASHPs employed in the decentralised properties means that the whole life costs are slightly worse overall.

Community feedback from working group meetings and a community presentation evening has led us to propose a further solution – in essence a 'community-led' decentralised solution. Sections 3.1.9 and 5.3 collective options refer to resources for further research of these opportunities. The next section outlines key differentiators for this model.

6.2 Summary of most economically viable option

Community-led decentralised retrofit and Solar PV solution

- Differs from the decentralised retrofit scenario in that a community owned solar PV array is implemented. Due to the scale, this would require third party investment, this could be from the community itself although it is uncertain if sufficient funding could return or by the community alone – other investment is likely to be required. A further complication is that individual residents may decide to either invest in the solar farm as there would be a relatively attractive return or invest in installing an ASHP to decarbonise their heating – which is unlikely to provide a return on investment.
- This solution also presumes that the 'village' would be able to act as single entity in procurement and programming of the overall scheme to decarbonise Littlebury. This does offer the potential to facilitate individual property decentralised retrofit for lower costs due to the collective buying power of an entity potentially buying multiple systems for installation versus an individual buying as a one-off, however it is virtually impossible to predict how effective a resultant Littlebury Village entity may be – as a result we cannot model this with any certainty and any comparisons included within the techno-economic modelling are indicative only.
- The economic analysis which we have performed for this scenario uses the same size of solar PV array (10MWp) for ease of comparison.

It is our view following the study that the two heat network solutions (fully centralised and hybrid), although able to provide a real terms payback over the expected project lifetime, are unlikely to be economically attractive to Littlebury due to the substantial CAPEX, OPEX and REPEX costs. It is important for the financial metrics of both approaches that a substantial solar PV array is incorporated as this improves their economic cases due to the attractive return of the solar farm 'balancing out' the unattractive payback of the heat network alone. However, in both situations it is not possible to describe them as financially or economically viable given the costs involved in implementing either of them.

The conclusions of this report should not prevent those within Littlebury who wish to 'decarbonise' by switching to a form of low carbon heating (such as an individual ASHP) from doing so and we would reiterate that the cost assumptions made in several areas, particularly with regards to the cost of changing from a fossil fuel heating system to an ASHP, are based on averages at this stage of the project. In order to firm up these estimates more work would be required at the next stage of project feasibility and design development to assess typical properties and existing heating installations.

As mentioned in section 4.2, the Techno-Economic Assessment model has been updated to provide the facility to test the potential case for inclusion of a community solar farm. Whilst the scope of this opportunity falls outside of the scope of this initial feasibility study (relying heavily on community involvement), this could offer a means of enhancing the community's overall investment in decarbonisation. It is hoped that the model prepared under this project may come in use in future, should this option be of interest to the village.

6. Key conclusions

6.3 Community benefits of decarbonisation

The Littlebury Energy Project Feasibility Study offers a range of significant benefits for the local community, positioning Littlebury as a forward-thinking village committed to sustainable energy solutions. The study explores the potential for a **centralised** approach and a **decentralised** approach to decarbonising the heating supply for the village. The centralised approach tested a centralised heat network – requiring shared systems and investment, while decentralised approach examined the impact of individual solutions to reduce energy demand from homes across the village, and the potential to deliver at scale and collaboratively.

The project aimed to deliver both economic and environmental advantages, while fostering a stronger, more resilient community.

- **Lower heating costs for residents:** The project has the potential to reduce heating costs by introducing retrofit measures and low carbon, efficient heating technology that could lower individual energy bills.
- **Reliable and efficient heating:** The proposed centralised system offers a reliable and modern alternative to older, less efficient heating methods. With a centralised management approach, the risk of breakdowns or inefficiencies is minimised, ensuring a more consistent and dependable heating source. If a home cannot connect to the district system, installation of an individual air source heat pump (ASHP) can still yield these benefits. ASHPs have a long track record of high performance and durability when installed and operated correctly.
- **Significant reduction in carbon emissions:** One of the primary goals of the project is to drastically reduce Littlebury's carbon footprint. A home heat pump could reduce carbon emissions compared to an oil boiler by up to 80% contributing to both national and global efforts to combat climate change. This would also align with the UK's climate targets for reducing greenhouse gas emissions.
- **Energy savings and efficiency gains:** A new community heat network is expected to improve heating system efficiency from circa 90% (for a typical modern oil boiler) to over 250%, helping households consume less energy. This improvement in energy efficiency will translate to both environmental and economic savings for residents, as less energy is used. Individual air source heat pumps fulfil the same energy efficiency and decarbonisation aims.
- **Increased energy independence:** A centralised, locally managed heating system fed by a solar farm reduces Littelbury's reliance on external energy sources, including reducing the reliance on polluting fossil fuels. A more resilient system ensures stable service, particularly during extreme weather conditions, when heating is most critical.
- **Long-term benefits for future generations**: The feasibility study lays the groundwork for a sustainable heating solution that will benefit not only current residents but future generations. By investing in a low/zero carbon heating system, whether centralised or decentralised, Littlebury is ensuring the long-term environmental and economic well-being of the village.

7. Appendices

7. Appendices

7.1 Community engagement summary

In order to support the technical feasibility, a thorough community engagement strategy was implemented. This strategy aimed to communicate with the local community and understand their opinions and views on implementing a community heat network in the village.

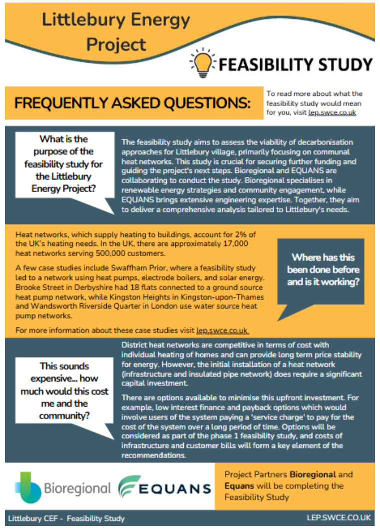
The community engagement strategy included:

- Website content
- Promotional articles for a local magazine
- Promotional leaflet
- Community engagement survey
- Community engagement meeting
- FAQ generation

This section summarises the key community engagement activities.

Articles and leaflets

The project team produced monthly articles and an informational leaflet during the study. These were distributed to homes and over social media channels – aiming to reach all Littlebury residents via print or digital engagement.



Littlebury Energy Project

FEASIBILITY STUDY

FREQUENTLY ASKED QUESTIONS:

To read more about what the feasibility study would mean for you, visit lep.swce.co.uk

What is the purpose of the feasibility study for the Littlebury Energy Project?

The feasibility study aims to assess the viability of decarbonisation approaches for Littlebury village, primarily focusing on communal heat networks. This study is crucial for securing further funding and guiding the project's next steps. Bioregional and EQUANS are collaborating to conduct the study. Bioregional specialises in renewable energy strategies and community engagement, while EQUANS brings extensive engineering expertise. Together, they aim to deliver a comprehensive analysis tailored to Littlebury's needs.

Where has this been done before and is it working?

Heat networks, which supply heating to buildings, account for 2% of the UK's heating needs. In the UK, there are approximately 17,000 heat networks serving 500,000 customers.

A few case studies include Swaffham Prior, where a feasibility study led to a network using heat pumps, electrode boilers, and solar energy. Brooke Street in Derbyshire had 18 flats connected to a ground source heat pump network, while Kingston Heights in Kingston-upon-Thames and Wandsworth Riverside Quarter in London use water source heat pump networks.

For more information about these case studies visit lep.swce.co.uk

This sounds expensive... how much would this cost me and the community?

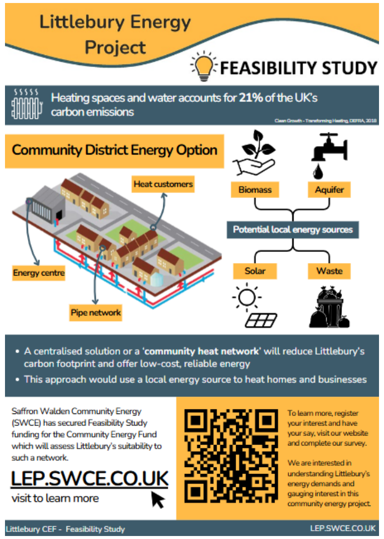
District heat networks are competitive in terms of cost with individual heating of homes and can provide long term price stability for energy. However, the initial installation of a heat network (infrastructure and insulated pipe network) does require a significant capital investment.

There are options available to minimise this upfront investment. For example, low interest finance and payback options which would involve users of the system paying a 'service charge' to pay for the cost of the system over a long period of time. Options will be considered as part of the phase 1 feasibility study, and costs of infrastructure and customer bills will form a key element of the recommendations.

Bioregional EQUANS

Project Partners **Bioregional** and **Equans** will be completing the Feasibility Study

Littlebury CEF - Feasibility Study LEP.SWCE.CO.UK



Littlebury Energy Project

FEASIBILITY STUDY

Heating spaces and water accounts for **21%** of the UK's carbon emissions

Clean Growth - Transforming Heating, DEFRA, 2018

Community District Energy Option

- A centralised solution or a '**community heat network**' will reduce Littlebury's carbon footprint and offer low-cost, reliable energy
- This approach would use a local energy source to heat homes and businesses

Saffron Walden Community Energy (SWCE) has secured Feasibility Study funding for the Community Energy Fund which will assess Littlebury's suitability to such a network.

LEP.SWCE.CO.UK

visit to learn more

To learn more, register your interest and have your say, visit our website and complete our survey.

We are interested in understanding Littlebury's energy demands and gauging interest in this community energy project.

Littlebury CEF - Feasibility Study LEP.SWCE.CO.UK

Littlebury Energy Project

SAFFRON WALDEN COMMUNITY ENERGY

PULL-OUT SUPPLEMENT

Consultation Results Community Meeting

Save the date - Discover options for the future of energy in Littlebury!

Date: Wednesday 25th September 2024

Time: 19:00 – 20:30

Location: Littlebury Village Hall

Join the consultants we have been working with, and the LEP team, for a community meeting to learn about the results of the Littlebury community energy feasibility study. Over the summer they have been exploring ways for Littlebury to become more energy efficient, including the investigation of an area-wide heat network. Meet us, hear the project findings and learn about the next steps.

Refreshments will be served

We look forward to seeing you there!

RSVP

RSVP to contact@lep.org.uk or https://lep.swce.co.uk/rsvp

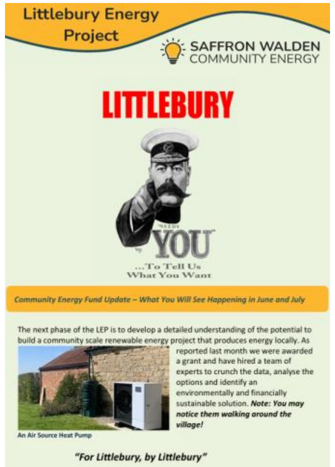
Not required, but helpful in our planning!

Any questions before the meeting?

The LEP team has pulled together a page of FAQs at https://lep.swce.co.uk/cef/

Contact Littlebury Energy Project (LEP) at contact@lep.org.uk or 01799 252501

"For Littlebury, by Littlebury"



Littlebury Energy Project

SAFFRON WALDEN COMMUNITY ENERGY

LITTLEBURY

Community Energy Fund Update – What You Will See Happening in June and July

The next phase of the LEP is to develop a detailed understanding of the potential to build a community scale renewable energy project that produces energy locally. As reported last month we were awarded a grant and have hired a team of experts to crunch the data, analyse the options and identify an environmentally and financially sustainable solution. ***Note: You may notice them walking around the village!***

An Air Source Heat Pump

"For Littlebury, by Littlebury"

Littlebury Energy Project

SAFFRON WALDEN COMMUNITY ENERGY

PULL-OUT SUPPLEMENT

Littlebury Energy Project (LEP): Feasibility Study Update

We have lift off! This month saw an insightful site visit to Littlebury from the project's technical team, followed by a start of the analysis on Littlebury's energy needs.

Testing the feasibility of a community heat network in Kings Langley

Learning from similar communities is invaluable, and the Grand Union Community Energy (GUCE) Kings Langley project is an excellent example. It demonstrates how a feasibility study was able to identify a low-carbon solution tailored to the village's specific needs. Understanding Kings Langley's approach can give valuable insights to inform Littlebury's transition to a more sustainable future.

Read more overleaf ......

Have questions? Check out our FAQs:

We are sure a few questions are starting to come to mind! Check out the FAQs on our website to help understand potential outcomes of the study.

https://lep.swce.co.uk/cef/

Have views? Help us with the survey!

You can help the study by responding to our community survey. A paper copy will be delivered in the first week of July, and an online copy is here:

https://lep.swce.co.uk/fs

"For Littlebury, by Littlebury"

7. Appendices

7.1 Community engagement summary – website and FAQs

A project website has been created to store all relevant information about the Littlebury CEF Feasibility Study. This website is linked to the Saffron Walden Community Energy (SWCE) website, and you can conveniently find the section for the Littlebury CEF Feasibility Study under the 'Feasibility Study' header on the SWCE website.

