HyNet North West Hydrogen Pipeline

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Route Corridor Report

January 2022

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Glossary

Term	Description
Blending	The blending of hydrogen with the existing natural gas supply to create a hybrid gas for use by users
DCO	Development Consent Order. The consent required for Nationally Significant Infrastructure Projects, of which this Project is one.
EIA	Environmental Impact Assessment. A formal assessment of the environment significance of a proposed development.
HyNet North West	A wider scheme to assist with the decarbonisation of the region of which this project forms a part.
HAGI	Hydrogen Above Ground Installation. Infrastructure required in places along the pipeline to facilitate connection and/or provide maintenance points.
Hydrogen Production Plant	A production plant at Essar's Stanlow site which will produce hydrogen to be transported by the pipeline to the Hydrogen Storage Facility and to users.
Hydrogen Storage Facility	A storage facility for hydrogen at Inovyn's underground caverns to the south of Northwich. Hydrogen stored in these caverns will be transported by the pipeline to users.
PEIR	Preliminary Environment Information Report. A report detailing the findings of the preliminary EIA work undertaken.
Preferred Route Optioneering / Preferred Route Alignment	Third stage of works where specific pipeline route options are considered within the Preferred Corridor in order to identify a Preferred Route Alignment which will provide the basis of the final pipeline route.
The Project	The HyNet North West Pipeline Project. The 125km pipeline and supporting HAGIs which are the subject of this report.
Route Corridor Identification / Preferred Route Corridor	Second stage of works where corridors within which a pipeline would run are considered along the Preferred Strategic Option. This will identify a Preferred Route Corridor.
Strategic Optioneering / Preferred Strategic Option	Initial stage of works to consider strategic layouts for the pipeline route and select a preferred option which will then be used to identify a route corridor for the pipeline.

Contents

1. Introduction

1.1 Overview

1.1.1 The HyNet North West Hydrogen Pipeline Project (hereafter 'the Project') is a proposal by Cadent Gas Ltd to construct and operate the UK's first at scale 100 per cent hydrogen pipeline. It will deliver hydrogen - a clean energy source - to multiple industrial users and power generators and taking hydrogen to gas blending points for introduction into the existing gas network.

1.1.2 The Project is part of the wider HyNet North West scheme that will produce, store and distribute hydrogen as well as capture and store carbon from industry in the North West of England and North Wales. By achieving this, HyNet North West will create and maintain thousands of local jobs, enabling long-term sustainability for businesses and supporting financial security for communities across the region. It is possible that further hydrogen pipelines will be built across the north west region to support the wider supply of hydrogen to homes and industrial users.

1.1.3 The Project includes the construction, operation and maintenance of approximately 125km of new pipeline to distribute hydrogen to industry and for blending into the existing natural gas network in the North West. Hydrogen Above Ground Installations (HAGIs) are also required to control the flow and pressure of hydrogen at key points along the proposed pipeline.

Purpose of This Report

1.1.4 The purpose of this report is to present the outputs of the routeing and siting work which has been undertaken to identify the corridors in which the pipeline and some connection spurs would be located, and potential locations for the HAGIs required along the pipeline route. The findings of the study have been used to identify the boundary of the Project for use in the Environmental impact Assessment (EIA) Scoping exercise and for use within the public consultation exercise which commences in January 2022.

1.2 Background to the Project

1.2.1 If constructed, the pipeline would connect to the Hydrogen Production Plant at the Essar Stanlow site as a source of hydrogen for onward distribution to the network. Connections would also be needed to:

- the Hydrogen Storage facility, south of Northwich, for the storage of hydrogen in underground caverns;
- Partington and Warburton, for the blending of hydrogen into the existing gas network; and
- St. Helens, for connections to industrial users.

1.2.2 The location of these connection points is shown in Figure 1.1.

1.2.3 A number of other industrial users exist to which connections will also need to be made from the pipeline.

1.3 Project Team

1.3.1 The project team consists of:

- Cadent Gas Ltd;
- A lands, environment, consents and stakeholder team, led by Wood Group UK Ltd; and
- A Front End Engineering Design (FEED) team, led by Wood Group UK Ltd.

1.4 Structure of the Report

1.4.1 This report contains:

- Chapter 2: Approach to Routeing and Siting: the methodology for the study.
- Chapter 3: Strategic Optioneering: the work undertaken to identify a general layout for the project.
- Chapter 4: Route Corridors: the work undertaken to identify the corridors within the strategic layout, and the HAGIs and spur connections needed.
- Chapter 5: Confirmation of the Preferred Route Corridor.

Key

- Scoping boundary
- Hydrogen Production Facility (at Stanlow Refinery)
- Hydrogen Storage Facility
- Blending points to the existing Cadent gas network
- A cluster of industrial operations in St Helens

0 1 2 3 4 5 Kilometers

Scale at A3: 1:110,000

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Route Corridor Study

Figure 1.1
Connection Points

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2. Approach to Routeing and Siting

2.1.1 Chapter 2 provides the methodology of the routeing and siting work to be undertaken as part of the HyNet project.

2.2 Objectives

2.2.1 The key requirement of the routeing and siting work is that it must allow the following objective of the Project to be met:

2.2.2 The HyNet North West Hydrogen Pipeline project will transport low carbon hydrogen from the Hydrogen Production Plant or the Hydrogen Storage Facility to identified industrial users and to blending points at Partington and Warburton (the "Users"). In this way it will support the north west's transition to Net Zero Carbon by 2050.

2.2.3 In addition, the Project design selected must be:

- technically and economically fit for purpose;
- able to receive the relevant consents;
- able to be safely constructed; and
- safe to operate.

2.2.4 In order to be technically and economically fit for purpose, the Project design must include flexibility around which industrial users may connect to the Project.

2.3 Identify constraints and beneficial features

2.3.1 From the consenting perspective, relevant legislation (in the Planning Act 2008) requires that the overall decision on the DCO must be in compliance with Section 104 of the Planning Act 2008 and therefore has to have regard to:

- Any relevant national policy statement;
- Any local impact report;
- Any matters prescribed by regulations; and
- Any other matters which the decision maker considers to be both important and relevant to the decision.

2.3.2 From reviewing policy documents at a national level, and those documents which form the Local Development Plans, a range of topics can be identified which will need to be considered by the consenting process.

- Air Quality
- Biodiversity and Geodiversity
- Civil and military aviation and defence interests

- Coastal change
- Pollutants (dust odour, light etc)
- Flood risk
- Historic Environment
- Landscape and Visual
- Green infrastructure
- Noise and Vibration
- Socio-economic
- Traffic and transport
- Green Belt
- Local Wildlife Sites
- Mineral Safeguarding Areas
- Housing Allocations
- Local Geological Sites
- Tree Preservation Orders
- Public Rights of Way, and National recreational routes

2.3.3 The following constraints have been considered with regard to ensuring safe construction and operation, plus viable design;

- Ground conditions
- Densely populated areas:
- Existing / future built developments
- Overhead power lines
- Mineral / mining extraction / landfill sites
- Unstable ground
- Active/dormant landslips
- Rock at/near surface
- UXO / UXB
- Steep slopes
- Major highway crossings
- Rail line crossings
- Major watercourse crossings
- Buried services

- Overhead lines
- Access (temporary and permanent)

2.3.4 These issues are considered to provide an appropriate broad coverage of the regulatory and 'other' matters which will have a bearing on the identification of strategic options, routeing and design and on the Development Consent Order (DCO) determination.

2.3.5 A number of the constraints or topic areas considered will be relevant for both environment and engineering considerations, or for multiple environmental topic areas and will cover the regulatory and 'other' matters identified by the Planning Act 2008.

The features

2.3.6 A range of designations, policy allocations and features relating to the subjects above have been identified and mapped into a GIS system for use in the study.

2.3.7 The features are split between the consenting and engineering disciplines, although in practice there will be cross-over between the features and the two disciplines.

Consenting

2.3.8 The features in Table 1.1 have been identified as being of relevance to the consenting process for this project. The majority could be seen as routeing constraints, however the Green Belt is considered differently (as described in **paragraphs 2.38-2.3.9**).

Table 2.1 Key Policy Constraints

Topic	Constraint
Air Quality	Urban areas Special Protection Areas (SPA) Special Areas of Conservation (SAC) Ramsar sites National Nature Reserves (NNR) Sites of Special Scientific Interest (SSSI)
Biodiversity and Geodiversity	Special Protection Areas (SPA) Special Areas of Conservation (SAC) Ramsar sites National Nature Reserves (NNR) Sites of Special Scientific Interest (SSSI) Local Nature Reserves (LNR) Priority habitats Ancient woodlands Tree Preservation Orders (TPOs)
Civil and military aviation and defence interests	Ministry of Defence land
Coastal change	N/A

Topic	Constraint
Pollutants (dust, odour, light etc)	Urban/built up areas Public Rights of Way and cyclepaths
Flood risk	Flood zones 2 and 3
Historic Environment	Historic battlefields Registered parks and gardens Scheduled Ancient Monuments World Heritage Sites Listed Buildings Conservation Areas Historic Landscapes (Wales)
Landscape and Visual	Areas of Outstanding Natural Beauty No National Parks within study area
Green infrastructure	Green Belt (see paragraphs 2.3.8-2.3.9) National Trust land Country parks Public access land (Countryside and Rights of Way Act)
Noise and Vibration	Urban areas Special Protection Areas (SPA) Special Areas of Conservation (SAC) Ramsar sites National Nature Reserves (NNR) Sites of Special Scientific Interest (SSSI) Public Rights of Way and cyclepaths
Socio-economic	National cycle routes National/Regional walking routes Areas of public recreation/open space
Traffic and transport	N/A: National policy is related to traffic generation issues rather than constraints to be avoided

Rural / Green Belt

2.3.9 The construction of a pipeline development generally favours the use of rural land to avoid the constraints posed by built up areas, such as existing utilities, residential homes and community facilities.

2.3.10 Within the study area, a Green Belt designation covers substantial extents of the development area and as the pipeline is required to link various points it is a designation and constraint which cannot be avoided.

2.3.11 The purpose of Green Belt land is to maintain open/rural areas between settlements such that it should not be a constraint for a pipeline development, especially where land will be reinstated to its original condition after construction. However, it should be noted that a pipeline project would usually be able to be developed in general compliance with Green Belt policy on the basis that it can be

demonstrated to be an 'engineering operation' and so is not inappropriate development in the Green Belt for the purposes of the NPPF.

2.3.12 Green Belt designations are therefore not considered in the initial Strategic Optioneering work, but will be introduced later in the Route Corridor Identification stage.

Engineering

2.3.13 From an engineering perspective, the routeing exercise starts with constraints, particularly those which cover more extensive areas of land or which would give rise to substantial levels of difficulty or cost for a pipeline to be routed through.

Table 2.2 Key Engineering Constraints

Topic	Constraints
Ground conditions	Geo-hazards (i.e. major faults/seismic issues) Karstic features (i.e. limestone caves, sink holes) Marshland or peat type soils Topography (steep forward or side slopes)
Densely populated areas	Towns Suburban Areas (therefore maximising rural land) Note: these areas are defined in IGE/TD/1 pipeline code by population density.
Existing / future built developments	Planning permissions/applications Planning policy designations Landowner option agreements Outdoor leisure facilities
Overhead power lines	Parallel running with overhead power lines
Minerals / mining extraction / landfill sites	Historic, present and future planned activity Deep and shallow mining Shafts Spoil heaps Opencast high walls Contaminated land

Hydrogen Above Ground Infrastructure

2.3.14 Hydrogen Above Ground Infrastructure (HAGI) are considered differently in the routeing and siting work to the pipeline. The pipeline is a buried structure above which land is re-instated. This would avoid any permanent features appearing in the landscape and allow any disturbance to existing features to be temporary in nature. A HAGI, however, would be a permanent piece of infrastructure in the landscape and therefore will result in differing impacts arising from the land lost to development.

2.3.15 For example, HAGIs will have a different landscape impact than a pipeline. The significance of impact will depend on the scale and nature of each HAGI and the particular characteristics of the landscape in the locations being considered for

their siting. However, the exact route of the pipeline may also restrict the ability to locate HAGIs depending on the route identified and the nature of the connections that the HAGIs will make.

Classification of features

2.3.16 The constraints identified above are then plotted using a GIS system to build a 'heatmap'. The heatmap identifies highly constrained areas and areas with significant constraints which should be avoided if possible. It is however important to note that constraints may not in themselves become a critical barrier as the appropriateness of a corridor (and subsequent route).

2.4 Strategic Optioneering

2.4.1 The Strategic Optioneering stage involves the consideration of strategic layouts for the pipeline route and the selection of a preferred option which will then be used to identify a route corridor for the pipeline.

2.4.2 In principle, the easiest method of laying a pipeline between any fixed points would be to take a direct line between these points. However, constraints are likely to require a direct route line to be amended to avoid or minimise conflict between the pipeline and the constraints. Autorouteing software is therefore used with the heatmaps to identify strategic options for the pipeline routes.

2.4.3 The options identified through the software are then subject to professional judgement by the both the consenting and engineering teams to compare the options and identify a Preferred Strategic Option to take forward.

2.4.4 For this project, there are four fixed points (the Hydrogen Production Plant, the Hydrogen Storage Facility, the blending points at Partington and Warburton and identified industrial users in St Helens). A variety of strategic options could be used to link these four points together.

2.5 Route Corridor Identification

2.5.1 Using the preferred strategic option identified at the previous stage, route corridors are created between the fixed points identified in section 1.2. These corridors can be broad (e.g. 1+km wide) and aim to identify a linear area of land avoiding constraints wherever possible such that the pipeline could feasibly be consented and developed. Corridor widths are not fixed at this stage and can change in width to accommodate route options where required or narrow in response to specific pinch points between identified constraints. The principle followed is that the corridors identified would seek to avoid constraints unless it would make a corridor otherwise unfeasible e.g. the length of the pipeline would increase significantly to route around the constraint. In that case the approach would be to minimise routeing through any constraint areas as much as possible.

2.5.2 This process has been undertaken in part by using the autoroute software and the heatmap previously developed. The autorouting software reviews all the constraints simultaneously and identifies potential routes between the fixed points

which have the least impacts in terms of constraints. A number of potential routes can be identified along the preferred strategic option and a corridor identified around these options.

2.5.3 The corridor is then reviewed by the consenting and engineering teams. This review considers the nature of the individual constraints identified and their value or sensitivity, and what residual effects there may be where the route and these constraints overlap. It also considers whether there are amendments which could be made to avoid the residual effects, or to mitigate them if that is not possible. For example, the engineering review will consider aspects that affect both the constructability and operation of the pipeline. These may include:

- Suitability of access for both construction and operation.
- Minimisation of construction challenges (i.e. reduction of front/side slope or optimisation of drainage).
- Optimisation of number of crossing and locations, including other utilities.
- Consideration of landowner activities (i.e. ongoing farming activities).

2.5.4 As part of the appraisal a site visit may be undertaken to review some pinch points, potential crossing locations and/or opportunities to move the corridor. The site visit may also be used to confirm rationale for not selecting alternative corridor routes if required.

Alternatives appraisal

2.5.5 The aim of the routeing and siting work is always to refine any options down to a single route corridor as soon as practically possible, however alternative corridors may be identified where options to avoid key constraints are available. Employing corridor options reduces the risk of returning to this phase if, at a later stage, issues arise that remove the possibility of using a specific corridor.

2.5.6 The decision on which corridor/s to take forward for further assessment is be taken by back-checking the corridor options against the requirements of this methodology and a review of stakeholder or consultee representations where appropriate.

2.5.7 For clarity, **Chapters 3 and 4** in this report describe the work which has been undertaken up to this point in the methodology. The items described in **sections 2.6 and 2.7** describe future work.

2.6 Consultation on Preferred Route Corridors

2.6.1 The corridors identified will be presented within a consultation exercise to allow stakeholders (including members of the public) the opportunity to comment on their location. The results of the consultation exercise will then influence the final corridors being taken forward, alongside ongoing technical assessment work.

2.7 Preferred Route Optioneering

2.7.1 A route optioneering study, where defined route options through the corridors are identified, is undertaken next.

2.7.2 Although the earlier phases of work should have avoided many of the constraint features identified in **section 2.3**, there will be places within the corridors where it has not been possible to avoid every constraint. Where constraints exist within the corridors, expert advice from the environmental and engineering teams will be used to examine how a pipeline could be routed to avoid, or minimise its impact on, these features whilst maintaining a viable project.

Selection of Preferred Route Alignment

2.7.3 A comparison of any different route/siting options developed from this work will then be used to select a preferred route alignment. The selection of the preferred route will follow the advice on the routeing of natural gas pipelines in National Policy Statement EN-4.

2.7.4 The objective of this exercise will be to identify a Preferred Route Alignment which avoids the greatest constraints. Where it is not practicable to avoid all constraints then commentary is made about where mitigation could be developed to minimise the impact on/from those constraints.

2.7.5 The Preferred Route Alignment will be assessed for its environmental effects and engineering feasibility. A preliminary environmental assessment will be undertaken, with information provided for statutory consultation as part of the Preliminary Environmental Information Report (PEIR). The consultation responses will influence the finalise the route alignment for DCO submission.

3. Strategic optioneering

3.1 Introduction

3.1.1 As mentioned earlier, the basic principle behind pipeline routeing is to get from the identified connection points in the most efficient way possible. In a theoretical location which had no constraints, this would involve straight line pipelines between the fixed points relevant to the project. In practice, a straight line route is almost never possible for any pipeline as there will always be environmental and engineering matters arising which require a deviation.

3.1.2 Four fixed points are relevant to the Project (as shown in Figure 1.1):

- the Hydrogen Production Plant at Stanlow;
- the Hydrogen Storage Facility, south of Northwich;
- the blending points at Partington and Warburton; and
- identified industrial users in St Helens

3.2 Strategic Options

3.2.1 Employing the methodology described in **section 2.4** identifies four strategic alternatives:

Strategic Option A: X Layout

3.2.2 As can be seen in **Figure 3.1**, connecting the defined end points produces an 'X' shaped layout west-east and north-south, with all legs running through a central hub location.

3.2.3 In this layout, the western leg follows the M56 corridor between Stanlow and Frodsham, avoiding constraint features to the north (wind turbines and waste sites), built-up areas and related listed buildings to the south. The leg would then pass a number of listed building and ancient woodlands features to reach a central hub location.

3.2.4 The northern leg follows largely open land between the built-up areas of Halton and Widnes in the west, and Warrington in the east, from the central area to St Helen's. Whilst there are isolated constraint features through this path (TPOs, ancient woodland, waste sites and listed buildings) they are not sufficient widespread as to prevent a pipeline being developed. Once at St Helen's, a pipeline would then need to pass built up areas, which cannot be avoided due to the urban nature of this location.

3.2.5 The eastern leg passes between Partington, Lymm and the M56, avoids some ancient woodland and TPO features to the north, providing a fairly direct connection between Partington and the central hub location.

3.2.6 A direct route between the hydrogen storage area south of Northwich and the central hub location is not possible due to the town of Northwich being located directly between the two points. Two alternatives for the southern leg of an X layout were therefore identified. The first (Alternative 1) runs around the western and southern extents of the town and avoids ancient woodland and SSSI features in this area. The second (Alternative 2) runs around the northern and eastern extents, avoiding TPO, ancient woodland and SSSI features. Alternative 2 does pass over a waste site identified to the east of Northwich, but this is a deep waste storage facility in the salt caverns in this location and at this strategic stage it was assumed that it would not be affected by a close-to-surface level pipeline.

Strategic Option B: H Layout

3.2.7 Strategic Option B seeks to connect the western clusters of connection points with the north cluster, and the south cluster with the east cluster. A central connection would then join these two legs. This layout is shown on **Figure 3.2**.

3.2.8 The western leg would follow the M56 corridor between Stanlow and Frodsham (like Strategic Option A), before crossing the Mersey Estuary to the northern cluster. This would pass through the SSSI, SPA and Ramsar designation on the Mersey, but avoids the built-up areas of Speke and Huyton to the west and Runcorn and Widnes to the east.

3.2.9 The eastern leg would follow the Option A leg from Partington to a point near the M6 / M56 Lymm interchange, before heading south to the Hydrogen Storage facility south of Northwich. This southern section is relatively unconstrained.

3.2.10 The central connection between the two legs would follow some of the northern leg of Strategic Option A between St Helen's and the Manchester Ship Canal, before cutting across relatively unconstrained land to join the eastern leg.

Strategic Option C: XH Layout

3.2.11 Option C provides a combination of Strategic Options A and B, with the western, northern and eastern legs remaining the same, but the southern leg following the leg from Option B between the Lymm interchange and the Hydrogen Storage Facility south of Northwich. This layout is shown on **Figure 3.3**.

Strategic Option D: U Layout

3.2.12 Option D utilises the western and eastern legs of Strategic Option B but does not provide a central connection. Instead, a connection is provided from the western leg to reach the northern cluster of connections points (following a section of the Option A northern leg) and a west-east connection is provided via a southern leg between Stanlow and Northwich. This layout is shown in **Figure 3.4**.

3.2.13 The southern leg runs from Stanlow, bypassing the built up area of Helsby to the south before passing to the north of Delamere Forest. The pathway then runs south around Sandiway, avoiding some isolated ancient woodland, SSSI and Ramsar features, before connecting to the Hydrogen Storage Facility.