The website can be found at the address below:

https://lep.swce.co.uk/cef/

The website included the following relevant information:

- A general introduction to the Feasibility Study
- FAQs
- Case studies (Swaffham Prior, Brooke Street, Kingston Heights, Wandsworth Riverside Quarter).
- Overview of the community benefit of community heat networks
- Survey link and information
- Link and relevant information

Frequently Asked Questions (FAQs)

- Community Energy Fund (CEF) Feasibility Study
  - What is the purpose of the feasibility study for the Littlebury Energy Project?
  - How does feasibilty work?
  - How can community members stay informed about the progress of the feasibility study?
- District Heat Networks
  - What is a district heat network, and how does it work?
  - What could an energy centre look like?
- Community concerns
  - Developing a heat network sounds like a lot of disruption, how will this impact me/the community?
  - Who can join the heat network?
  - Can building and running a heat network harm local ecosystem?
  - This sounds expensive... how much would this cost me/ the community?
- Community Input
  - How can your input shape the future of heating in Littlebury?
  - What are the potential cost savings for your household with the new heating system?
  - How can we ensure reliable and eco-friendly heating for every home in Littlebury?
  - Why did we do the survey?

Community Energy Fund (CEF) Feasibility Study

What is the purpose of the feasibility study for the Littlebury Energy Project?

- The feasibility study aims to assess the viability of decarbonisation approaches for Littlebury village, primarily focusing on communal heat networks. This study is crucial for securing funding and guiding the project's next steps. Bioregional and EQUANS are collaborating to conduct the study. Bioregional specialises in renewable energy strategies and community engagement, while EQUANS brings extensive engineering expertise. Together, they aim to deliver a comprehensive analysis tailored to Littlebury's needs.

How does feasibilty work?

- The study will assess the village's energy demand, explore options for improving energy efficiency in buildings, evaluate renewable energy sources like water, air, and ground source heat networks, and engage with residents and businesses to gather feedback on proposed solutions.
- Community engagement is a key aspect of the study. Residents and business owners will have opportunities to provide input through surveys, community events, and other outreach activities. Community feedback will help shape the recommendations presented in the feasibility report.
- Following the feasibility study, the project may progress to Stage 2 of the Community Energy Fund (CEF) grant scheme. This could involve further development of the preferred decarbonization option, securing funding for implementation, and continued community involvement in the project.

How can community members stay informed about the progress of the feasibility study?

- Regular updates on the study's progress, upcoming events, and opportunities for community input will be shared through various channels, such as village newsletters, community meetings, and the project website. Residents are encouraged to stay engaged and provide feedback throughout the process.

https://lep.swce.co.uk/cef/frequently-asked-questions-faqs/

7. Appendices

7.1 Community engagement summary – community survey

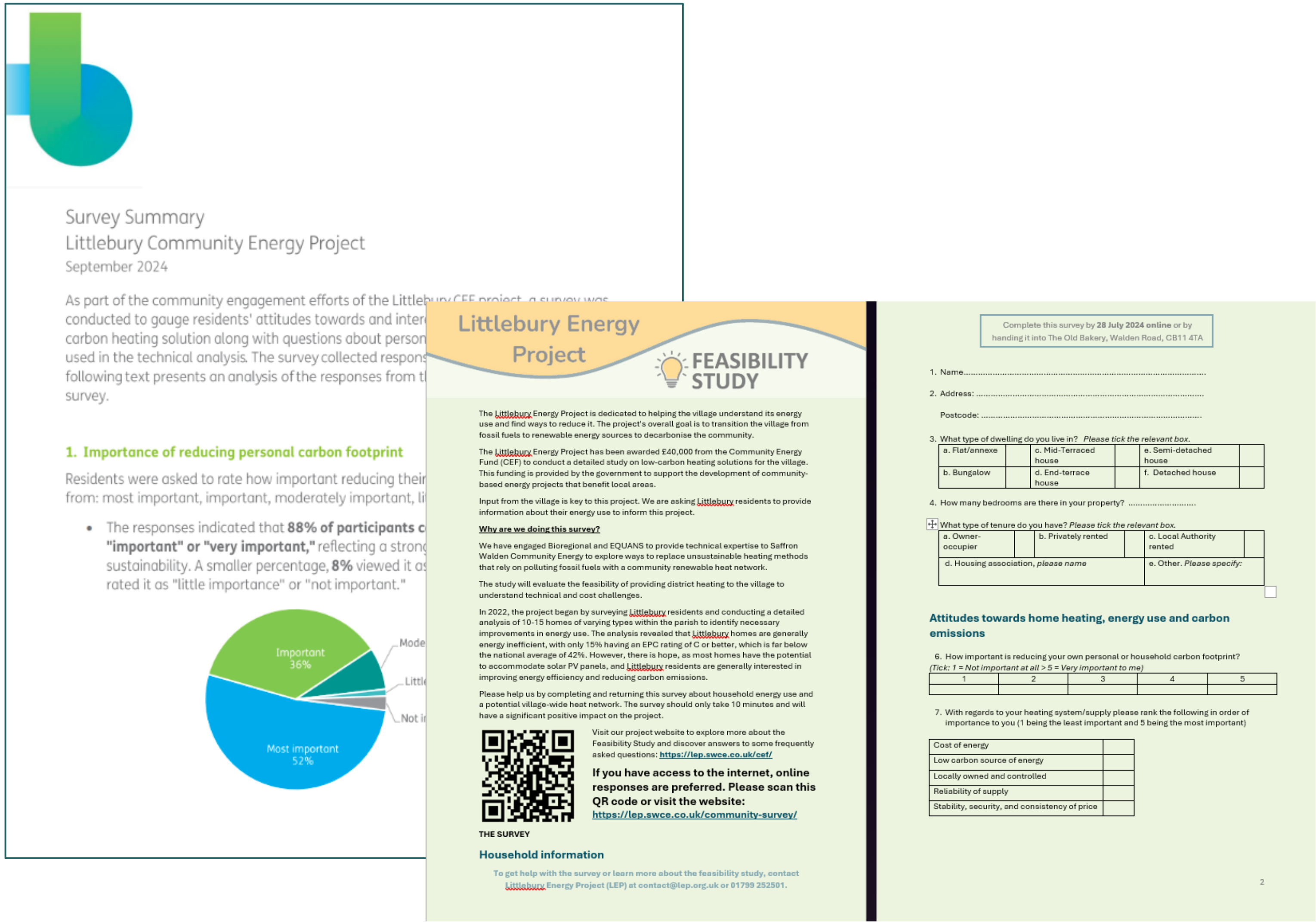
A survey was sent out to understand the villages energy use and the residents' opinions about implementing a community heat network. The survey was open for 5 weeks and was available online for residents to fill out. A physical copy was also shared to allow residents without technology access. 80 residents completed the survey.

Survey findings

Residents are generally open to reducing their personal carbon footprint. However, opinions on using low-carbon heating sources were mixed. The cost of energy and reliability of supply were identified as the most critical factors. There was little interest in local ownership of a heating system.

While most residents were interested in exploring a community energy solution, fewer were enthusiastic about participating in its ownership, possibly due to scepticism about financial benefits. Nearly as many residents were uninterested in investing in the community share offer as those who were very interested.

A full summary report is available in the appendices to the final report.



Survey Summary
Littlebury Community Energy Project
September 2024

As part of the community engagement efforts of the Littlebury CEF project, a survey was conducted to gauge residents' attitudes towards and inter… carbon heating solution along with questions about person… used in the technical analysis. The survey collected respons… following text presents an analysis of the responses from t… survey.

1. Importance of reducing personal carbon footprint

Residents were asked to rate how important reducing their… from: most important, important, moderately important, li…

- The responses indicated that **88% of participants c… "important" or "very important,"** reflecting a strong… sustainability. A smaller percentage, **8%** viewed it as… rated it as "little importance" or "not important."

Littlebury Energy Project

FEASIBILITY STUDY

The Littlebury Energy Project is dedicated to helping the village understand its energy use and find ways to reduce it. The project's overall goal is to transition the village from fossil fuels to renewable energy sources to decarbonise the community.

The Littlebury Energy Project has been awarded £40,000 from the Community Energy Fund (CEF) to conduct a detailed study on low-carbon heating solutions for the village. This funding is provided by the government to support the development of community-based energy projects that benefit local areas.

Input from the village is key to this project. We are asking Littlebury residents to provide information about their energy use to inform this project.

Why are we doing this survey?

We have engaged Bioregional and EQUANS to provide technical expertise to Saffron Walden Community Energy to explore ways to replace unsustainable heating methods that rely on polluting fossil fuels with a community renewable heat network.

The study will evaluate the feasibility of providing district heating to the village to understand technical and cost challenges.

In 2022, the project began by surveying Littlebury residents and conducting a detailed analysis of 10-15 homes of varying types within the parish to identify necessary improvements in energy use. The analysis revealed that Littlebury homes are generally energy inefficient, with only 15% having an EPC rating of C or better, which is far below the national average of 42%. However, there is hope, as most homes have the potential to accommodate solar PV panels, and Littlebury residents are generally interested in improving energy efficiency and reducing carbon emissions.

Please help us by completing and returning this survey about household energy use and a potential village-wide heat network. The survey should only take 10 minutes and will have a significant positive impact on the project.

Visit our project website to explore more about the Feasibility Study and discover answers to some frequently asked questions: https://lep.swce.co.uk/cef/

If you have access to the internet, online responses are preferred. Please scan this QR code or visit the website: https://lep.swce.co.uk/community-survey/

THE SURVEY

Household information

To get help with the survey or learn more about the feasibility study, contact Littlebury Energy Project (LEP) at contact@lep.org.uk or 01799 252501.

Complete this survey by **28 July 2024 online** or by handing it into The Old Bakery, Walden Road, CB11 4TA

1. Name……………………………………………
2. Address: ……………………………………………

   Postcode: ……………………………………………

3. What type of dwelling do you live in? *Please tick the relevant box.*

a. Flat/annexe		c. Mid-Terraced house		e. Semi-detached house	
b. Bungalow		d. End-terrace house		f. Detached house	

4. How many bedrooms are there in your property? ……………………

What type of tenure do you have? *Please tick the relevant box.*

a. Owner-occupier		b. Privately rented		c. Local Authority rented	
d. Housing association, *please name*				e. Other. *Please specify:*	

Attitudes towards home heating, energy use and carbon emissions

6. How important is reducing your own personal or household carbon footprint?

(Tick: 1 = Not important at all > 5 = Very important to me)

1	2	3	4	5

7. With regards to your heating system/supply please rank the following in order of importance to you (1 being the least important and 5 being the most important)

Cost of energy	
Low carbon source of energy	
Locally owned and controlled	
Reliability of supply	
Stability, security, and consistency of price	

2

7.1 Community engagement summary – community engagement event

Community engagement event

On September 25th a community event was held at the Littlebury Village Hall. The presentation was attended by over 50 members of the public, including local residents. A hard copy of the feasibility summary report for the project was available to attendees.

The event was comprised of a presentation delivered by the project leads for SWCE, Bioregional, and Equans. The presentation introduced initial feasibility study findings including:

- The overview of the study
- Energy efficiency measures for homes
- District heating network

This was then followed by a Q&A session, where the audience asked questions broadly categorised as:

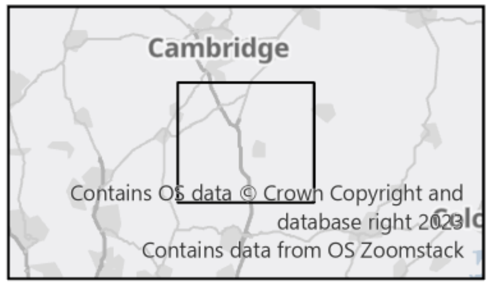
- The infrastructure requirements and advice on whether individual heating or heat network options will be more suitable for older homes
- Financial feasibility and individual costs of a heat network
- The reliability, timescales, and risks of the project.

The project team addressed many audience questions as they came in, and several queries were used to generate an update to the FAQ section of the website.