3.3 Comparison of Strategic Options

3.3.1 **Table 3.1** sets out a comparison of the four strategic options based on calculations undertaken at the time the strategic options were considered. All four options have been designed to connect to the four fixed points identified in **section 1.2**, plus to allow connections to multiple hydrogen users along the legs, so that they are not dependant on any one user.

Table 3.1 Strategic Options Comparison

	Option A	Option B	Option C	Option D
Constructability	Single multi-junction central hub	Require lengthy underground drilling under Mersey Estuary. Two multi-junction central hubs needed.	Two multi-junction central hubs needed.	Require lengthy underground drilling under Mersey Estuary.
Security of supply	Individual legs can be isolated at the central hub.	Isolation can occur at either of two central hubs	Isolation can occur at either of two central hubs	No central hub locations: isolation is more complex.
Total installed cost	Least expensive of the four options	+£15m over Option A	+£20m over Option A	+£22m over Option A
Pipeline length	99km	95km	96km	112km
Spurs	32km	34km	32km	34km
Environment	No significant constraints that cannot be routed around.	Closer proximity to / disturbance to Mersey Estuary designations.	No significant constraints that cannot be routed around. Increased land-take required for hubs over other options	Closer proximity to / disturbance to Mersey Estuary designations.

3.4 Preferred Strategic Option

3.4.1 From the comparison of the strategic options shown in **Table 3.1**, Option D was discounted as it

- provides the longest pipeline route;
- is the most expensive option; and
- requires a crossing of the Mersey Estuary with either lengthy underground drilling and/or potential disturbance to the SSSI, SPA and Ramsar designations.

3.4.2 Option C is also discounted due to the Mersey Estuary crossing and also the requirement for two central hubs, further increasing the complexity, cost and land take required for construction and operation.

3.4.3 The comparison between Option A and C shows that Option A has a longer route (by 3km), but that Option C would be £20m more expensive. Given that this increased route length of Option A would all be underground pipeline and that the surface land would be restored upon completion of its construction, the following impacts are considered to outweigh any construction related impacts from the increased length of Option A:

- increased permanent land take of the second hub;
- increased operational complexities for this facility; and
- increased costs.

3.4.4 Option A has therefore been identified as the Preferred Strategic Option.

Key

0 1 2 3 4 5 Kilometers

Scale at A3: 1:110,000

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Figure 3.1
Strategic Option A: X Layout

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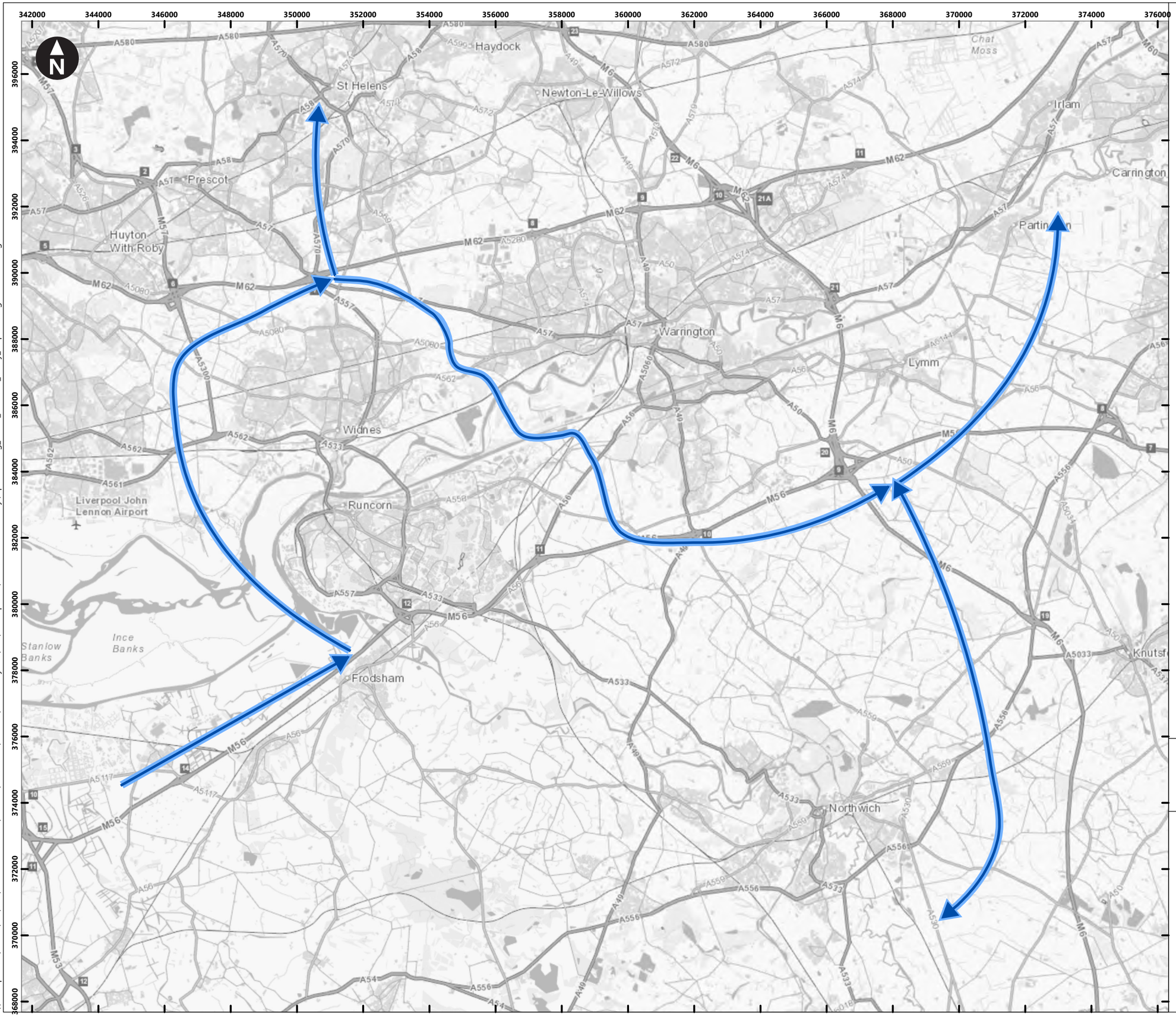

Key

0 1 2 3 4 5 Kilometers

Scale at A3: 1:110,000

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Figure 3.2
Strategic Option B: H Layout

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Key

0 1 2 3 4 5 Kilometers

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Figure 3.3
Strategic Option C: XH Layout

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Figure 3.4
Strategic Option D: U Layout

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4. Route Corridor Identification

4.1.1 Using the Preferred Strategic Option identified in **Chapter 3**, a route corridor selection exercise was undertaken using the methodology outlined in **Chapter 2**. This identified the following corridors, search areas for HAGIs and connection spurs along the Western, Northern, Eastern and Southern legs. The identification of HAGI search areas and spur corridors are dependent on the pipeline corridors, so this is a sequential exercise with the corridors being identified first.

4.1.2 Search areas for HAGIs were identified, rather than specific location options, as the corridor identification process itself should already have discounted land which is heavily constrained. Therefore, any location within the corridor could, in principle, be a suitable location for a HAGI. The precise location of each HAGI would be subject to detailed design, and therefore a search area has been identified for each HAGI in order to both provide some certainty as to their location but also provide flexibility for the Preferred Route Optioneering stage.

4.2 Western Leg

Pipeline Corridor

4.2.1 From the connection point at Stanlow, the western leg is required to achieve two further connections: one to the cluster of users in the Rocksavage / Weston area of Runcorn, and one to the central hub location (see **section 4.6**).

4.2.2 A straight line route joining up these connections would see a pipeline running parallel to the M56 on its northern side between Stanlow and Rocksavage, and then a route between Rocksavage and the central hub location which passes between Sutton Weaver to the north and Aston to the south.

Western Leg Options

4.2.3 Between Stanlow and Rocksavage, this straight-line corridor (named West 1, shown on **Figure 4.1**) is defined by the M56 to the south, and the industrial developments, the Frodsham Wind Farm and a former landfill in the Ince and Frodsham marshes area to the north. This corridor avoids crossings of the motorway, runs through a flat landscape and avoids the built-up areas of Helsby and Frodsham on the south side of the M56. This corridor does however run through an area of local landscape value, flood risk areas and small amounts of mineral safeguarding land, and also includes multiple listed buildings and areas of ancient woodland. An alternative option was therefore considered.

4.2.4 The alternative option (West 2, **Figure 4.1**) crossed the M56 south of Stanlow, before running in a roughly eastern direction between Dunham on the Hill and Helsby and on towards Kingsley. The corridor would then pass to the north of Kinglsey before running to the central hub location. A spur would need to run north from this option to allow the Rocksavage connection to be made. This would start near Kingsley and head in a northern direction, passing to the east of Frodsham to

reach Rocksavage. Between Stanlow and Kingsley, West 2 would encounter hilly terrain, an ancient woodland designation and numerous individual listed buildings and it would also run through multiple areas designated for local landscape value. The spur to Rocksavage would also run through land at risk of flooding and small amounts of minerals safeguarding areas. The requirement for the spur would also increase the length of West 2 over West 1 and would require a longer spur connection from Rocksavage to the Runcorn hub of industrial users.

4.2.5 A comparison of the two options is provided in **Table 4.1**:

Table 4.1 Western Leg Options

	West 1	West 2
Constructability	Single HAGI: to serve Rocksavage – Runcorn spur Flat topography	Two HAGIs: to serve Rocksavage – Runcorn and Kingsley to Rocksavage spurs Hill topography
Pipeline length	17.9km	20.9km
Rocksavage to Runcorn Spur length	3.9km	4.6km
Historic Environment	Multiple listed buildings and two Scheduled Monuments (SM)s within corridor (but can be avoided by detailed routeing)	Multiple listed buildings and five Scheduled Monuments (SM)s within corridor (but can be avoided by detailed routeing)
Traffic and Transport	Crossings needed: 1no. motorway 1no. A-roads 1no, rail line 1-3no. watercourses 2no. walking trails	Crossings needed: 2no. motorways 1no. A-road 1no. rail line 1no. watercourse 5no. walking trails
Landscape	Within Weaver Valley Area of Special County Value (Part A: Lower)	Within Weaver Valley Area of Special County Value (Part A: Lower) and Helsby and Frodsham Hills Area of Special County Value
Biodiversity	Multiple areas of Ancient Woodland (but can be avoided by detailed routeing)	Multiple areas of Ancient Woodland (but can be avoided by detailed routeing)
Flood Risk	Pipeline would run through 8-10km of Flood Zones 2 and 3	Pipeline would run through 1km of Flood Zones 2 and 3

Preferred western option

4.2.6 Other than for flood risk, the comparison of West 1 and West 2 shows a preference for option West 1. During construction flood risk to nearby receptors is likely be able to be mitigated through dewatering practices and the controlled release of water back into watercourses. During operations existing levels of flood

storage capacity would not be lost as the pipe would be underground with the land returning to its baseline status with no increased risk of flooding for other receptors. Flood risk to the pipeline structure itself can be mitigated by the consideration of buoyancy in the design. West 1 was therefore the preferred option.

4.2.7 A corridor was therefore identified along West 1 which stretches up to 1.7km in width in places but takes a mostly direct route between the connection points.

4.2.8 From the initial corridor identified, further refinement has taken place to remove land associated with the ancient woodland and around listed building designations associated with Beckett's Wood, Chapel Wood and Aston from the centre of the corridor. The width of the corridor has also been reduced in places to avoid ancient woodland at Bird's Wood and Blackamoor Wood, and the ancient woodland and SSSI designations at Hatton's Hey Wood, Whittle's Corner and Bank Rough. This corridor would allow a route pathway to be selected through it which can avoid, or substantially reduce impact on, the designations identified within it. This refined corridor is shown in **Figure 4.2**.

HAGIs

4.2.9 A HAGI would be needed at the Rocksavage connection point, and a search area has therefore been identified within the corridor at this point . To serve potential industrial users in the Runcorn area, the search area includes three parcels of land 1) to the north west of the M56, dissected by the River Weaver; and 2) to the south east of the M56, mainly between the River Weaver and the Weaver Navigation (shown as the Rocksavage HAGI Search Area on **Figure 4.2**). A third search area has also been identified to the north of the Weaver Navigation between the M56 and the A557 (the Runcorn HAGI Search Area shown on **Figure 4.2**). Areas 1 and 2 are almost entirely within Flood Zones 2 and 3 and also contain part of former landfill sites. Area 3 is outside of flood risk areas but does also contain a former landfill site.

Spurs

4.2.10 In order to provide connections between the HAGIs and the identified industrial users in the Rocksavage area, pipeline spurs will need to be provided. Options are limited in this area for the spur corridors due to the existing urban nature of much of the land here, so a direct corridor has been identified between the users. This spur corridor is shown on **Figure 4.2**.

4.3 Northern leg

Pipeline Corridor

4.3.1 The connection point cluster in St. Helens is made up of two locations, industrial users in central St Helens, and a single user at Lea Green Industrial Park. Between these and the connection to the central hub, the northern leg is also required to achieve one further connection: to industrial users in the Warrington

area. The initial corridor identified is shown in **Figure 4.3**, with the refined corridor described below shown in **Figure 4.4**.

4.3.2 From the central St Helens users a direct route is heavily constrained by the existing urban area and a desire to maximise use of the open space between Sutton Heath and Rainhill. One overall corridor was therefore identified which followed Sherdley Road and Elton Head Road before running through this open space between Sutton Heath and Rainhill to eventually cross the A570 between Micklehead Green and the junction of the A570 with the M62. The section was subsequently refined to narrow this corridor to avoid a housing allocation/planning permission for housing at the former Linkway Distribution Park / Suttons transport site. Additional land was also added to provide a potential option that crosses the A570 at Sherdley Park, to then utilise open space in this area before re-joining the corridor in the open space near Micklehead Green.

4.3.3 Around the M62, the initial corridor covered a wide stretch of land between the northern side of the M62, the Omega Business Park and Lingley Green in the east, the Manchester to Allerton Junction rail line in the south and the A557 in the west. This section of the corridor was then amended to avoid land within Sutton Manor Woodland from the north of the M62. In addition, land at the Mersey Valley Golf Club and its Local Wildlife Site were removed from the centre of the corridor and the western extent was drawn back from the A557 to reduce land take.

4.3.4 Running south to the A56, the route of the corridor is restricted to a relatively direct route through the open space between Cuerdley Cross, Fiddlers Ferry Power Station and Sandymoor to the west, and Penketh and Higher Walton in the east, to the M56. Subsequent refinement of this section saw additional land included around the Birch Wood area to help facilitate the connection to Warrington, land included around Daresbury to provide optionality in passing this settlement and land drawn in from the eastern side of Halton to avoid this settlement. The corridor then runs in a direct line between the M56 to the central hub.

HAGIs

4.3.5 Four HAGI search areas have been identified along the northern corridor to accommodate five HAGIs. All four search areas are shown in **Figure 4.4**:

St Helens

4.3.6 At the northern extent of the corridor to connect to the St Helen's users. A search area for this has been identified immediately adjacent to the users. This search area is free from all constraints except for historic landfill sites. However, given the extent of these historic landfills, and that much of their land (outside of the search area) has been previously developed, it is not expected to prove to be a major constraint to a HAGI development.

Clock Face and Burtonwood

4.3.7 In the Clock Face area, a HAGI will need to be provided to allow a connection to be made to the Lea Green spur user.

4.3.8 A HAGI to service a potential future connection in a northern direction, past Burtonwood and towards Wigan, is also proposed.

4.3.9 A combined search area for these two HAGIs has been identified. This search area constraints a number of constraints (a small area of flood risk land at the northern extent, near Lea Green, and a small number of TPO protected trees, one listed building and a small area of historic landfill) all of which could be easily avoided when looking to route the pipeline.

Cuerdley

4.3.10 A HAGI is proposed close to Cuerdley Cross to serve potential future users in Widnes.

Higher Walton

4.3.11 Near Higher Walton, a HAGI is proposed to connect to the industrial users in Warrington. A search area has been identified within the corridor, which straddles the Manchester Ship Canal. The northern half of the search area would be the preferred location to allow a connection to run to the north of the canal to join the users located here. However, the northern part of the search contains a waste site, local wildlife site and areas of flood risk. The search area south of the Ship Canal is largely free from constraints.

Spurs

4.3.12 Three spurs are required from the northern pipeline corridor to industrial users (shown in **Figure 4.4**). At the northern extent, a short spur would connect the St Helen's users.

4.3.13 At Lea Green, two spur options have been identified, one running from the corridor along Eurolink Road, and the second running through a corridor around Chapel Road and then following Lea Green Road. The Eurolink option avoids any constraints. The Chapel Road option contains a number of TPOs, although there is available land with the option to avoid these trees.

4.3.14 At Higher Walton, a spur would run east towards Warrington to connect three Phase users. The spur corridor identified runs to Slutchers Lane, before splitting into two legs. A northern leg that follows the River Mersey and an eastern leg that follows public highways through the Latchford area. Part of the corridor to Slutchers Lane includes an area identified as permitted waste site and there are a number of listed buildings located along the spur corridor, although not to an extent that they cannot be avoided.

4.4 Eastern leg

Pipeline Corridor

4.4.1 The connection cluster on the eastern leg includes two connections to the existing natural gas network where hydrogen can be blended into the natural gas supply (one at Warburton and one at Partington), and also a connection to an industrial

user at Partington. The corridor identified from the central hub location, is able to follow an almost straight path with only a slight diversion to the south of the Lymm Interchange (where the M62 and M6 cross). This variation also avoids a cluster of ancient woodland and TPO constraints between Lymm and the M62. Other than these constraints, there are isolated listed buildings within the corridor and the corridor route is crossed by minerals safeguarding areas, flood risk zones and the proposed line of HS2. However, these constraints are mainly linear in nature and will need to be crossed for any corridor option chosen for the eastern leg. The initial corridor identified is shown in **Figure 4.5**, with the refined corridor described below shown in **Figure 4.6**.

4.4.2 The corridor route runs between Higher Whitley and Antrobus in the A559 Northwich Road area, between the Lymm Interchange, Lymm and High Leigh around the M6 and M62, before running to the north and passing Warburton and into Partington. It is a maximum of 2.5km in width, narrowing to around 700m where it crosses the A50 and M62.

4.4.3 The initial corridor was subsequently amended to avoid ancient woodland at Spud Wood near Lymm, and also Hey Wood near Deansgreen. The corridor was also narrowed between these points to also avoid Deansgreen itself and other properties around Kay Lane and the A56. The corridor was also narrowed to bring the corridor further away from Dunham Massey Park and to avoid the Dunham Massey and Dunham Woodhouses settlements, and also to avoid the settlements of Frandley, Antrobus and Arley. A small area of additional land (with no constrains) was added to the corridor near the B5159 Mill Lane.

HAGIs

4.4.4 Two HAGIs will be required, at Warburton and at Partington to service the connections needed. Search areas for both are shown on **Figure 4.6**.

Warburton blending point

4.4.5 At Warburton, the HAGI search area is located adjacent to the Warburton gas network site. Part of the search area (including the existing gas network site) is covered by a wildlife corridor which runs adjacent to the River Bollin. The remainder of the search area is free from constraints.

Partington blending point

4.4.6 At Partington, the HAGI search area is located at the eastern extent of the corridor, on previously developed land located adjacent to the Partington gas network site, which is free of constraints.

Spurs

4.4.7 One spur is identified from the eastern corridor (shown in **Figure 4.6**): running from the eastern extent of the corridor (and the associated Partington HAGI). There are no constraints associated with this spur.

4.5 Southern leg

Pipeline Corridor

4.5.1 Two corridors have been identified on the southern leg, corresponding to the two options available around Northwich (Strategic Options A and B identified in **Section 3.2**). The initial corridors for both options are shown in **Figure 4.7**, with the refined corridors both shown in **Figure 4.8**.

4.5.2 Option A runs around the west and south of Northwich, taking a route between Acton Bridge, Cuddington, Sandiway and Wharton to the west, and Weaverham, Hartford and Moulton to the east, to reach the hydrogen storage facility. It is approximately 17.5km in length, is mainly in flat, open fields and crosses:

- 4no. A-roads (A533 twice, A556, A530);
- 3no. watercourses (River Weaver, Weaver navigation and Trent and Mersey Canal; and
- 3no. rail lines

4.5.3 This corridor also avoids the SSSI and ancient woodland associated with Pettypool Wood and some of the TPO designations around Vale Royal Abbey.

4.5.4 The initial corridor was substantially narrowed in the Acton Bridge area to remove the land around Acton Bridge and to draw the corridor away from Weaverham where the corridor crosses Station Road. Minor amendments were also made around Vale Royal Park to move the corridor boundary away from the golf course and additional TPO coverage there. Land was also removed from the corridor around the ancient woodland at Newbridge Wood and the at Weaver Parkway and Vale Royal River Park (caravan site). The corridor was also amended to remove land around Bostock Hall and the listed buildings here, and a permitted waste site close to here.