7. Appendices
7.2 Study area maps

Littlebury Heat Network

EQUANS



Legend

Littlebury Location

Location Plan

Site Centre (BNG) : 551647 , 239655
Grid Reference (6 figure) : TL516396
Address (near) : High Street, Littlebury, Uttlesford, Essex.
Postcode (nearest) : CB11 4TD

N W E S

0 1 2 3 4 5

Kilometers Scale 1:50,000 when reproduced A3 size

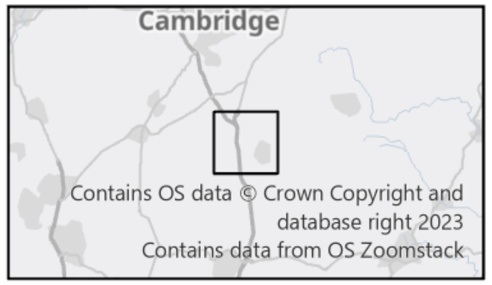
Drawn by: AW 14/06/2024
Checked by: 1557/LP/001a
Approved by:

Littlebury Heat Network

EQUANS

551000 551200 551400 551600 551800 552000 552200 552400

240200 240000 239800 239600 239400 239200



Legend

Littlebury Location

DRAFT

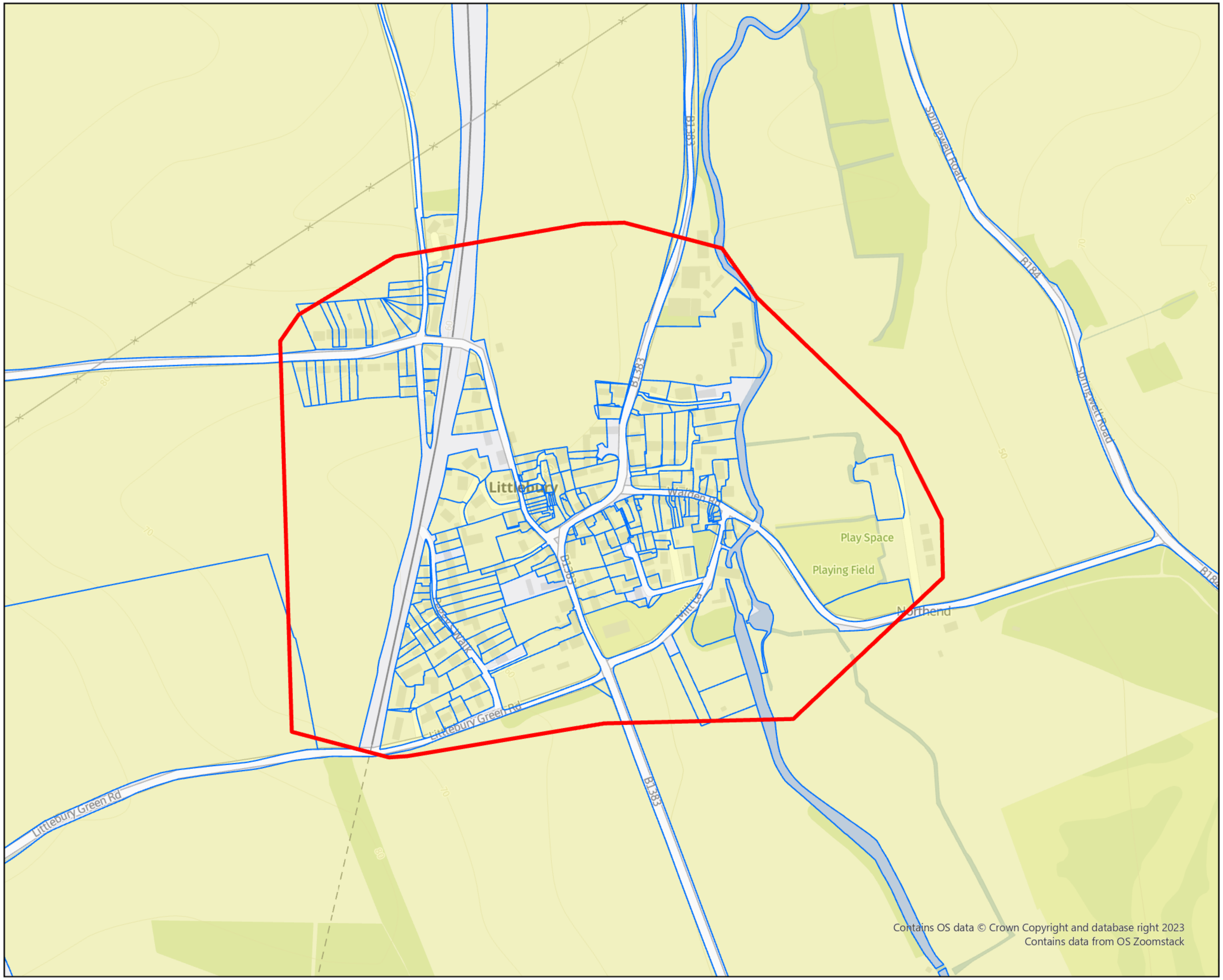
Site Location

Site Centre (BNG) : 551647 , 239655
Grid Reference (6 figure) : TL516396
Address (near) : High Street, Littlebury, Uttlesford, Essex.
Postcode (nearest) : CB11 4TD

N W E S

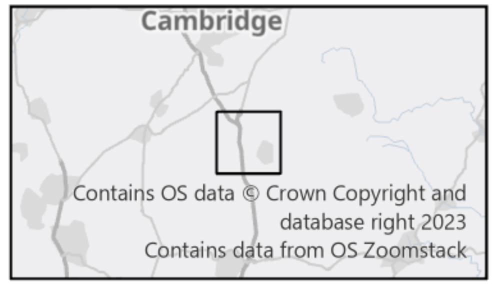
0 100 200 300 400 500
Meters Scale 1:5,000 when reproduced A3 size

Drawn by: AW 14/06/2024
Checked by: 1557/LP/002a
Approved by:



Littlebury Heat Network

EQUANS



Legend

- Littlebury Location
- Land Parcels

DRAFT

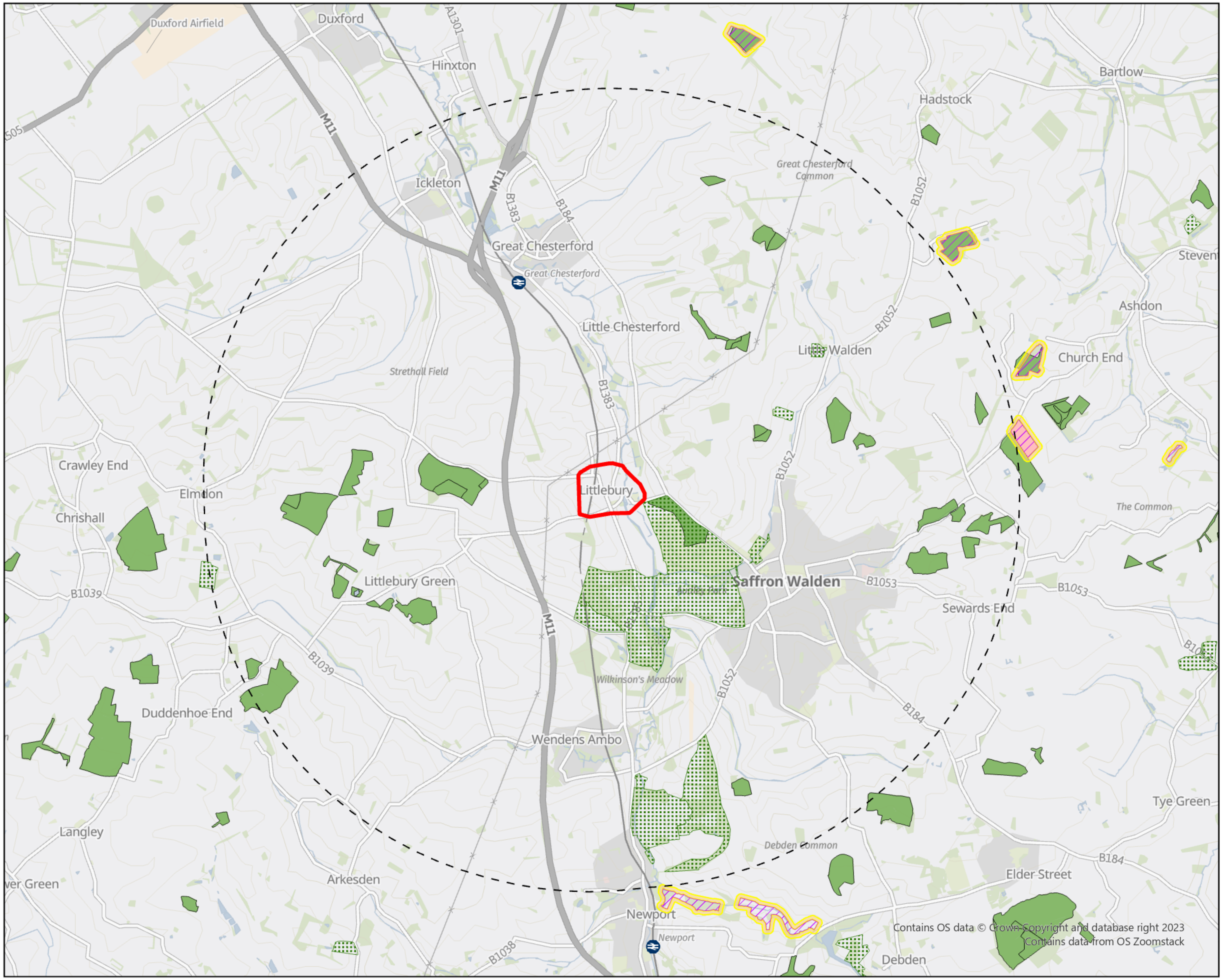
Land Boundaries

N W E S

0 100 200 300 400 500

Meters Scale 1:5,000 when reproduced A3 size

Drawn by: AW 14/06/2024
Checked by: 1557/LP/003a
Approved by:



Littlebury Heat Network

EQUANS

Cambridge

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Contains data from OS Zoomstack

Legend

- Littlebury Location
- Littlebury 5km Buffer
- Sites of Special Scientific Interest (SSSI)
- SSSI Impact Risk Zone - All planning applications - except householder applications.
- National Nature Reserves
- Ancient Woodland
- Woodland Pasture & Parkland

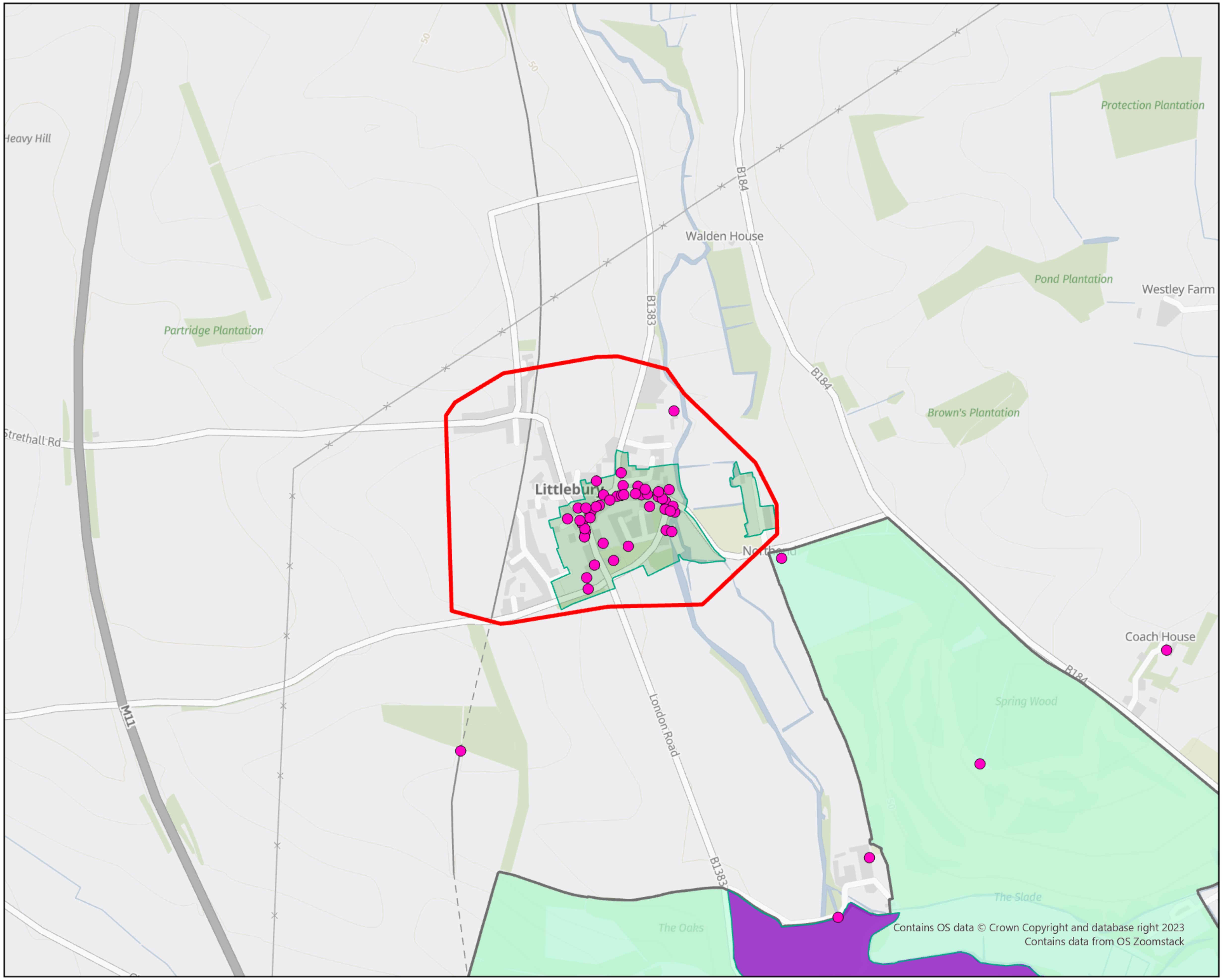
DRAFT

Environmental Land Designations

Kilometers 0 1 2 3 4 5

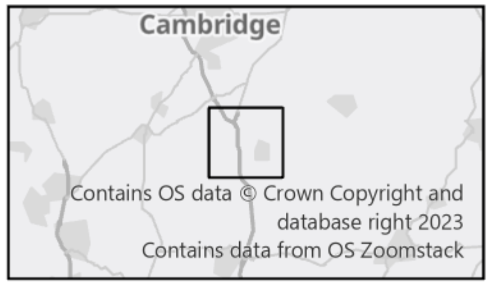
Scale 1:50,000 when reproduced A3 size

Drawn by: AW 14/06/2024
Checked by: 1557/CP/004a
Approved by:



Littlebury Heat Network

EQUANS



Legend

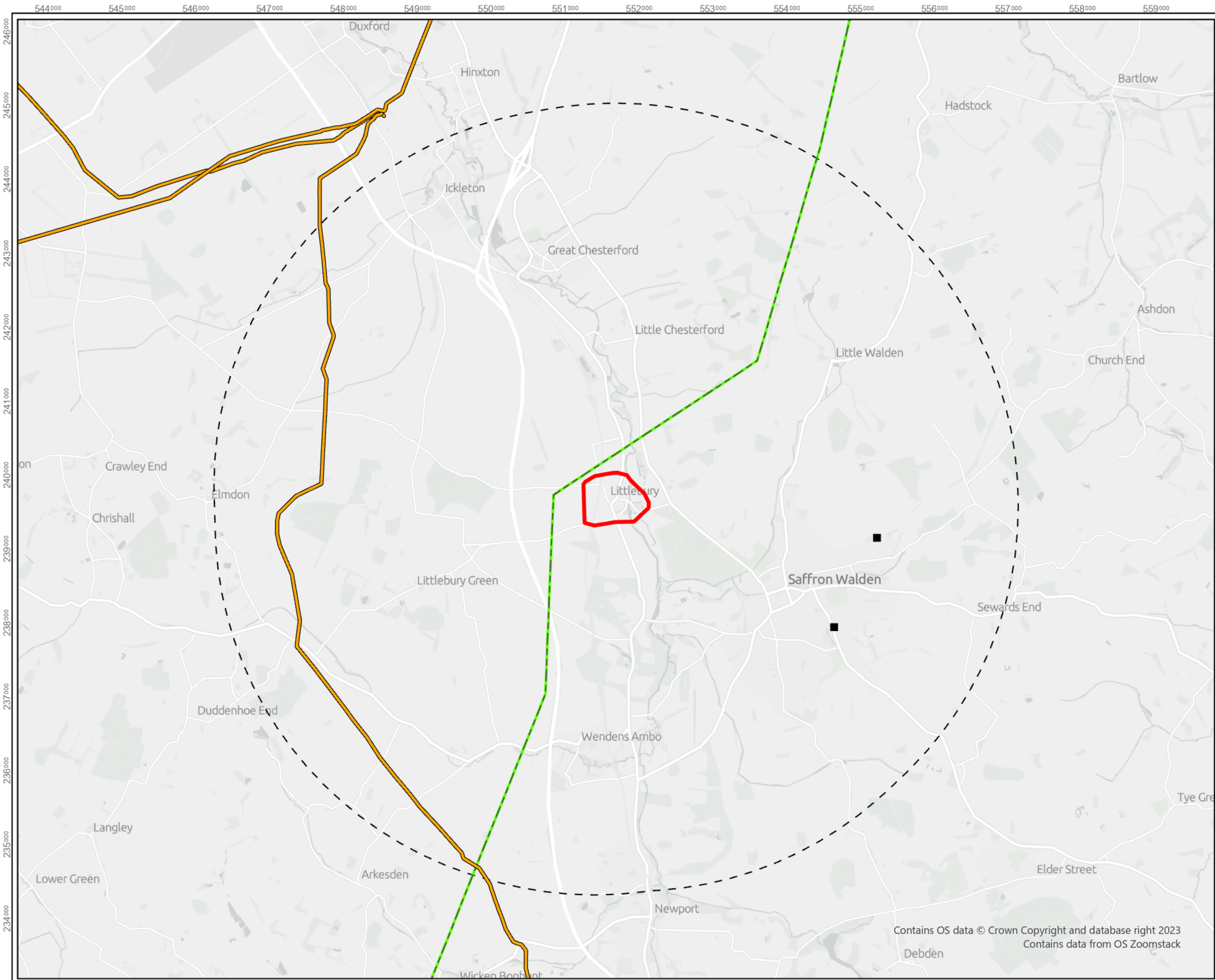
- Littlebury Location
- Listed Buildings
- Conservation Area
- Scheduled Monuments
- Registered Parks & Garden

DRAFT

Cultural Heritage Land Designations

0 200 400 600 800 1,000
Meters Scale 1:10,000 when reproduced A3 size

Drawn by: AW 14/06/2024
Checked by: 1557/CP/005a
Approved by:



Littlebury Heat Network

EQUANS

Cambridge

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Legend

- Littlebury Location
- Littlebury 5km Buffer
- Substation
- National Grid 400kV Powerlines
- National Grid Gas Pipes

DRAFT

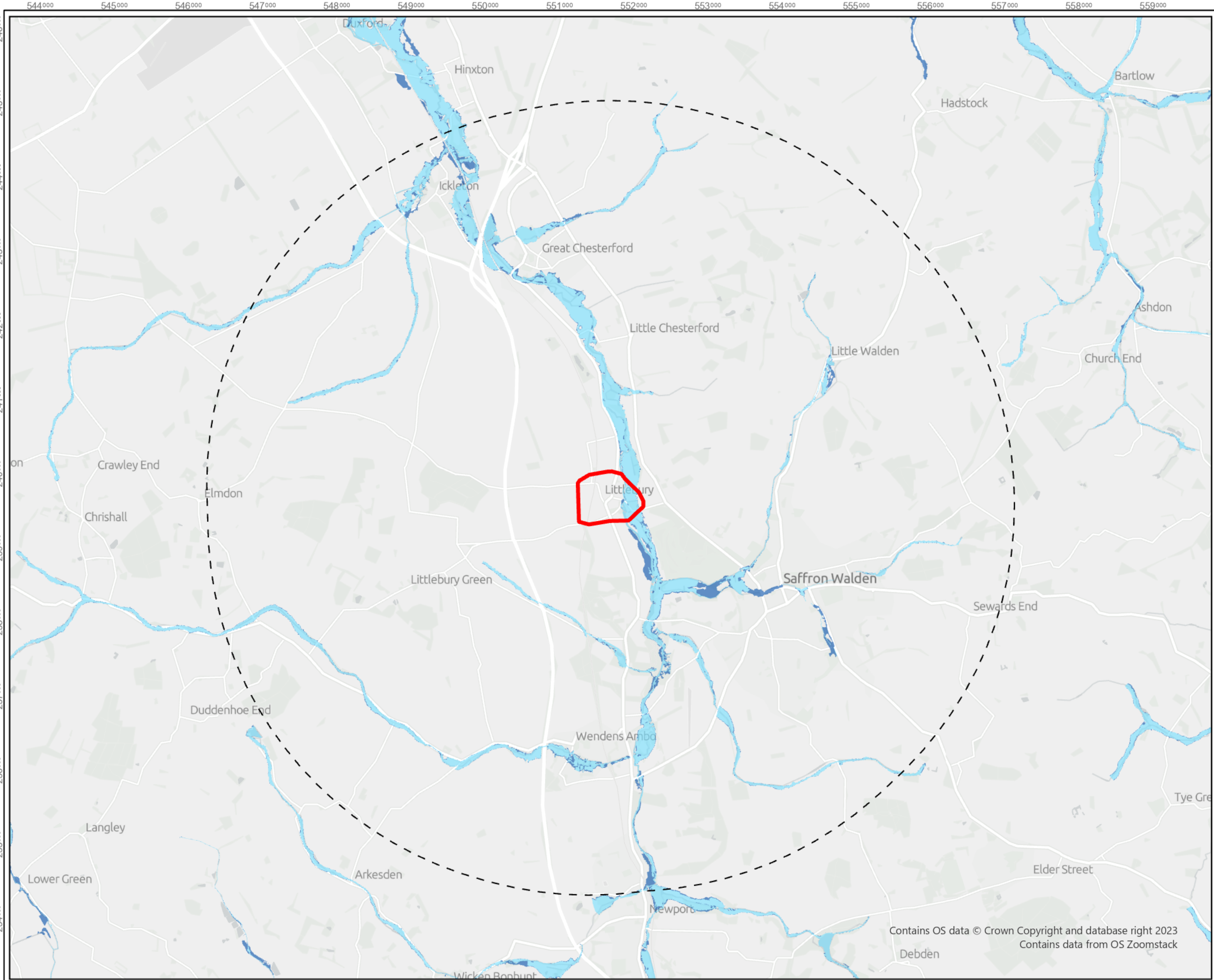
Grid

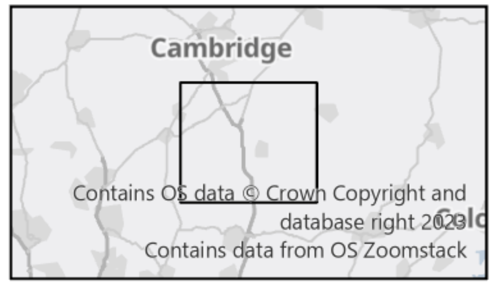
0 1 2 3 4 5
Kilometers
Scale 1:50,000 when reproduced A3 size

Drawn by: AW 16/06/2024
Checked by: 1557/CP/006a
Approved by:

Littlebury Heat Network

EQUANS





Legend

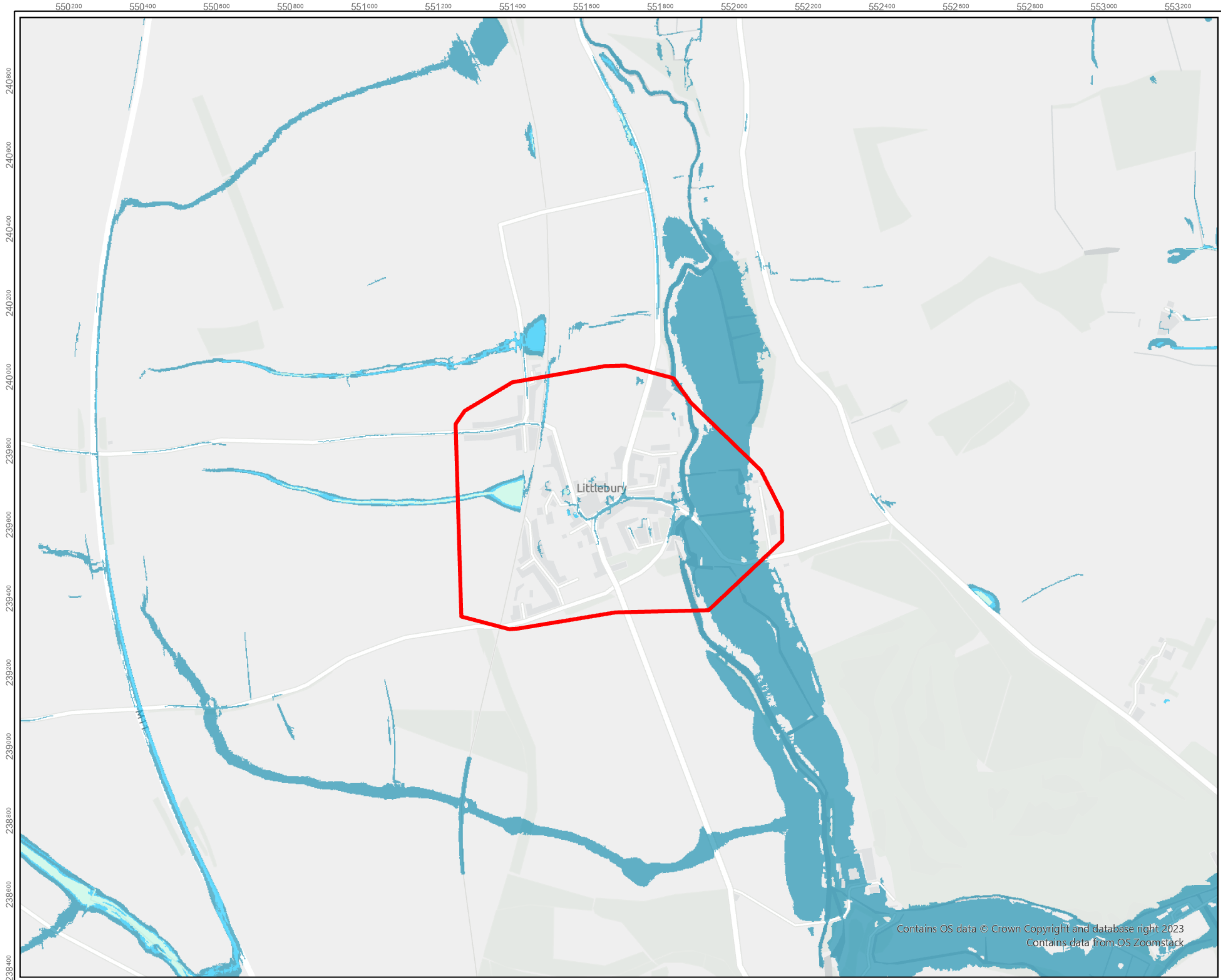
- Littlebury Location
- Littlebury 5km Buffer
- Flood Zone 3
- Flood zone 2