4.5.5 Option B runs around the north and east of Northwich, with the initial corridor passing to the north of Marbury Country Park (and associated TPOs and ancient woodland), between Wincham and Higher Wincham, around Lostock Gralam and Lostock Green and then passing east of Rudheath to reach the hydrogen storage facility. The corridor is close to 19km in length, is mainly in flat, open fields and crosses:

- 5no. A-roads (A49, A559 three times, A556);
- 3no. B-roads (B5075, B5391, B5082); and
- 1no. rail line.

4.5.6 This corridor also avoided, or mainly avoided, ancient woodland and TPOs at Winnington and Leonard's Woods, and the Plumley Lime Beds scheduled ancient monument and SSSI, to the east of Lostock Gralam. The corridor did pass over the permitted waste operations associated with the salt caverns around Lostock Green and include some TPO designations at Wincham Hall. It also includes TPOs located around Comberbach and Greater Budworth although there should be routes through these designations to avoid them.

4.5.7 The corridor route was subsequently amended to take a route that generally runs further to the east of the initial corridor. It passes around Pickmere and then between Lostock Gralam and Plumley, passes to the east of the salt caverns around Lostock Green and then around Lach Dennis to reach the hydrogen storage facility. This amendment was made to avoid expected buried services associated with the salt caverns. This amended route still includes the TPOs around Comberbach and Greater Budworth, but largely avoids the TPOs around Wincham Hall and passes around the Plumley Lime Beds scheduled ancient monument and SSSI. It does include the ancient woodland and TPOs at Winnington and Leonard's Woods.

4.5.8 Both Option A and Option B pass across areas of minerals safeguarding and flood risk zones. Due to the extent of these designations, it would not be possible to avoid them on either option. In addition, Option A contains 1no. crossing of the HS2 route, with Option B containing two crossings.

4.5.9 A comparison of the two options is provided below:

Table 4.2 Southern Leg Options

	Option A	Option B
Constructability	Flat topography	Flat topography
Pipeline length	17.5km	18.6-19km
Historic Environment	Multiple listed buildings and one Scheduled Monuments (SM) within corridor (but can be avoided by detailed routeing)	Multiple listed buildings within corridor (but can be avoided by detailed routeing)
Traffic and Transport	Crossings needed • 4no. A-roads • 3no. watercourses • 3no. rail lines • 3no. walking trails • 2no. national cycle routes	Crossings needed: • 5no. A-roads • 3no. B-roads • 1no. rail line. • 1no. walking trail • 1 national cycle route
Landscape	Within Weaver Valley Area of Special County Value (Part A: Lower and Part B: Middle)	Within Weaver Valley Area of Special County Value (Part A: Lower)
Biodiversity	Multiple areas of Ancient Woodland (but can be avoided by detailed routeing)	Multiple areas of Ancient Woodland and one SSSI (but can be avoided by detailed routeing)

4.5.10 From the comparison in **Table 4.2**, it can be seen that there is little substantial difference between the two options. Option A is slightly shorter and avoids a SSSI designation, whereas Option B avoids a scheduled monument designation and has fewer recreational route crossings. Due to the similarities, it is considered that both options should be taken forward to the Preferred Route Optioneering stage.

4.5.11 A pipeline running through either of these corridors would require a block valve due to the length of the pipeline between the central hub and the hydrogen storage

facility. A block valve provides a cut-off point, to isolate a section of pipeline for maintenance, repair or safety reasons.

HAGIs

4.5.12 One HAGI is identified at the hydrogen storage facility, and would be part of either Option A or Option B. Other than a minerals safeguarding area (for deep-lying salt) there are no constraints identified with this HAGI search area, which is shown in **Figure 4.8**.

Spurs

4.5.13 A spur will be needed within the southern corridor area to potential hydrogen user at Winnington.

4.5.14 From Corridor Option A, a spur corridor (Spur 1 on Figure 4.8) was identified that passed through open land between Weaverham and Hartford, and then between Barnton and Winnington to reach the site. This spur included ancient woodland at Beach Hill Wood, part of a permitted waste site north of Wallerscote Road and across flood risk zones around the Weaver Navigation and River Weaver. Depending on the exact route chosen through the spur corridor, there could be up to 4 watercourse crossings and 1 A-road crossing.

4.5.15 From Corridor Option B, a corridor spur (Spur 2 of Figure 4.8) would pass through Marbury Country Park / Anderton Nature Park to the site. This spur includes ancient woodland at Big Wood in the country park, flood risk zones around the Forge Brook, Marbury Brook and Weaver Navigation and the local nature reserve at Anderton Nature Park. Two watercourse crossings would be needed.

4.5.16 These corridors were subsequently amended to widen around Wallerscote Road to allow an option to follow the public highway through Winnington and to narrow the corridor through Marbury Country Park / Anderton Nature Park to avoid the Big Wood ancient woodland.

4.5.17 For either of these two spur options a HAGI would be required within the relevant corridor. Search areas have not been identified for such a HAGI at this stage, as it is likely that any HAGI would be incorporated into the same site as the block valves required within the corridor. Due to the detailed design needed to identify block valve locations, a HAGI location would be considered during subsequent stages should either of these two spurs be chosen.

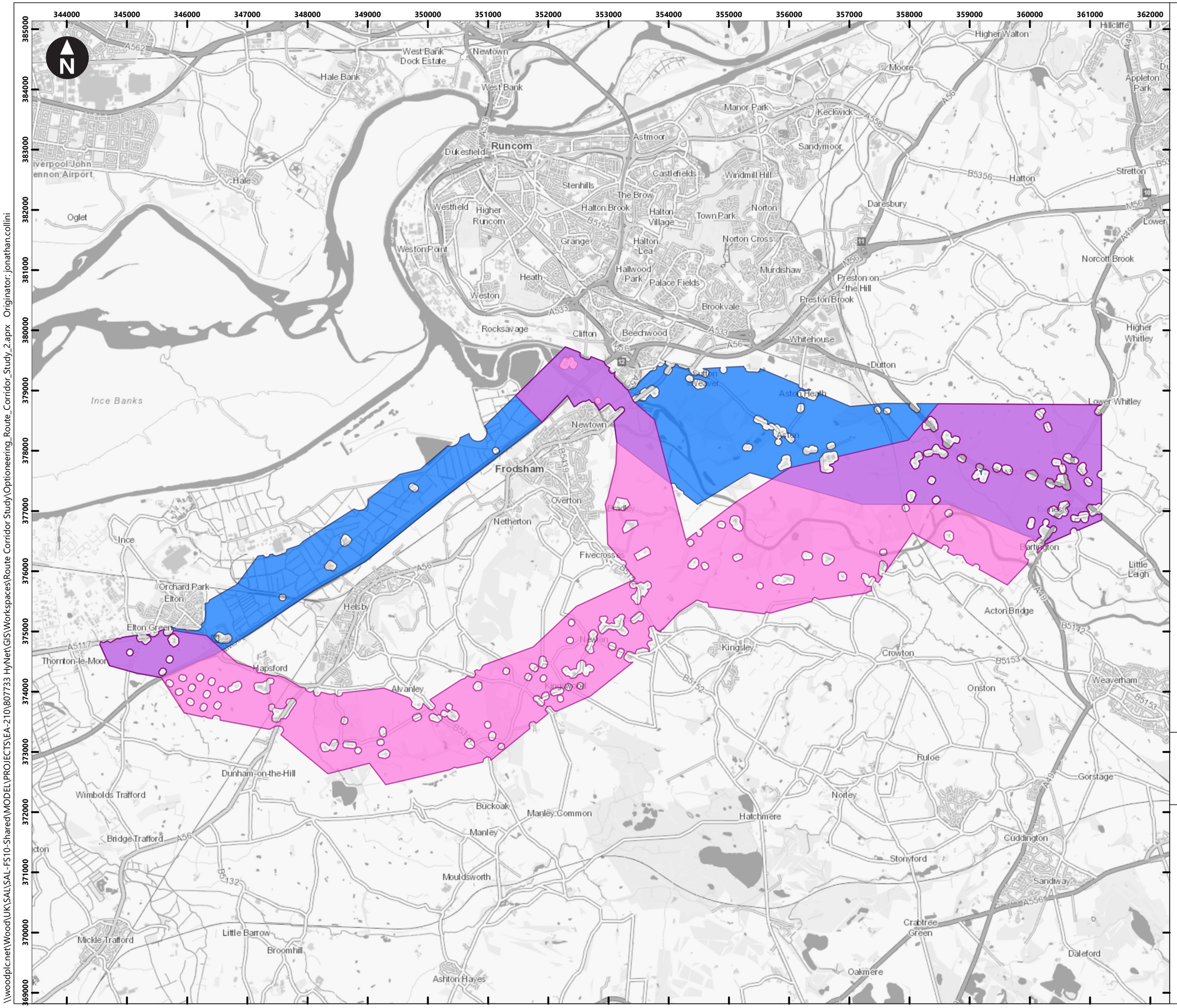
4.5.18 Two additional spurs were subsequently introduced. Both would run direct from the central hub location, one passing to the north of Barnton and Anderton to reach the site and one running between Barnton and Weaverham (Spurs 3 and 4 respectively on **Figure 4.8**).

4.5.19 Spur 3 would be largely free of constraints until it passes Anderton, where it runs through some of the Anderton local nature reserve and crosses flood risk zones on the Weaver Navigation. Two watercourse crossings would be needed.

4.5.20 Spur 4 would run between Weaverham and Runcorn, before joining the route of Spur 1 near to Wallerscote Road. This spur option would cross flood risk zones and require up to six watercourse crossings.

4.6 Central Hub HAGI

4.6.1 Where all four corridors meet a HAGI search area is required. The HAGI to be located here will provide a central hub of all four pipelines legs. The four corridors meet around the Dones Green crossroads (the junction of the A553 and A49). A search area (**Figure 4.9**) has been identified in the location, mostly to the west of the A49. In the north of the search area there is land within flood risk zones and in the south an area of ancient woodland. Mineral safeguarding areas exist in both the north and south of the search area.