DRAFT

Flood Map for Planning (Rivers and Sea)

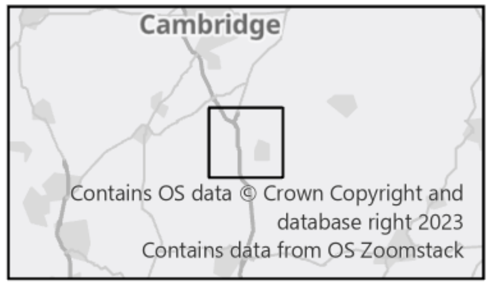
Kilometers 0 1 2 3 4 5 — Scale 1:50,000 when reproduced A3 size

Drawn by: AW 14/06/2024
Checked by: 1557/CP/007a
Approved by:



Littlebury Heat Network

EQUANS



Legend

- Littlebury Location
- Flood risk extent for 1 in 30 Annual Exceedance Probability
- Flood risk extent for 1 in 100 Annual Exceedance Probability
- Flood risk extent for 1 in 1000 Annual Exceedance Probability

DRAFT

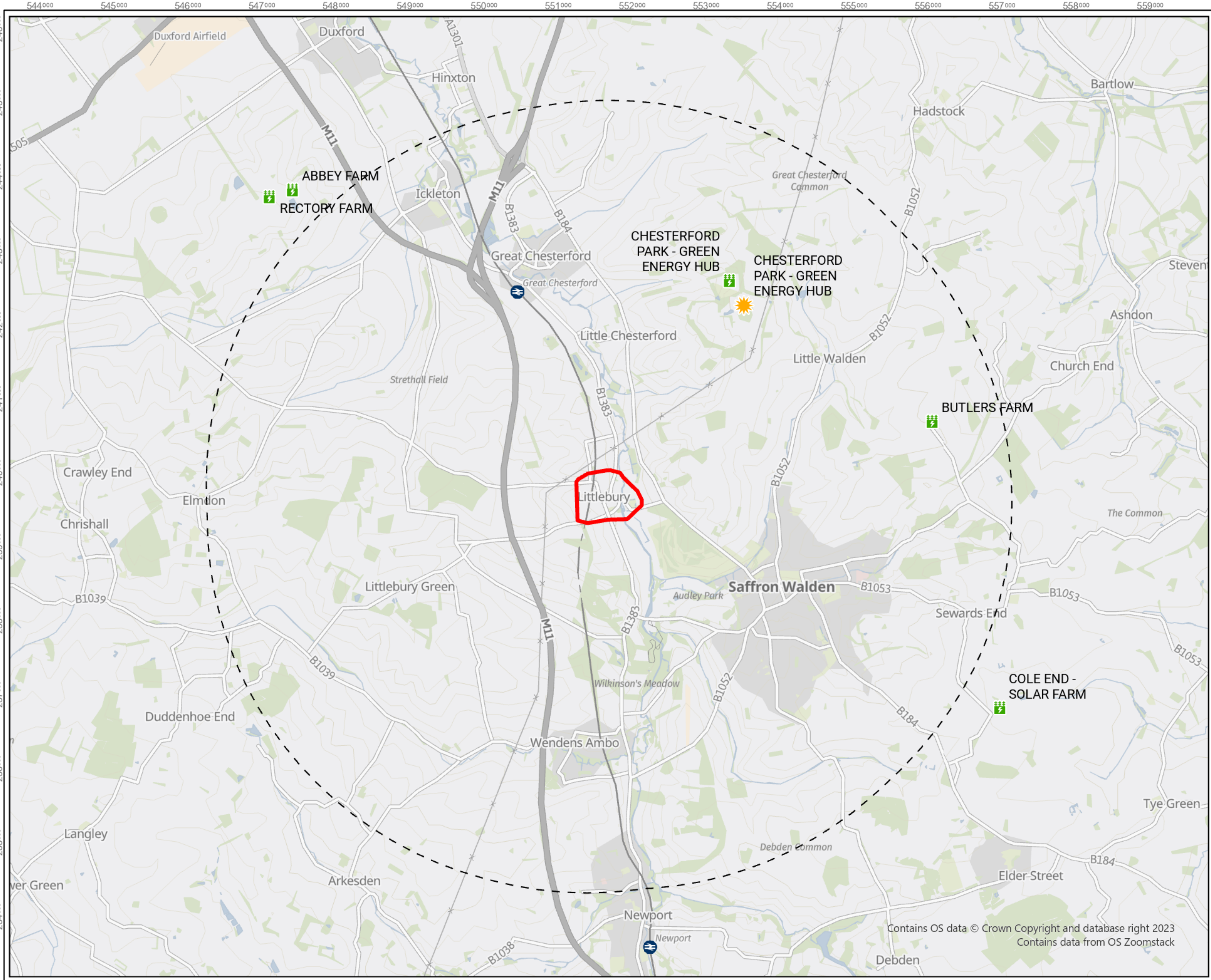
Risk of Flooding from Surface Water

N W E S

0 200 400 600 800 1,000

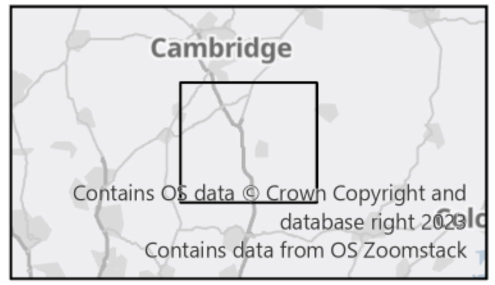
Meters Scale 1:10,000 when reproduced A3 size

Drawn by: AW 14/06/2024
Checked by: 1557/CP/008a
Approved by:



Littlebury Heat Network

EQUANS



Legend

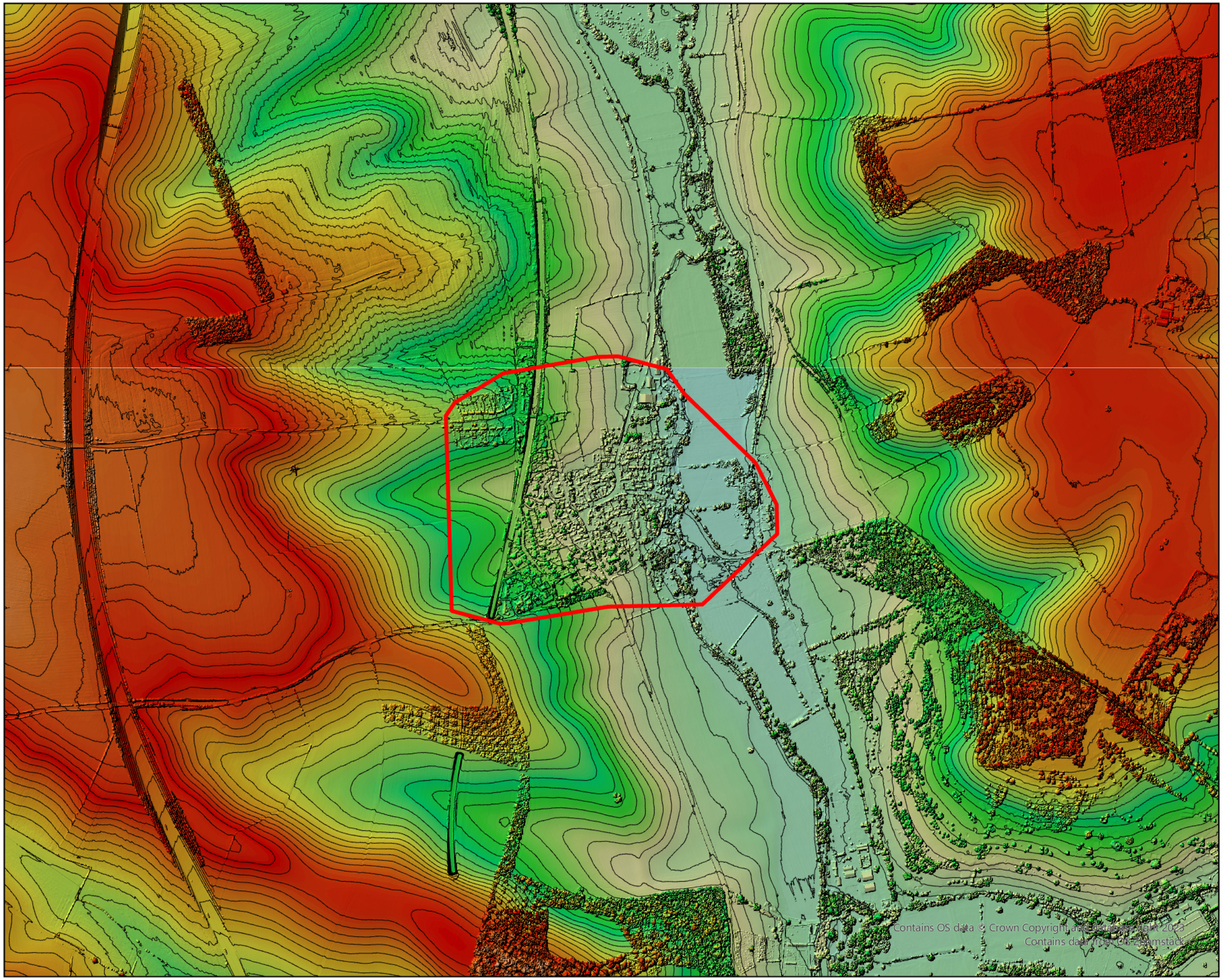
- Littlebury Location
- Littlebury 5km Buffer
- Battery Storage
- Solar Photovoltaics

DRAFT

Renewables Energy Activity

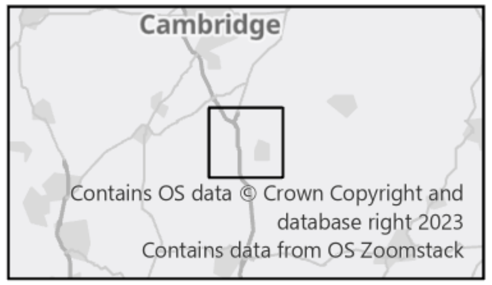
0 1 2 3 4 5 Kilometers — Scale 1:50,000 when reproduced A3 size

Drawn by: AW — 14/06/2024
Checked by: — 1557/CP/009a
Approved by:



Littlebury Heat Network

EQUANS



Legend

Littlebury Location

DRAFT

Terrain

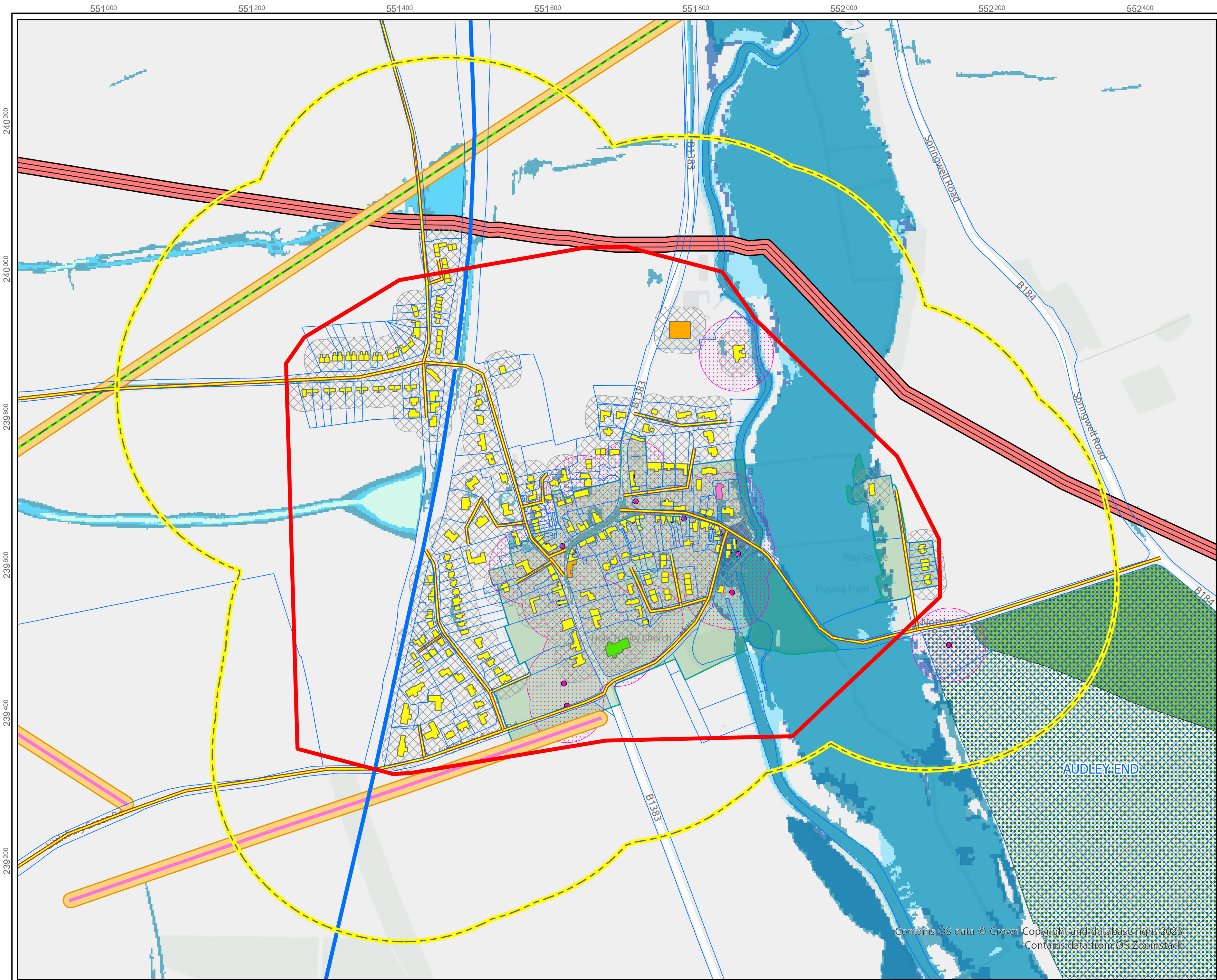
N W E S

0 200 400 600 800 1,000

Meters

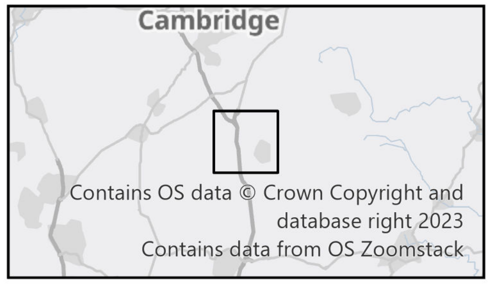
Scale 1:10,000 when reproduced A3 size

Drawn by: AW 14/06/2024
Checked by: 1557/LS/010a
Approved by:



Littlebury Heat Network

EQUANS



Legend

- Littlebury Location
- 250m Buffer Zone
- Land Parcels
- Railway Line
- Local roads

Building Type

- Commercial
- Community
- Religious
- Residential
- Structures & Storage
- Building 20m Buffer Zone
- Distribution Powerlines
- 400kV Powerlines
- Distribution 10m Powerline Buffers
- Exolum Pipeline
- Exolum Pipeline 10m Buffer

Listed Buildings Grade

- I
- II
- Listed Building 50m Buffers
- Conservation Area
- Scheduled Monuments
- Registered Parks & Garden
- Sites of Special Scientific Interest (SSSI)
- SSSI Impact Risk Zone - All planning applications - except householder applications.
- National Nature Reserves
- Woodland Pasture & Parkland
- Ancient Woodland
- Flood risk extent 1 in 30
- Flood risk extent 1 in 100
- Flood risk extent 1 in 1000
- Flood zone 2
- Flood Zone 3

DRAFT

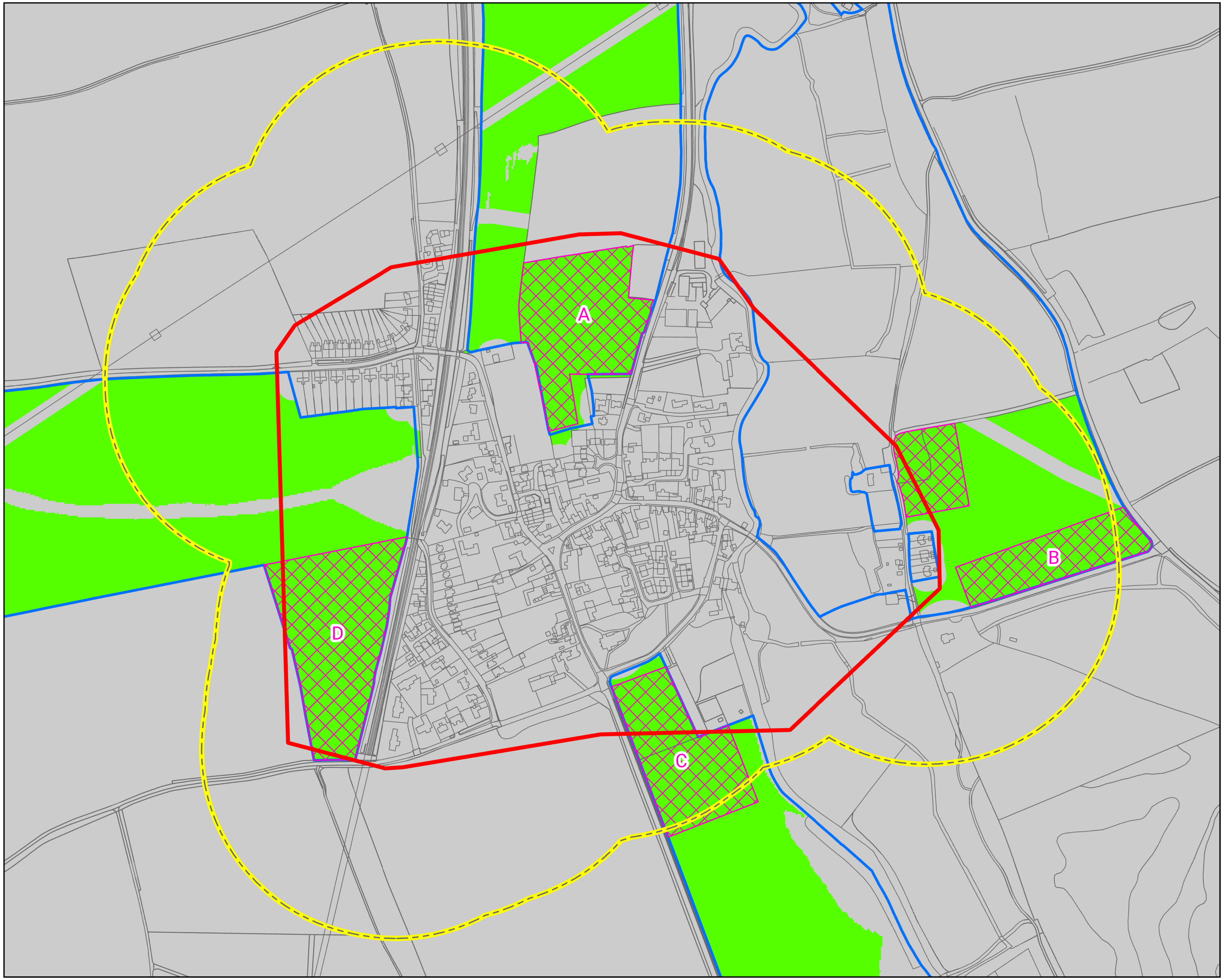
Constrained Land

N W E S

0 100 200 300 400 500

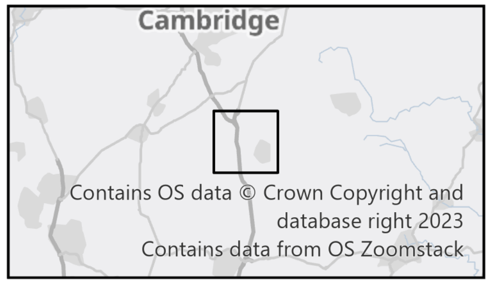
Meters Scale 1:5,000 when reproduced A3 size

Drawn by: AW 27/08/2024
Checked by: 1557/CP/015a
Approved by:



Littlebury Heat Network

EQUANS



Legend

- Littlebury Location
- 250m Buffer Zone
- EC Locations
- Land Parcels
- Constrained Land
- EC Land Selection

DRAFT

Energy Centre Land Selection

N W E S

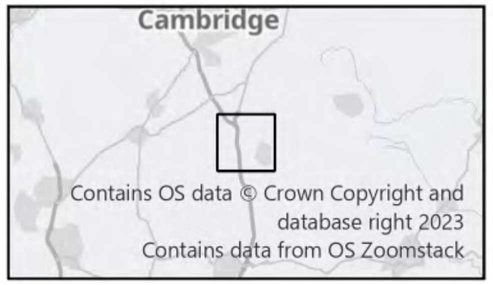
0 100 200 300 400 500

Meters Scale 1:5,000 when reproduced A3 size

Drawn by: AW 29/08/2024
Checked by: 1557/LP/016b
Approved by:

Littlebury
Heat Network

EQUANS



Legend

- Proposed EC Location
- Land Parcels

DRAFT

EC Locations
Site : A

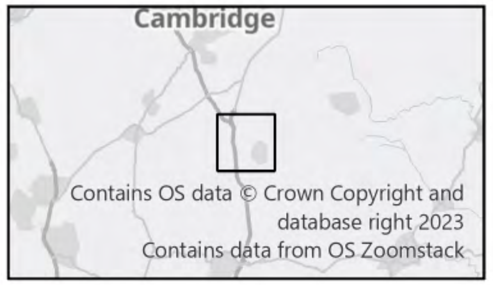
N W E S

0 40 80 120 160 200
Meters
Scale 1:2,000 when reproduced A3 size

Drawn by: AW 27/08/2024
Checked by: 1557/CP/017c
Approved by:

Littlebury Heat Network

EQUANS



Legend

- Proposed EC Location
- Land Parcels

DRAFT

EC Locations
Site : B

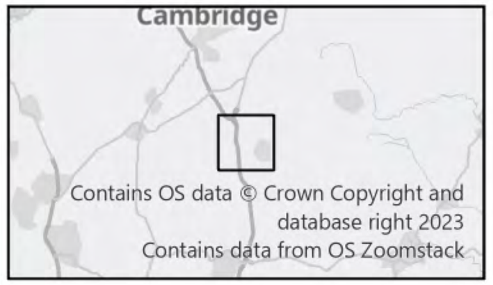
N W E S

0 40 80 120 160 200
Meters Scale 1:2,000 when reproduced A3 size

Drawn by: AW 27/08/2024
Checked by: 1557/CP/017c
Approved by:

Littlebury Heat Network

EQUANS



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Legend

- Proposed EC Location
- Land Parcels

DRAFT

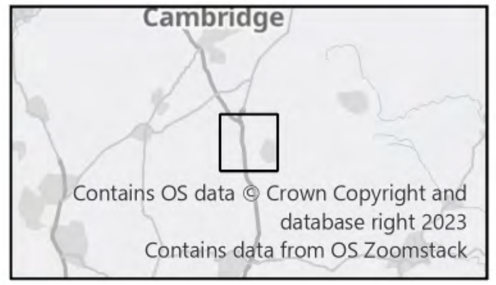
EC Locations
Site : C

N W E S

0 20 40 60 80 100
Meters Scale 1:1,000 when reproduced A3 size

Drawn by: AW 27/08/2024
Checked by: 1557/CP/017c
Approved by:

Littlebury Heat Network



Legend

- Proposed EC Location
- Land Parcels

DRAFT

EC Locations
Site : D

N W E S

0 40 80 120 160 200

Meters Scale 1:2,000 when reproduced A3 size

Drawn by: AW 27/08/2024
Checked by: 1557/CP/017c
Approved by:

Google Earth
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Image © 2024 Airbus