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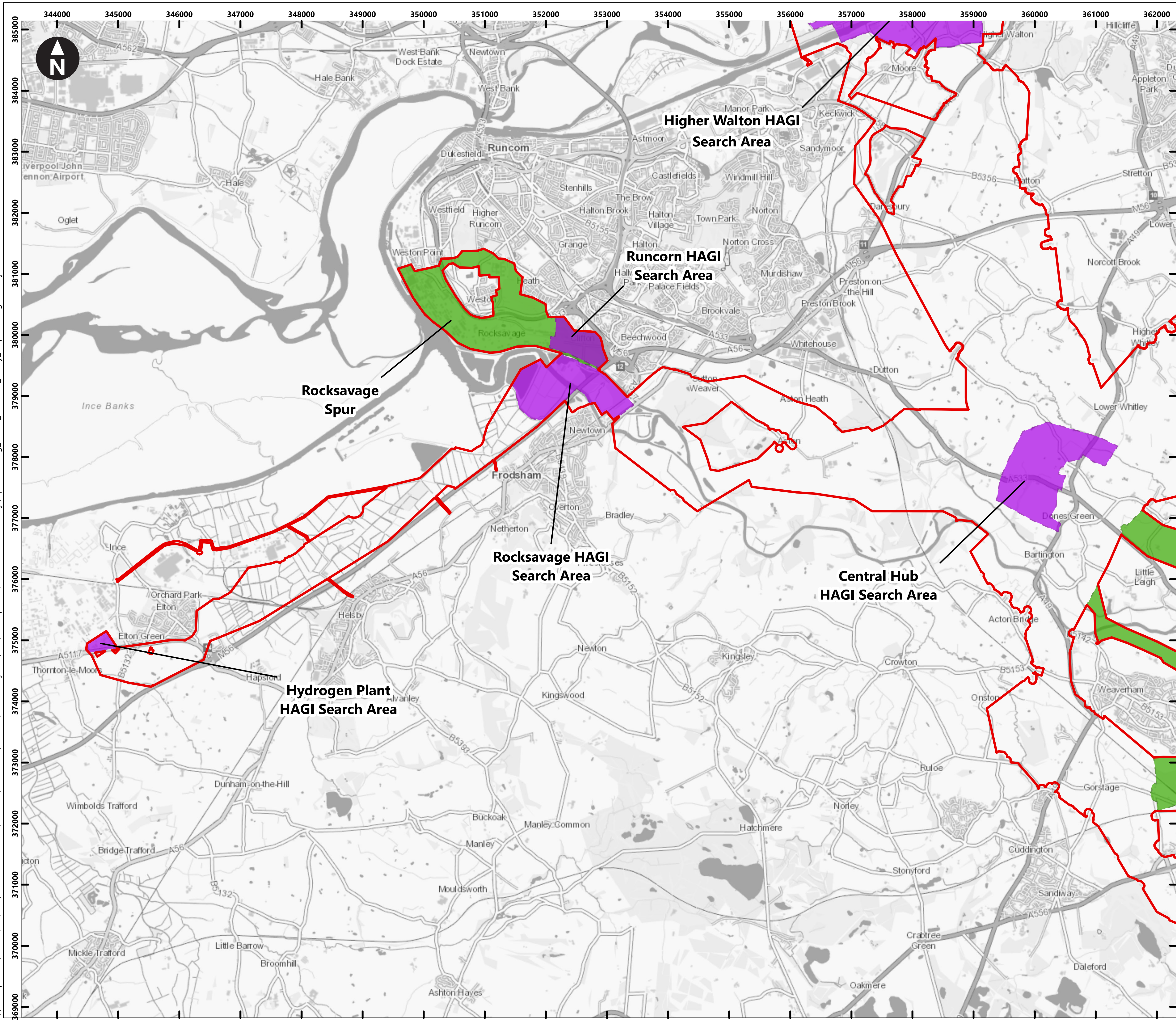

Key
- Scoping boundary
- HAGI search areas
- Spurs to industrial users

0 1 2 3 Kilometers

Scale at A3: 1:60,000

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Route Corridor Study

Figure 4.2
Refined West Corridor

January 2022

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Key

North

0 1 2 3 4 Kilometers

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Figure 4.3
Initial North Corridor

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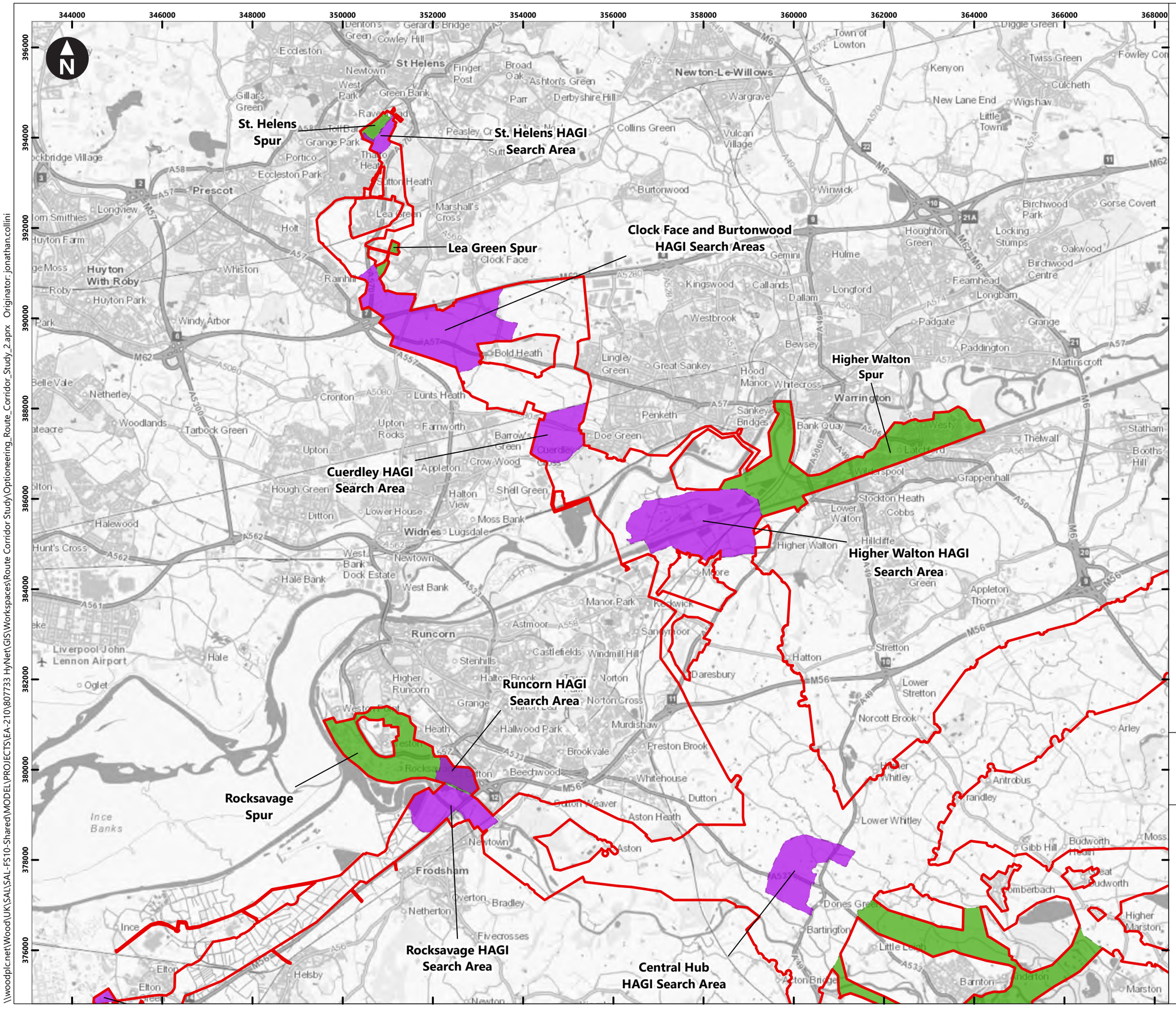

Key

- Scoping boundary
- HAGI search areas
- Spurs to industrial users

0 1 2 3 4 Kilometers

Scale at A3: 1:80,000

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Route Corridor Study

Figure 4.4
Refined North Corridor

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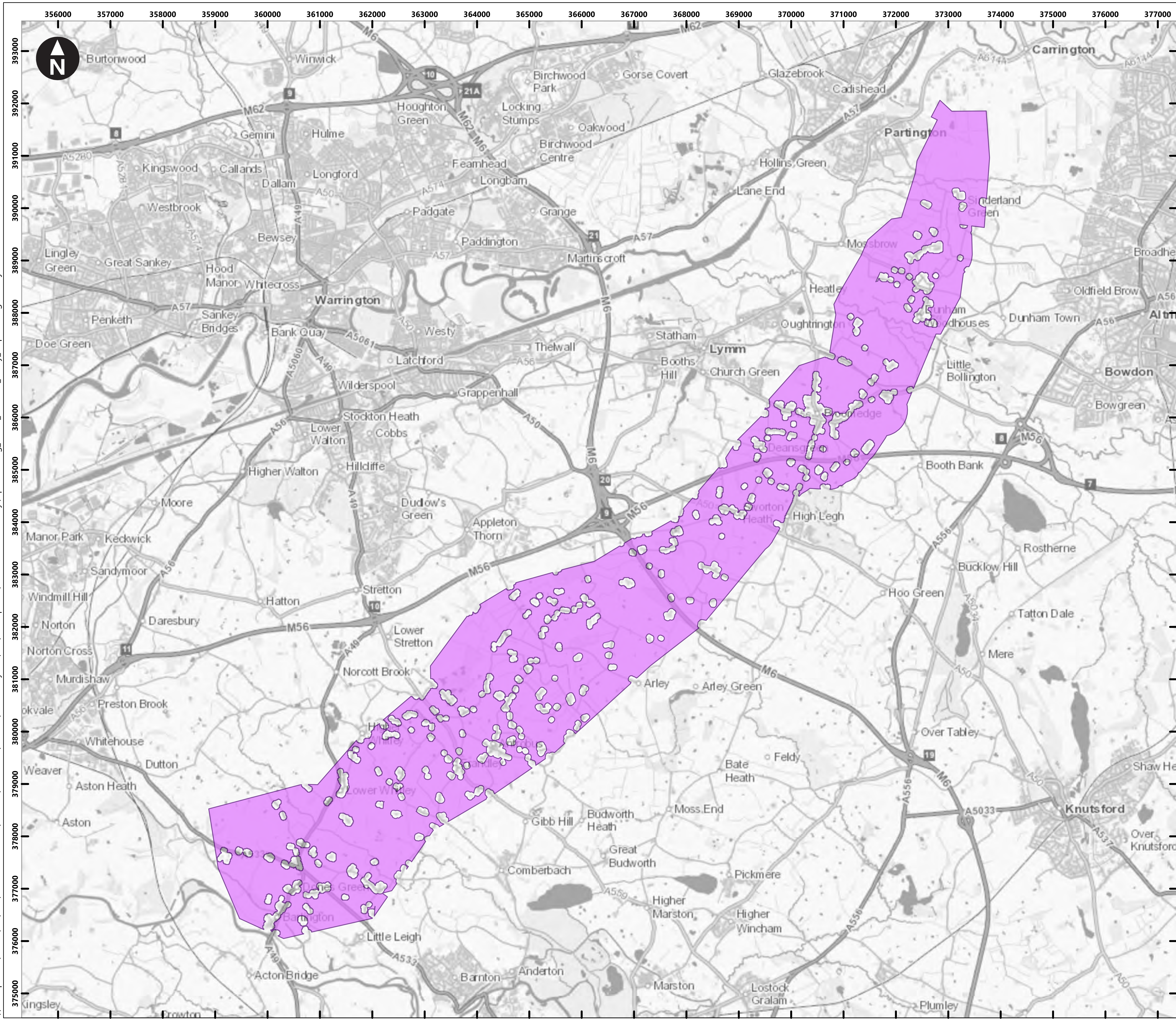

Key

East

0 1 2 3 Kilometers

Scale at A3: 1:70,000

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Route Corridor Study

Figure 4.5
Initial East Corridor

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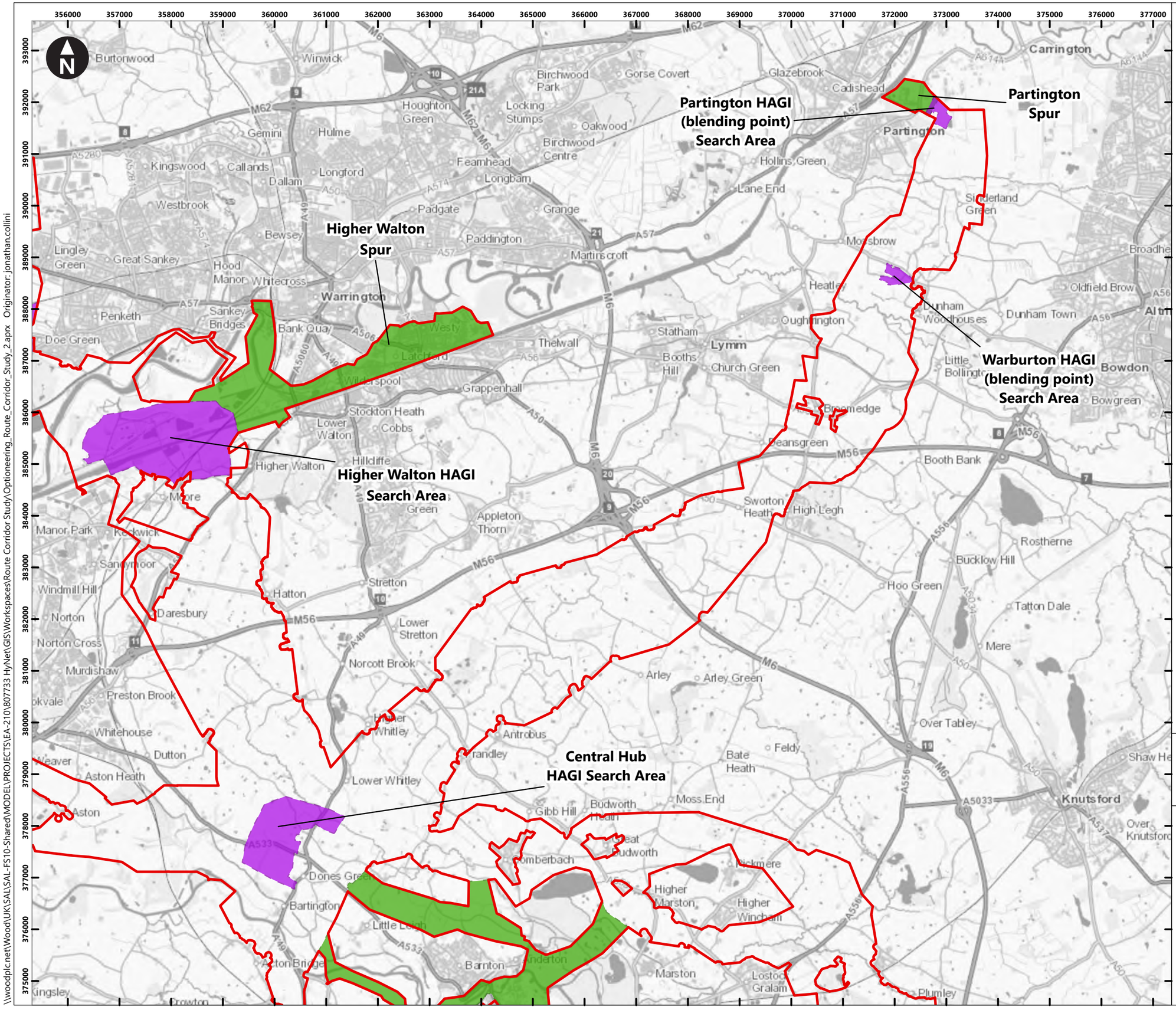

Key

Client

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Route Corridor Study

Figure 4.6
Refined East Corridor

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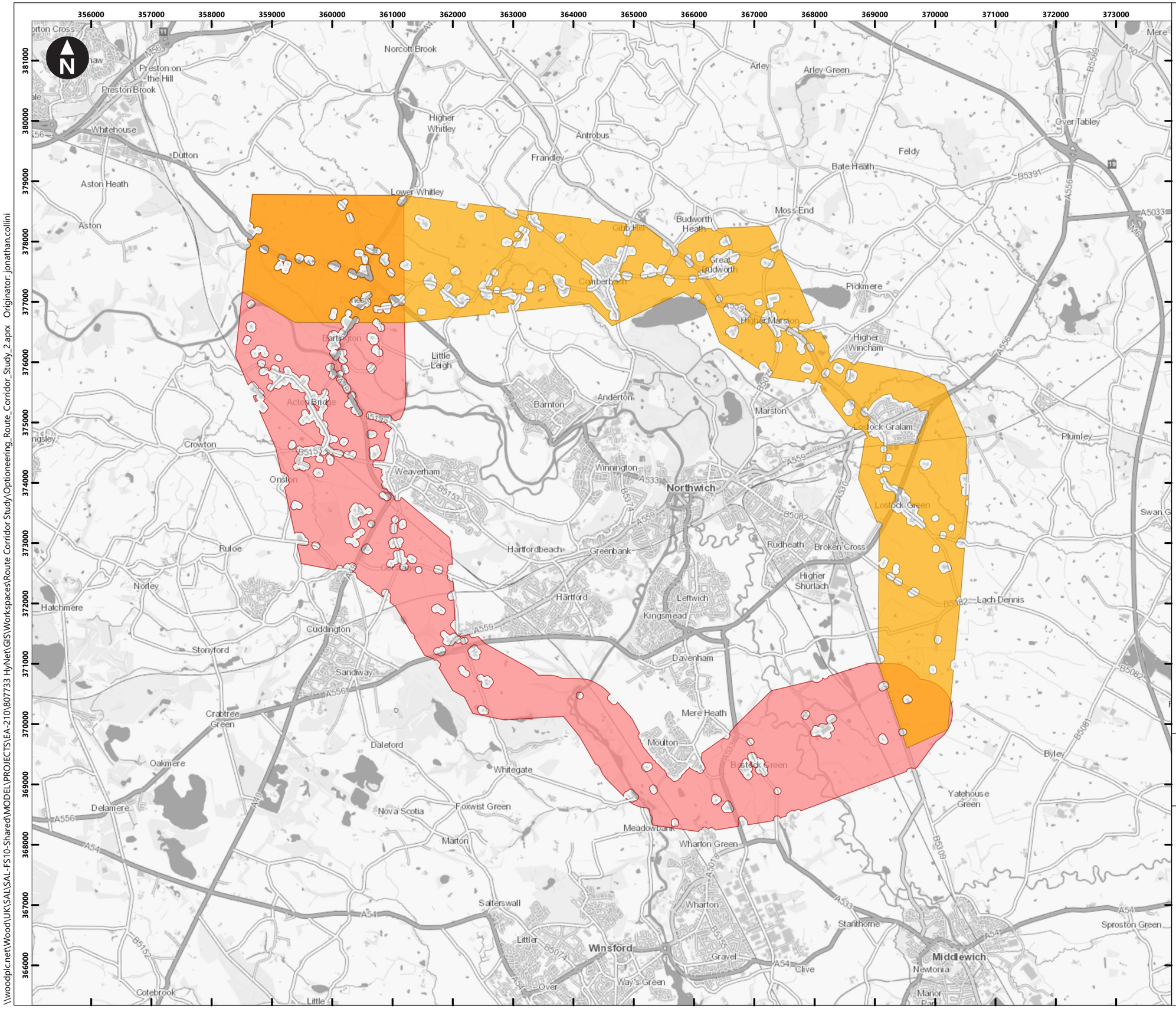