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Image © 2024 Airbus


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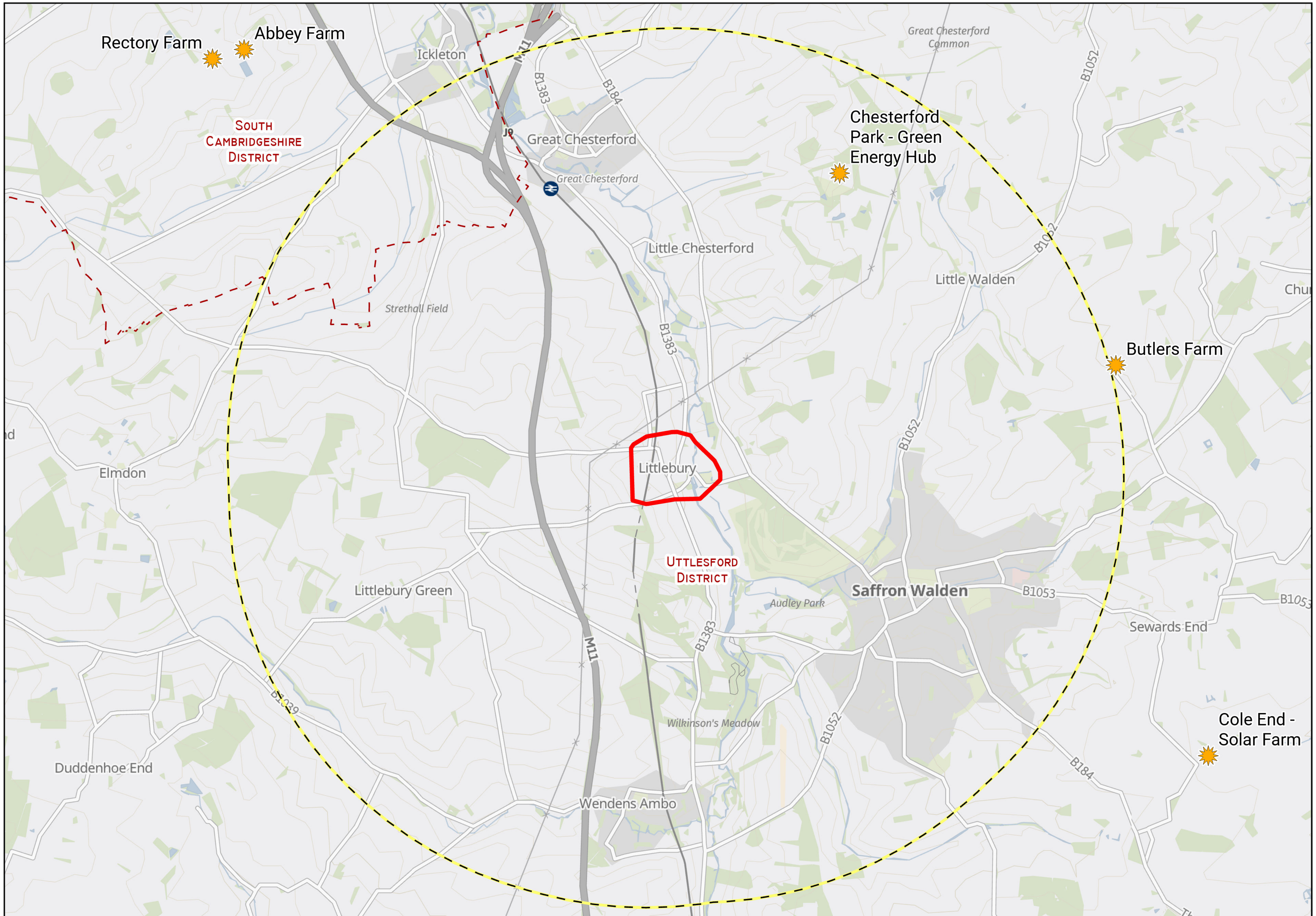
Littlebury Heat Network

EQUANS



Operator (or Applicant)	Site Name	Installed Capacity (MW)	Development Status	Planning Application Ref
Push Energy	Butlers Farm	7.7	Appeal Refused	UTT/14/2755/FUL
Push Energy	Abbey Farm	5	Application Withdrawn	S/2617/15/FL
Push Energy	Rectory Farm	5	Application Withdrawn	S/2642/15/FL
Low Carbon Solar Park 4 Limited	Cole End - Solar Farm	30	Awaiting Construction	UTT/21/0688/FUL
Chesterford Park (General Partner) Limited	Chesterford Park - Green Energy Hub	2.8	Awaiting Construction	UTT/21/2846/FUL

Cambridge

Legend

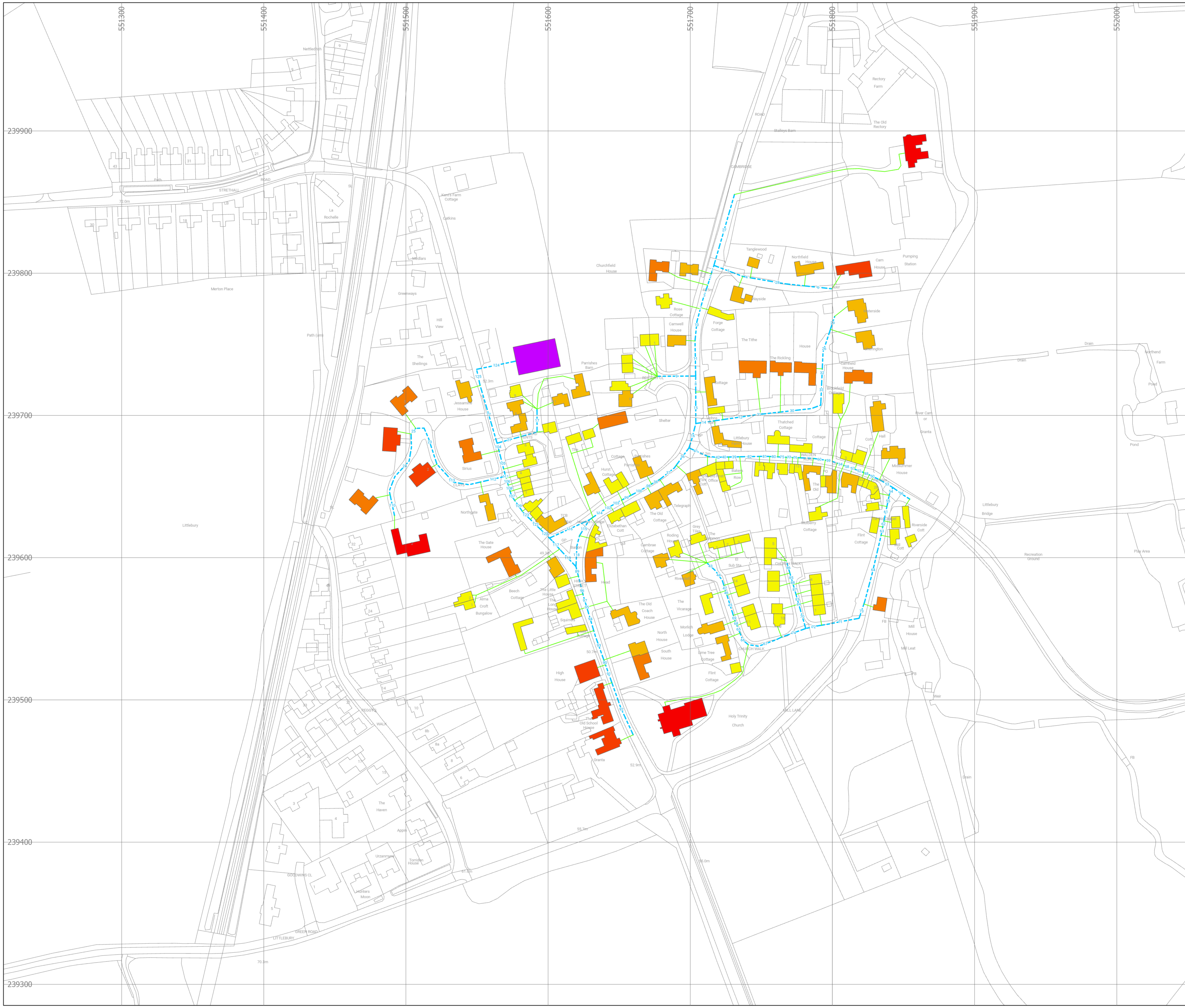
- Littlebury Location
- Littlebury 4km Buffer
- Solar Farm
- Borough Council Boundaries

DRAFT

Renewables Energy Activity

0 0.8 1.6 2.4 3.2 4
Kilometers Scale 1:40,000 when reproduced A3 size

Drawn by: AW 24/09/2024
Checked by: 1557/CP/009b
Approved by:



ID	Length (m)
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2	4.30
3	20.61
4	5.49
5	21.65
6	19.43
7	0.90
8	11.22
9	26.96
10	22.95
11	24.64
12	24.52
13	6.07
14	13.16
15	22.15
16	17.80
17	16.15
19	11.56
20	0.17
21	17.43
22	42.30
23	32.86
24	47.60
25	5.18
26	28.62
27	51.91
28	38.56
29	9.60
30	44.50
31	2.32
32	5.55
33	18.49
34	4.78
36	15.11
37	15.48
38	6.59
39	7.78
40	6.54
41	20.28
42	2.45
43	3.67
44	16.61
45	14.93
46	3.15
47	3.94
48	4.09
49	4.60
50	3.30
51	0.41
52	6.38
53	10.98
54	6.18
55	7.96
56	14.39
57	1.77
58	6.55
59	8.72
60	8.47
61	10.30
62	4.31
63	6.00
64	49.80
65	5.87
66	10.28
67	24.69
68	3.53
69	4.06
70	17.57
71	26.76
72	11.43
73	10.63
74	18.14
75	5.76
76	3.96
77	4.55
78	9.10
79	1.68
80	5.70
81	7.27
82	13.84
83	7.13
84	0.27
85	6.92
86	8.86
87	7.10
88	1.64
89	6.87
90	3.51
91	13.37
92	39.67
93	21.88
94	17.13
95	0.07
96	12.97
97	9.66
98	3.60
99	7.11
100	12.92
101	0.32
102	2.65
103	8.73
104	5.32
105	18.68
106	4.96
107	7.16
108	4.62
109	9.37
110	14.94
111	1.55
112	18.05
113	36.52
114	13.29
115	14.96
116	30.81
117	8.13
118	22.01
119	16.82
120	11.17
122	10.04
123	8.05
124	28.26
125	11.63

Legend

Proposed Properties

Demand kWh

- Below 12000
- 12000 - 18000
- 18000 - 25000
- 25000 - 36000
- Above 36000
- Potential Energy Centre (Site A)
- Connectors
- Heat Network Route (ID Pipe Number)

CURRENT ISSUE INFORMATION

VERSION	AUTH	CHKD	APP	REASON FOR ISSUE	DATE
A	AW	--	--		12/09/2024

SUITABLE CODE	SUITABLILITY DESCRIPTION

EQUANS

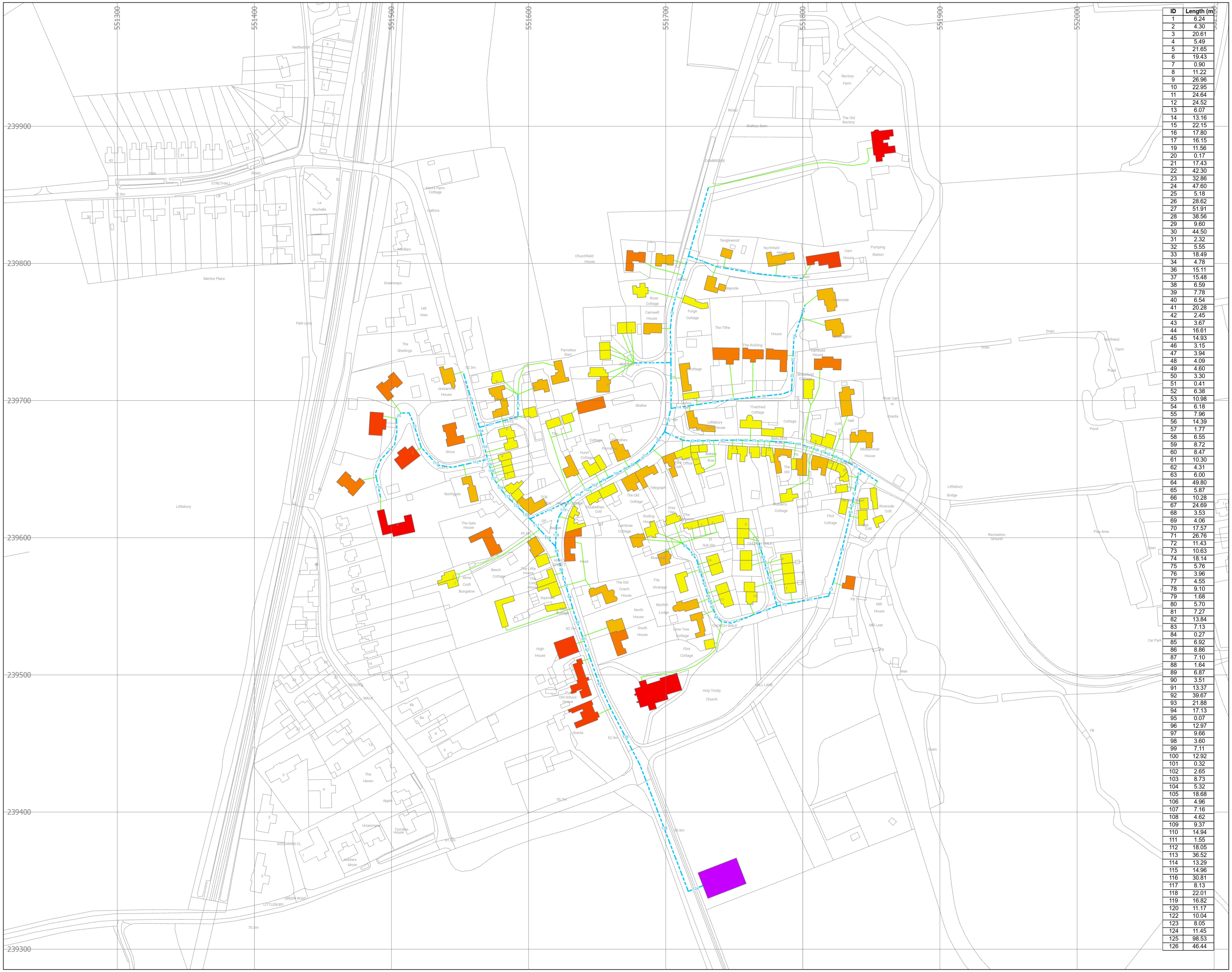
LITTLEBURY

HEAT NETWORK ROUTE
ENERGY CENTRE

SITE A PLAN

SCALE	SHEET SIZE
1 : 100	A1

DRAWING NUMBER	REVISION
1557 / 019a	A



ID	Length (m)
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55	7.96
56	14.39
57	1.77
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63	6.00
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65	5.87
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67	24.69
68	3.53
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72	11.43
73	10.63
74	18.14
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80	5.70
81	7.27
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83	7.13
84	0.27
85	6.92
86	8.86
87	7.10
88	1.64
89	6.87
90	3.51
91	13.37
92	39.67
93	21.88
94	17.13
95	0.07
96	12.97
97	9.66
98	3.60
99	7.11
100	12.92
101	0.32
102	2.65
103	8.73
104	5.32
105	18.68
106	4.96
107	7.16
108	4.62
109	9.37
110	14.94
111	1.55
112	18.05
113	36.52
114	13.29
115	14.96
116	30.81
117	8.13
118	22.01
119	16.82
120	11.17
122	10.04
123	8.05
124	11.45
125	98.53
126	46.44