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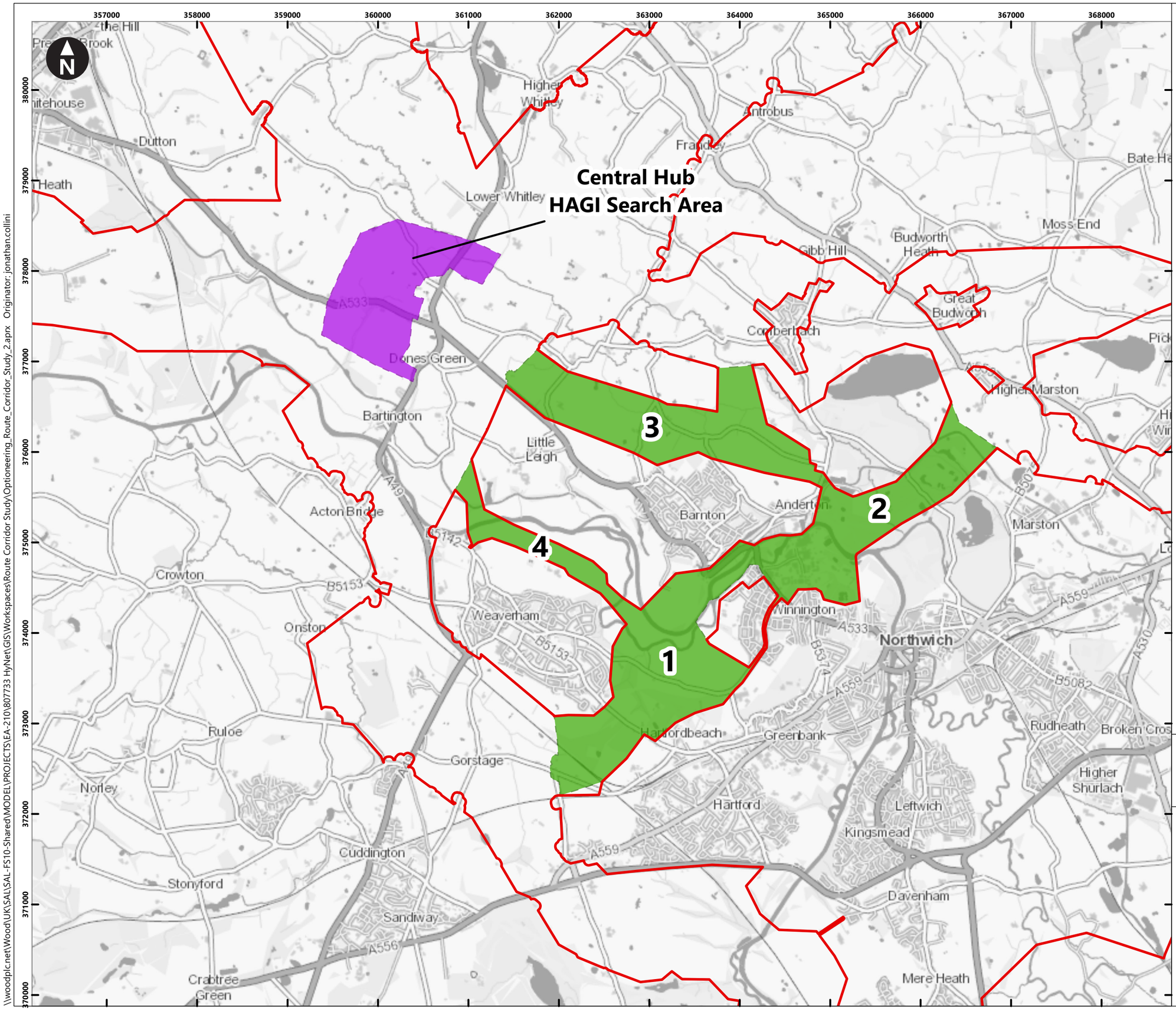
Central Hub
HAGI Search Area
1
2
3
4
Key
Scoping boundary
HAGI search areas
Spurs to industrial users
0 1 2 Kilometers
Scale at A3: 1:40,000
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Figure 4.8
Refined South Corridor Options
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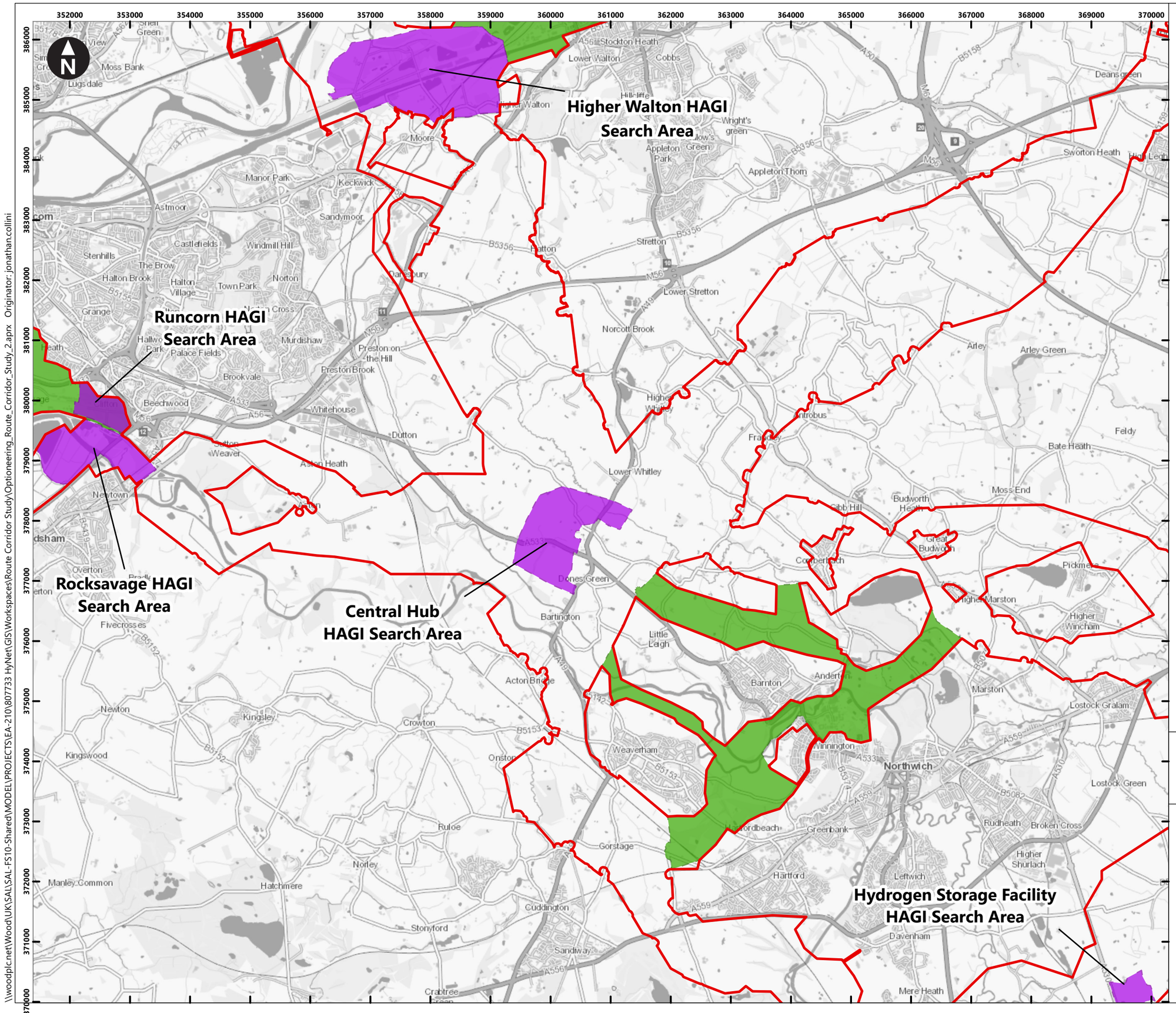
Higher Walton HAGI
Search Area
Runcorn HAGI
Search Area
Rocksavage HAGI
Search Area
Central Hub
HAGI Search Area
Hydrogen Storage Facility
HAGI Search Area
Key
Scoping boundary
HAGI search areas
Spurs to industrial users
0 1 2 3 Kilometers
Scale at A3: 1:60,000
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Figure 4.9
Central Hub
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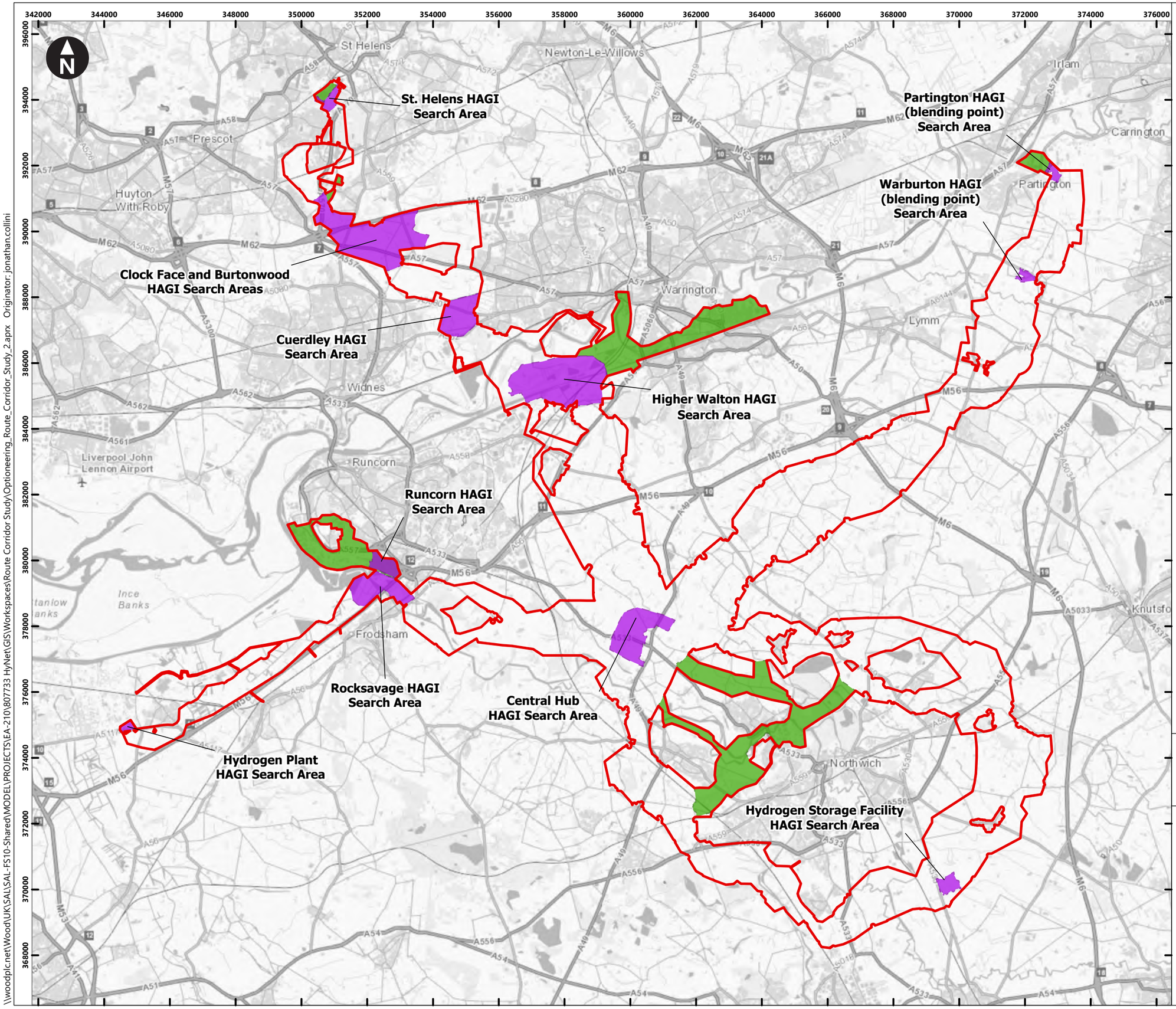
5. Preferred Route Corridors

5.1.1 **Figure 5.1** shows the Preferred Route Corridor options that have been selected for use in the EIA scoping and public consultation exercises commencing in January 2022, along with HAGI search areas and spur corridors to provide connections to users.

5.2 Next steps

5.2.1 Following the methodology in Chapter 2, comments which are received on the route corridor work through the public consultation exercise in early 2022 will be used alongside ongoing technical work in the Preferred Route Optioneering stage. This will be where a preferred pipeline route is identified through the corridors, along with preferred HAGI locations and spur routes.

5.2.2 These preferred routes will be subject to another public consultation exercise prior to final work to confirm the routes and location for a Development Consent order submission.



Key

- Scoping boundary
- HAGI search areas
- Spurs to industrial users

0 1 2 3 4 5 Kilometers

Scale at A3: 1:110,000

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Route Corridor Study

Figure 5.1
Preferred Route Corridor

January 2022

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