Legend

Proposed Properties

Demand kWh

- Below 12000
- 12000 - 18000
- 18000 - 25000
- 25000 - 36000
- Above 36000
- Potential Energy Centre (Site C)
- Connectors
- Heat Network Route (ID Pipe Number)

CURRENT ISSUE INFORMATION

VERSION	AUTH	CHKD	APP	REASON FOR ISSUE	DATE
A	AW	--	--		12/09/2024

SUITABLE CODE	SUITABILITY DESCRIPTION

EQUANS

LITTLEBURY

HEAT NETWORK ROUTE
ENERGY CENTRE

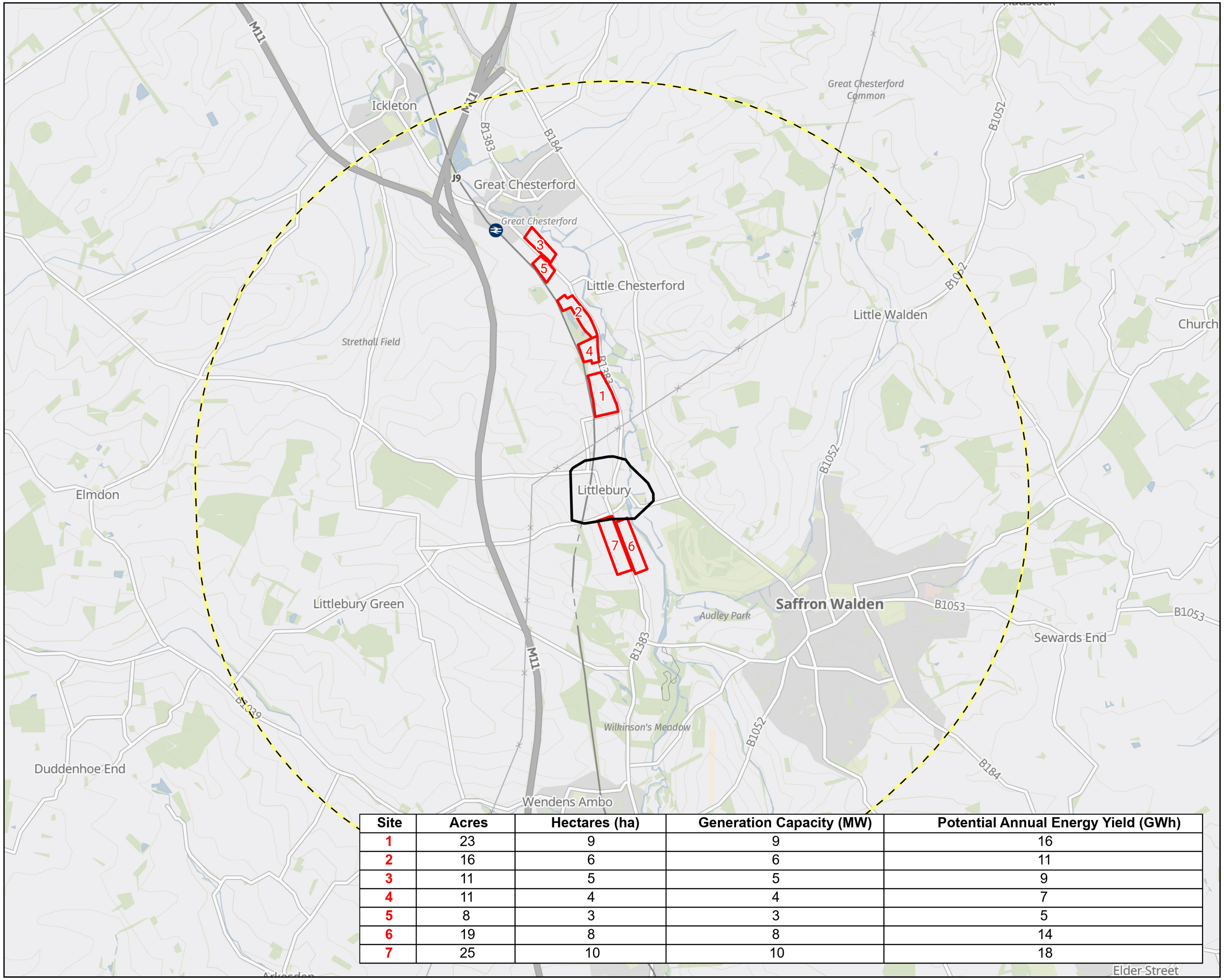
SITE C PLAN

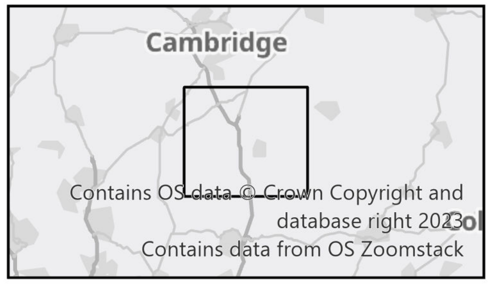
SCALE	SHEET SIZE
1 : 100	A1

DRAWING NUMBER	REVISION
1557 / 019a	A

Littlebury Heat Network

EQUANS





Legend

- Littlebury Village Boundary
- Littlebury 4km Buffer
- Potential Solar Farm Land Selection

Site	Acres	Hectares (ha)	Generation Capacity (MW)	Potential Annual Energy Yield (GWh)
1	23	9	9	16
2	16	6	6	11
3	11	5	5	9
4	11	4	4	7
5	8	3	3	5
6	19	8	8	14
7	25	10	10	18

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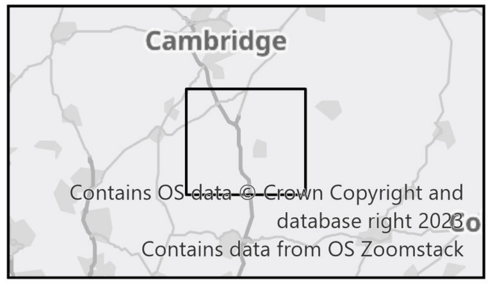
Solar Farm Land Selection

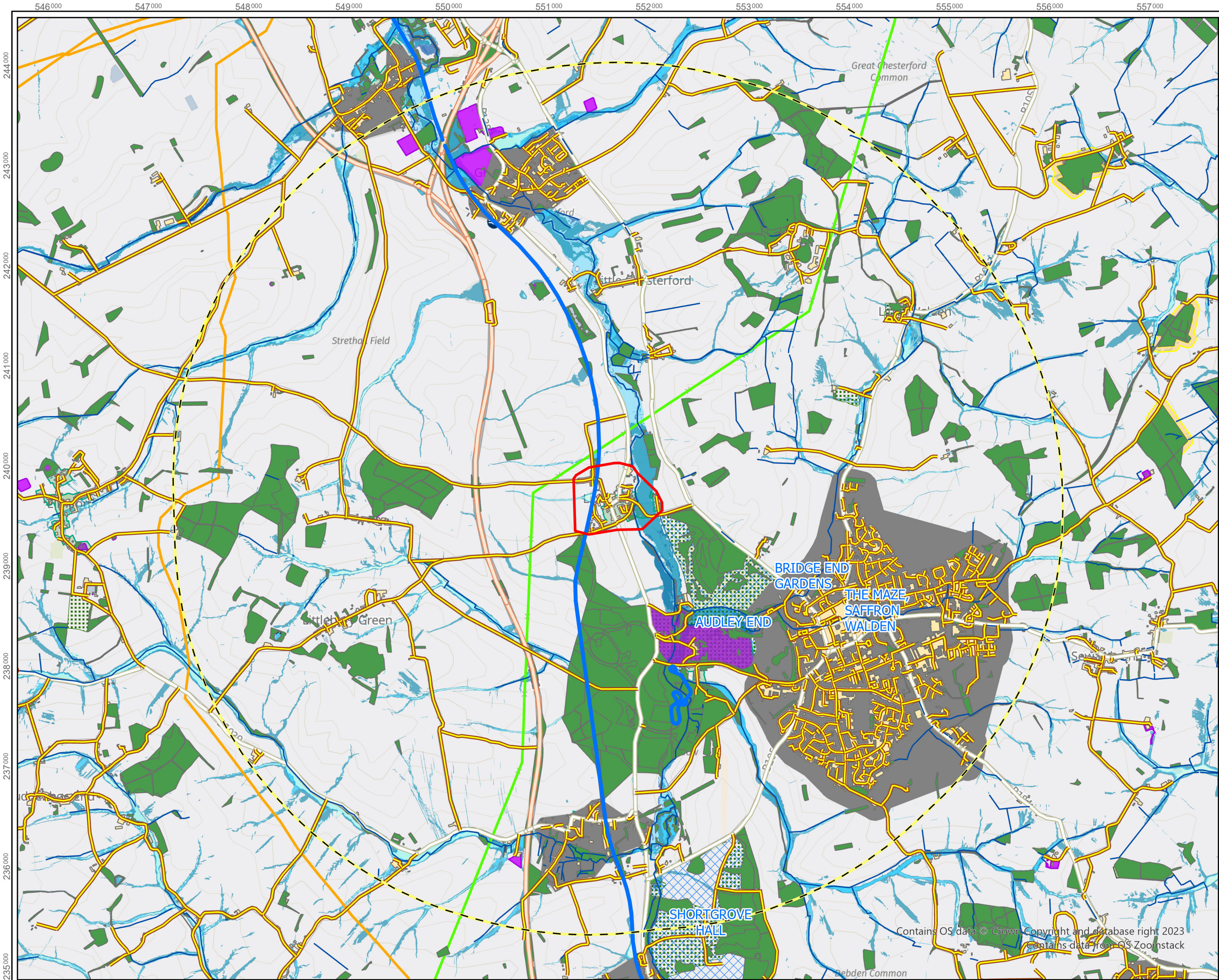
0 0.8 1.6 2.4 3.2 4
Kilometers Scale 1:40,000 when reproduced A3 size

Drawn by: AW 22/10/2024
Checked by: 1557/LP/020c
Approved by:

Littlebury Heat Network

EQUANS





Legend

- Littlebury Village Boundary
- Littlebury 4km Buffer
- Railway Line
- Local roads
- Watercourses
- Regional roads
- National roads
- Woodland
- Urban areas
- District Buildings
- Overhead Power Line
- Gas Pipe
- Listed Buildings
- Conservation Area
- Scheduled Monuments
- Registered Parks & Garden
- Sites of Special Scientific Interest (SSSI)
- SSSI Impact Risk Zone - All planning applications - except householder applications.
- National Nature Reserves
- Woodland Pasture & Parkland
- Ancient Woodland
- Flood risk extent for 1 in 30 Annual Exceedance Probability
- Flood risk extent for 1 in 100 Annual Exceedance Probability
- Flood risk extent for 1 in 1000 Annual Exceedance Probability
- Flood Zone 3
- Flood zone 2

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Solar Farm Constraints Map

N W E S

0 0.75 1.5 2.3 3 3.8

Kilometers Scale 1:37,015 when reproduced A3 size

Drawn by: AW 22/10/2024
Checked by: 1557/LP/022a
Approved by: