magnitude surveys

# Geophysical Survey Report

# of

# Old Hall Farm,

# Thornton-le-Street, North Yorkshire

**For**

**Thornton-le-Street History Group**

**Magnitude Surveys Ref: MSSE193**

**December 2017**

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# Abstract

Magnitude Surveys was commissioned to assess the subsurface archaeological potential of a *c.*10.5ha area land at Old Hall Farm, Thornton-le-Street, North Yorkshire. A fluxgate gradiometer survey was successfully completed and anomalies with archaeological origins were identified across the site. The geophysical results primarily reflect evidence of settlement that may relate to the origins of the modern village of Thornton-le-Street, and specific responses have been interpreted as reflecting possible plot boundaries, enclosures and individual occupation features such as pits. The survey results build on information currently available from satellite imagery and LiDAR data, and provide a firm foundation for further work by the Roads to the Past Project.

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# 1. Introduction

1.1. Magnitude Surveys Ltd (MS) was commissioned by Thornton-le-Street History Group to undertake a geophysical survey on a *c.*10.5ha area of land at Old Hall Farm, Thornton-le-Street, North Yorkshire (SE 4115 8636).

1.2. The geophysical survey comprised hand-pulled cart-mounted fluxgate gradiometer survey.

1.3. The survey was conducted in line with the current best practice guidelines produced by Historic England (David *et al.*, 2008), the Chartered Institute for Archaeologists (CIfA, 2014) and the European Archaeological Council (Schmidt *et al.*, 2015).

1.4. The site includes a Scheduled Monument (National Monument Number: 31348) and the survey was conducted in accordance with the Historic England Section 42 licence obtained in advance by Solstice Heritage (Case Number: SL00169156).

1.5. The survey commenced on 12th October 2017 and took 2 days to complete.

# 2. Quality Assurance

2.1. Project management, survey work, data processing and report production have been carried out by qualified and professional geophysicists to standards exceeding the current best practice (CIfA, 2014; David *et al.*, 2008, Schmidt *et al.*, 2015).

2.2. Magnitude Surveys is a corporate member of ISAP (International Society of Archaeological Prospection).

2.3. Director Graeme Attwood is a Member of the Chartered Institute for Archaeologists (CIfA), the chartered UK body for archaeologists, as well as the Secretary of GeoSIG, the CIfA Geophysics Special Interest Group. Director Finnegan Pope-Carter is a Fellow of the London Geological Society, the chartered UK body for geophysicists and geologists, as well as a member of GeoSIG, the CIfA Geophysics Special Interest Group. Director Chrys Harris has a PhD in archaeological geophysics from the University of Bradford and is the Vice-Chair of the International Society for Archaeological Prospection.

2.4. All MS managers have postgraduate qualifications in archaeological geophysics. All MS field staff have relevant archaeology or geophysics degrees and supervisors have at least three years' field experience.

# 3. Objectives

3.1. The geophysical survey aimed to investigate the subsurface archaeological potential of the survey area.

3.2. The survey forms part of the larger Heritage Lottery-funded research project Roads to the Past, conducted by the Thornton-le-Street History Group. This project aims to increase knowledge and understanding of the historic and archaeological heritage of the village of Thornton-le-Street, placing it in the broader context of the evolving landscape. The project has a strong community bias, aiming to encourage engagement with the local heritage resource as well as offering the opportunity for local people to develop new skills. The geophysical survey results will contribute to this multifaceted project, complementing information provided by techniques such as historic map regression, test pitting and historic building recording.

# 4. Geographic Background

4.1. The site is located on the A168, *c.*4.5km northwest of Thirsk and *c.*8.5km southeast of Northallerton, North Yorkshire (Figure 1). Survey was undertaken over land surrounding Old Hall Farm, located immediately northwest of the village of Thornton-le-Street. The survey area is located east of the A168 and is delineated to the north and east by Cod Beck (a tributary of the River Swale) and adjacent former mill race, and to the south by properties of the village (Figure 2). The survey area is currently under pasture, with several internal divisions (see Paragraph 4.2), and also includes the garden of a property on the northern edge of the village. The land is generally flat, however low earthworks indicate the presence of subsurface settlement remains (see Section 5).

4.2. Survey considerations:

| Survey Area | Ground Conditions | Further Notes |
|---|---|---|
| 1 | Short pasture, low earthworks including the northwest-southeast 'causeway' forming the route of a postulated Roman road. | Slight general slope down to the E and SE; bounded by wire and/or wooden fences; bisected by causeway/track running north from the village to Mill House (on the E side of this area); bisected by a line of telegraph poles running N-S across the centre of the area; contains small unsurveyable fenced-off area of building remains to the W of Mill House and two trees that were avoided; the buildings of Old Hall Farm are located adjacent to the NW corner of the area; a former mill race runs along the E edge of the area. |
| 2 | Garden lawn | Flat; surrounded by garden shrubs; residential house located to the immediate W of the survey area. |
| 3 | Short pasture, some low earthworks | Localised depression on the N edge and shallow depression marking the route of the 'causeway' (see Paragraph 5.4); bounded to the N by trees and a drop to the river, to the SE by a wooden fence and to the W by a stone wall; the buildings of Old Hall Farm are located at the S corner of the survey area. |
| 4 | Short pasture, some low earthworks | Bounded by wire and/or wooden fences with steel fence along the NW edge; contains 2 internal divisions (wooden fences) running NE-SW; metal trough located close to gateway in the E side; a line of telegraph poles runs along the SW edge of the area, with 2 further poles located within the interior of the S portion of the field, close to a large rectangular depression. |
| 5 | Short pasture | Slopes gently down to N, with drop to the river; bounded by wood and/or steel fencing; located immediately NW of the buildings of Old Hall Farm; bisected E-W by telegraph lines; contains a tree fenced off with wire in the centre. |

4.3. The underlying geology comprises Redcar formation mudstone. This is overlain by glacigenic clay, sand and gravel deposits of the Vale of York formation, with river terrace deposits recorded in the northern and southern tips of the survey area and alluvium deposits along the eastern edge of the site (British Geological Survey, 2017).

4.4. The soils are recorded as slowly permeable seasonally wet slightly acid but base-rich loamy and clayey soils across the southwestern half of the survey area, with loamy and clayey floodplain soils with naturally high groundwater in the northeast (Soilscapes, 2017).

# 5. Archaeological Background

5.1. The majority of the survey area is scheduled by Historic England as the site of a deserted medieval settlement (National Monument Number: 31348), although little research or investigation has been conducted in the area to date; the Roads to the Past Project aims to address this situation. The information in this section represents a summary of information gleaned from a Heritage Gateway search and map regression exercise.

5.2. The NMR Excavation Index records that watching briefs have previously been undertaken during small-scale works at Old Hall Farm (no finds or features were detected); close to the 'causeway' track in the centre of the site (a few medieval finds were recovered); and at The Pines in the modern village (the continuation of a probable medieval boundary ditch was recorded).

5.3. No prehistoric archaeology or finds are known from the survey area.

5.4. The early Ordnance Survey maps record finds of a Roman coin and Roman pottery from the survey area, as well as a supposed Roman road running southeast-northwest across the centre of the survey area. The putative line of this road runs from the extant village towards Brawith Bridge (to the north of the site), and is visible on the ground as a causeway within the survey area. It is traditionally assumed that Thornton-le-Street lies at the junction of two Roman roads, although no firm evidence exists to support this hypothesis.

5.5. The site contains extensive low earthworks and depressions that are depicted as 'Old Inclosures' on the 1856-7 OS County Series map and continue to be recorded on subsequent maps; on the 1956 OS Plan, the same features are labelled as 'Romano-British settlement'. The earthworks, visible on satellite imagery and LiDAR are now considered to be the remains of medieval settlement. Such settlement probably represents part of the earlier village of Thornton-le-Street that has since gone into decline and shrunk to its modern proportions, focussed around the Norman church of St Leonards to the south of the survey area.

5.6. Old Hall, a Grade II listed building (MNY199) with possible 16$^{th}$ century origins and associated farm buildings, stands within the northern part of the survey area. Alongside the hall, an orchard is depicted on the 1856-7 OS County Series map.

5.7. The buildings of a former mill with possible 16$^{th}$ century origins (marked on 19$^{th}$ century OS maps as a corn mill) (MNY200, also Grade II listed) are located on the eastern edge of the survey area, with the associated mill race forming part of the eastern boundary of the site. The 1856-7 County Series OS map also indicates further buildings to the southwest of the mill building, which are present on OS maps until at least 1979; while no longer extant, their location is marked on the ground by a fenced-off area with a small amount of brick remains. The historic mapping also indicates a small enclosure off the eastern boundary located to the south of the mill buildings, the position of which is now marked on the ground by a line of trees.

# 6. Methodology

## 6.1. Data Collection

6.1.1. Geophysical prospection comprised the magnetic method as described in the following table.

6.1.2. Table of survey strategies:

| Method | Instrument | Traverse Interval | Sample Interval |
|---|---|---|---|
| Magnetic | Bartington Instruments Grad-13 Digital Three-Axis Gradiometer | 1m | 200Hz reprojected to 0.125m |

6.1.3. The magnetic data were collected using MS' bespoke hand-pulled cart system.

6.1.3.1. MS' cart system was comprised of Bartington Instruments Grad 13 Digital Three-Axis Gradiometers. Positional referencing was through a Hemisphere S321 GNSS Smart Antenna RTK GPS outputting in NMEA mode to ensure high positional accuracy of collected measurements. The Hemisphere S321 GNSS Smart Antenna is accurate to 0.008m + 1ppm in the horizontal and 0.015m + 1ppm in the vertical.

6.1.3.2. Magnetic and GPS data were stored on an SD card within MS' bespoke datalogger. The datalogger was continuously synced, via an in-field Wi-Fi unit, to servers within MS' offices. This allowed for data collection, processing and visualisation to be monitored in real-time as fieldwork was ongoing.

6.1.3.3. Rows of temporary sight markers were established in each survey area to guide the surveyor and ensure full coverage with the cart. Data were collected by traversing the survey area along the longest possible lines, ensuring efficient data collection and processing.

## 6.2. Data Processing

6.2.1. Magnetic data were processed in bespoke in-house software produced by MS. Processing steps conform to Historic England's standards for "raw or minimally processed data" (see sect 4.2 in David et al., 2008: 11).

Sensor Calibration – The sensors were calibrated using a bespoke in-house algorithm, which conforms to Olsen et al. (2003).

Zero Median Traverse – The median of each sensor traverse is calculated within a specified range and subtracted from the collected data. This removes striping effects caused by small variations in sensor electronics.

Projection to a Regular Grid – Data collected using RTK GPS positioning requires a uniform grid projection to visualise data. Data are rotated to best fit an orthogonal grid projection and are resampled onto the grid using an inverse distance-weighting algorithm.

Interpolation to Square Pixels – Data are interpolated using a bicubic algorithm to increase the pixel density between sensor traverses. This produces images with square pixels for ease of visualisation.

### 6.3. Data Visualisation and Interpretation

6.3.1. This report presents the gradient of the sensors' total field data as greyscale images. Multiple greyscales images at different plotting ranges have been used for data interpretation. Greyscale images should be viewed alongside the XY trace plot (Figure 8). XY trace plots visualise the magnitude and form of the geophysical response, aiding in anomaly interpretation.

6.3.2. Geophysical results have been interpreted using greyscale images and XY traces in a layered environment, overlaid against open street maps, satellite imagery, historic maps, LiDAR data, and soil and geology maps. Google Earth and Bing (2017) were also consulted, to compare the results with recent land usages.

## 7. Results

### 7.1. Qualification

7.1.1. Geophysical results are not a map of the ground and are instead a direct measurement of subsurface properties. Detecting and mapping features requires that said features have properties that can be measured by the chosen technique(s) and that these properties have sufficient contrast with the background to be identifiable. The interpretation of any identified anomalies is inherently subjective. While the scrutiny of the results is undertaken by qualified, experienced individuals and rigorously checked for quality and consistency, it is often not possible to classify all anomaly sources. Where possible an anomaly source will be identified along with the certainty of the interpretation. The only way to improve the interpretation of results is through a process of comparing excavated results with the geophysical reports. MS actively seek feedback on their reports as well as reports of further work in order to constantly improve our knowledge and service.

### 7.2. Discussion

7.2.1. The geophysical results are presented in consideration with satellite imagery (Figure 5), historic maps (Figure 6), LiDAR (Figure 7) and XY Traces (Figure 8).

7.2.2. The fluxgate gradiometer survey has responded well to the environment of the survey area. While the magnetic signals from some portions of the site were dominated by disturbance from modern features such as ferrous sources and/or sub-surface services, responses interpreted as being of archaeological origin were detected over large parts of the remaining survey area, complementing the evidence known from ground observation and LiDAR data.

7.2.3. The dominance of the NE-SW alignment is striking, although this is also reflected in the wider landscape, as elements such as land boundaries have been arranged perpendicular to the water source of Cod Beck. The archaeological responses identified in the magnetometer data imply a complex history of settlement on the site and add

detail to our understanding of what appears to be a 'classic' shrunken village, incorporating narrow plots extending off a central street that runs between the church and hall.

7.2.4. Given that the magnetic data does not give indications of the date of underlying features, it is not possible to assess the contemporaneity of components of the settlement directly. However, some variations in alignment may indicate multiple phases or the gradual development of occupation. The different forms of anomalies detected across the site imply a degree of zonation within the settlement, although it must be borne in mind that later ploughing activity will have affected the survival of many original archaeological features, with a knock-on effect on their detectability through geophysical survey. Anomalies that have been interpreted as having probable or possible archaeological origins have been identified on either side of the 'causeway'. This feature, clearly visible on the ground, appears to have been central to the layout of previous occupation.

7.2.5. To the east of the causeway, responses include a network of linear magnetic anomalies that are likely to reflect boundaries of plots of land running back from the street towards Cod Beck. The northern extent of this land use is difficult to determine, given the presence of a spread of strong ferrous signals apparently resulting from the demolition of a later building. To the north of this, a number of linear anomalies have been identified within a confined area, that are indicative of ridge and furrow agriculture.

7.2.6. To the west of the causeway, in Area 4, a complex of enclosures has been identified, some of which contain numerous small discrete magnetic anomalies. Comparatively few anomalies likely to be of archaeological origin have been identified in the southern part of Area 4, although LiDAR data evidences relatively modern ploughing in this area.

7.2.7. A large number of discrete sub-circular or sub-rectangular anomalies have been detected across the survey areas that have been interpreted as having possible archaeological origins. The majority of these are most likely to represent cut features such as rubbish or storage pits, while others may represent localised burning such as hearths, ovens or kilns.

7.2.8. Magnetic anomalies corresponding to known later features, including field boundaries, footpaths and buildings have also been detected.

## 7.3. Interpretation

### 7.3.1. General Statements

7.3.1.1. Geophysical anomalies will be discussed broadly as classification types across the survey area. Only anomalies that are distinctive or unusual will be discussed individually.

7.3.1.2. **Undetermined** – Anomalies are classified as Undetermined when the anomaly origin is ambiguous through the geophysical results and there is no supporting or correlative evidence to warrant a more certain classification. These

anomalies are likely to be the result of geological, pedological or agricultural processes, although an archaeological origin cannot be entirely ruled out. Undetermined anomalies are generally not ferrous in nature.

7.3.1.3. **Ferrous (Discrete/Spread)** – Discrete ferrous-like, dipolar anomalies are likely to be the result of modern metallic disturbance on or near the ground surface. A ferrous spread refers to a concentrated deposition of these discrete, dipolar anomalies. Broad dipolar ferrous responses from modern metallic features, such as fences, gates, neighbouring buildings and services, may mask any weaker underlying archaeological anomalies should they be present.

### 7.3.2. Magnetic Results - Specific Anomalies

7.3.2.1. **'Causeway' –** Running southeast-northwest across the site, the 'causeway' (see Paragraph 5.4) continues the line of the modern village street running past St Leonard's church towards the Old Hall, and is visible on the ground as well as in LiDAR data and satellite imagery. It is supposed that this causeway represents an earlier trackway or street of unknown date. However, it is only faintly apparent in the magnetic data, probably accounting for a number of linear trends and small spreads of increased magnetic disturbance (for example at **[1a]**), with possible indications of the small ditches/banks marking either side.

7.3.2.2. **Possible plot boundaries –** Some of the most prominent and coherent magnetic responses identified in the data include a number of strong and moderately-strong linear anomalies located throughout the southern half of Area 1 (centred around the points marked **[1b]** and **[1c]**). These anomalies are largely well defined and range from *c.* 1-3m in width and up to *c.*90m in length. The majority end approximately 50m west of the line of Cod Beck. They have been interpreted here as possible plot boundaries associated with the medieval settlement at Thornton-le-Street. A small number of weak linear anomalies have been identified on the opposite (western) side of the causeway; given their alignment and location, it is possible that they correspond to the ploughed out remains of further plot boundaries.

The linear anomalies appear to run as far west as the causeway that runs SE-NW across the centre of the site and continues the line of the main village street, although it is worth noting that they are not aligned exactly perpendicular to the modern causeway. If this causeway represents the approximate location of an original route, plots running back from the street line, in the manner of those still visible in the layout of the modern village, would be typical of a medieval 'shrunken village'. The anomalies around **[1c]** are stepped back from the line of the postulated street by up to *c.*35m, although some modern disruption, including a sub-surface service pipe, in this area may have caused truncation of the possible plot boundaries and a number of anomalies categorised here as 'Possible Archaeology' may be the result of this (see also Section 7.3.2.4). When compared with satellite imagery, several of the

linear anomalies (at **[1b]**) appear to share the alignment of current boundaries of modern residential properties running NE-SW off the main street.

Subtle variation on the *c.* NE-SW direction of some of the anomalies categorised as potential plot boundaries may hint at multi-phase use, with at least two identifiable alignments. Many of the linear anomalies correspond well to more or less pronounced positive and negative earthworks that are visible both on the surface and in satellite imagery and LiDAR (see Figures 5 and 7), although a detailed topographic survey was beyond the remit of this survey. **[1d]** and **[1e]**, for example, relate to particularly pronounced ditches, as does **[1f]**, which curves distinctly around to the east at its northeastern end.

Additional shorter, linear anomalies of varying strengths, such as those running NW-SE at **[1c]**, run at right angles across those anomalies described above, perhaps indicating sub-divisions within the main plots. Alternatively, they may represent a further phase of habitation.

At the northern end of the causeway, several weak anomalies may indicate potential boundaries running northeast off it towards the river (e.g. **[1g]** and **[3a]**). As the 'street' bends to the west at this point, the plots are more radial in shape than those previously described.

The relative strength of the archaeological anomalies implies that the focus of habitation may have been around these potential plots, particularly towards the possible street end; the data display something of a 'habitation effect' – a recognised effect whereby the ground undergoes a greater degree of magnetic enhancement around the core of a settlement due to the increased deposition of occupation debris compared with the peripheries. In this data, the most magnetically enhanced archaeological features appear to lie in the area surrounding **1c**, becoming increasingly ephemeral in the southeast, southwest and northern portions of the site. However, it is worth noting that the presence of quantities of more modern magnetic material close to this area of the site (for example, relating to demolished buildings) may have contributed to this.

7.3.2.3. **Enclosures –** To the west of the central 'causeway', a small complex of possible rectilinear enclosures has been identified. The two largest and most obvious, centring on **[4a]** and **[4b]** and sharing central boundary **[4c]**, correspond to the ditches and low banks clearly visible on the ground and in the satellite imagery and LiDAR (see Figures 5 and 7). In most places, the physical features have been detected in the magnetic data as positive or negative linear anomalies, flanked on either side by responses of the opposite polarity; for clarity, only the central response has been highlighted on the interpretation figures. The larger, parallelogram-shaped enclosure measures *c.* 70 x 65m and extends from Area 4 into Area 1. Its eastern side demonstrates a NW-SE axis that is not seen elsewhere in the data. The western enclosure **[4b]** measures *c.* 70 x 45m, although the responses generated by modern ferrous features along the western edge of the survey area mean that it is not clear whether or not the

western side of the enclosure has been truncated. These enclosures share the same NE-SW alignment as both the anomalies interpreted as plot boundaries to the east of the possible street and landscape features such as hedgerows to the west of the site.

The exact location of the anticipated eastern corner of **[4a**] is obscured by modern magnetic disturbance caused by the field boundary. However, it is possible that the eastern boundary continues to run southeast towards **[4d]**. A possible internal subdivision has been identified within enclosure **[4a]**, running in from the northeast and returning southeast to form a sub-square enclosure *c*. 30 x 30m within the eastern corner of the larger enclosure.

At the southern corner of enclosure **[4a]**, the perimeter ditch has been widened within the larger enclosure to create a sub-rectangular depression, *c.* 35 x 9m, that is clearly visible on the ground **[4e]**. Parallel linear anomalies in the magnetometer data correspond with the northern and southern edges of this feature. The interior does not appear to be significantly magnetically enhanced compared with surrounding areas. To the northeast of this, an L-shaped magnetic anomaly **[4f]**, suggests a further small enclosure immediately south of the eastern apex of enclosure **[4a]**, although further detail in this area is also masked by the magnetic effects of the extant field boundary.

A possible rectilinear enclosure, centred on **[4g]**, is indicated by more ephemeral magnetic responses. To the east of this, an L-shaped anomaly **[4h]** has been identified that suggests the possibility of an additional enclosure measuring *c*. 13m in the NE-SW direction (the southeastern boundary is obscured by modern disturbance).

7.3.2.4. **Possible Archaeology –** A large number of discrete magnetic anomalies have been detected across the site. Many of these are likely to represent individual discrete archaeological features, although others, such as those within **[4b]**, may represent the remains of linear features that have suffered truncation due to later plough damage. The densest congregations of such anomalies occur within and immediately northeast of enclosures **[4a]** and **[4b**], and in a band along the western extent of the postulated plot boundaries at **[1c]**.

Of those anomalies reflecting discrete features, it is expected that many would represent cut features such as rubbish or storage pits; closer to the river, some may represent clay extraction pits that have become backfilled with magnetically enhanced material.

It is likely that some of the stronger discrete anomalies, particularly those located on the edges of the settlement, reflect the remains of ovens, kilns or other areas of *in situ* burning. Of particular interest in this respect are several strong, sub-circular magnetic anomalies **[1h]**, ranging from *c.* 2-2.5m in diameter, three of which are aligned in a row running parallel to the adjacent plot boundary.

Immediately alongside the causeway, a large, very strong, amorphous magnetic anomaly has been identified **[1i]** that may represent an area of *in situ* burning, perhaps an area of metal working or other industrial process. While no evidence of such was visible on the surface, it is not possible to determine the age of any underlying feature from the magnetic data alone. However, it is likely that material from any such feature has contributed to the strength of magnetic responses detected over nearby ditches.

7.3.2.5. **Ridge and Furrow -** Numerous parallel linear anomalies **[1j]**, located in the northern part of Area 1, are typical of those resulting from ridge and furrow cultivation. Located between the mill race to the east and the projected line of the main street, where they appear to respect a narrow boundary running SE-NW. The anomalies are partially masked by the very strong ferrous responses from modern service pipes. Separated by distances of *c*.6-8m, the anomalies correspond well with the plough ridges that are clearly visible on the LiDAR data (see Figure 7).

7.3.2.6. **Agricultural (Former field boundaries) –** Forming a rectangular enclosure against the southeastern corner of Area 5, a linear spread (*c.* 5m wide) of magnetic disturbance was detected running northwest and returning northeast, where it is identifiable as a discrete band within a broader area of magnetic disturbance. The enclosure thus created, *c.* 50 x 40m, corresponds with a small plantation of trees marked on the 2nd Edition OS map (see Figure 6), and it is probable that the magnetic responses represent the boundaries that have since been removed or destroyed. A smaller, square enclosure (*c.* 11 x 11m), butting up to the first, is also depicted on the same map and corresponds with a spread of strong responses in the data and a wire-fence tree on the ground **[5a]**.

Running approximately NE-SW across the boundary between Areas 1 and 3, a further linear spread of magnetic disturbance (*c.* 5m wide) is discernible in the data **[3b]**, corresponding with the remains of a former field boundary marked on the 2nd Edition OS map (see Figure 6).

7.3.2.7. **Ferrous (Discrete and spread) -** The majority of strong ferrous responses are located around the edges of the survey areas, particularly in proximity to the modern farm buildings and the residential properties of the village. A number of smaller, discrete ferrous anomalies located across the survey area are likely to be modern. Given the archaeological context, some ferrous material may be older and therefore relevant to an archaeological interpretation of the site.

A band of magnetic disturbance crosses the centre of Area 1, corresponding with a footpath marked on the 2nd Edition OS map (see Figure 6). A broader area of ferrous disturbance to the immediate west of this surrounds the fenced-off area corresponding to the location of former buildings marked on the historic mapping and is probably related to their demolition (the fenced-off area contains some brick building remains). Other spreads of ferrous material have

been identified in Area 5 and are likely to relate to the nearby buildings and associated modern activity.

A number of sub-surface services have been detected running across the site. Particularly prominent ferrous responses mark the line of a service pipe running close to the previously noted causeway that runs SE-NW across the centre of the site.

7.3.2.8. **Unknown –** Running from the northern corner of Area 2, a linear magnetic anomaly of unknown origin runs northeast towards Cod Beck. Its origins are unknown, although it corresponds with a ditch visible on the ground. It continues the line of the modern garden, although this is at an angle to other plot boundaries in this area.

# 8. Conclusions

8.1. The magnetometer responded very well to the conditions of the survey area and effectively detected a range of magnetic anomalies, many of which have been interpreted as being of probable or possible archaeological origin on the grounds of their form, strength and character. The results of the survey serve to reinforce previous interpretation of the site as the location of former settlement (for example, in the scheduling document) as well adding detail to our understanding of the site. The geophysical survey complements other data sets, such as LiDAR and satellite imagery, and provides a strong foundation for future work by the Roads to the Past Project.

8.2. The magnetic anomalies identified on this site are typical of those to be expected from a former settlement. In this case, the layout suggests a linear development along a street or track. The data is consistent with the interpretation of the site when scheduled *i.e.* as a shrunken medieval village; however, the magnetic data obtained during this survey cannot provide either relative or absolute dates of archaeological features.

8.3. A degree of zonation is evident within the data, with the majority of parallel linear anomalies interpreted here as possible plot boundaries located to the east of the central trackway (which itself is clearly evident on the ground, though less so in the magnetic data), several enclosures to the west, an area of ridge and furrow in the northeastern quadrant and a relatively magnetically 'quiet' (perhaps plough damaged) area in the south. However, as noted above, the relative chronology of the archaeology that these anomalies represent is not clear.

8.4. A large number of smaller anomalies have been identified here and ascribed the category of 'Possible Archaeology'. It is likely that some of these represent discrete archaeological features such as pits and, in the case of magnetically stronger examples, ovens or hearths, that are commonly found on occupation sites. Others may represent linear features that have been truncated by later ploughing activity.

8.5. A number of anomalies have been identified that correspond to features depicted on historic mapping. These include former field boundaries and footpaths, and areas of ferrous debris.

8.6. Strong ferrous responses – the result of modern agricultural and building activity – were largely limited to the perimeters of the survey areas, with the exception of a number of services that run across the interior.

# 9. Archiving

9.1. MS maintains an in-house digital archive, which is based on Schmidt and Ernenwein (2013). This stores the collected measurements, minimally processed data, georeferenced and un-georeferenced images, XY traces and a copy of the final report.

9.2. MS contributes all reports to the ADS Grey Literature Library subject to any time embargo dictated by the client.

9.3. Whenever possible, MS has a policy of making data available to view in easy to use forms on its website. This can benefit the client by making all of their reports available in a single repository, while also being a useful resource for research. Should a client wish to impose a time embargo on the availability of data, this can be achieved in discussion with MS.

# 10. Copyright

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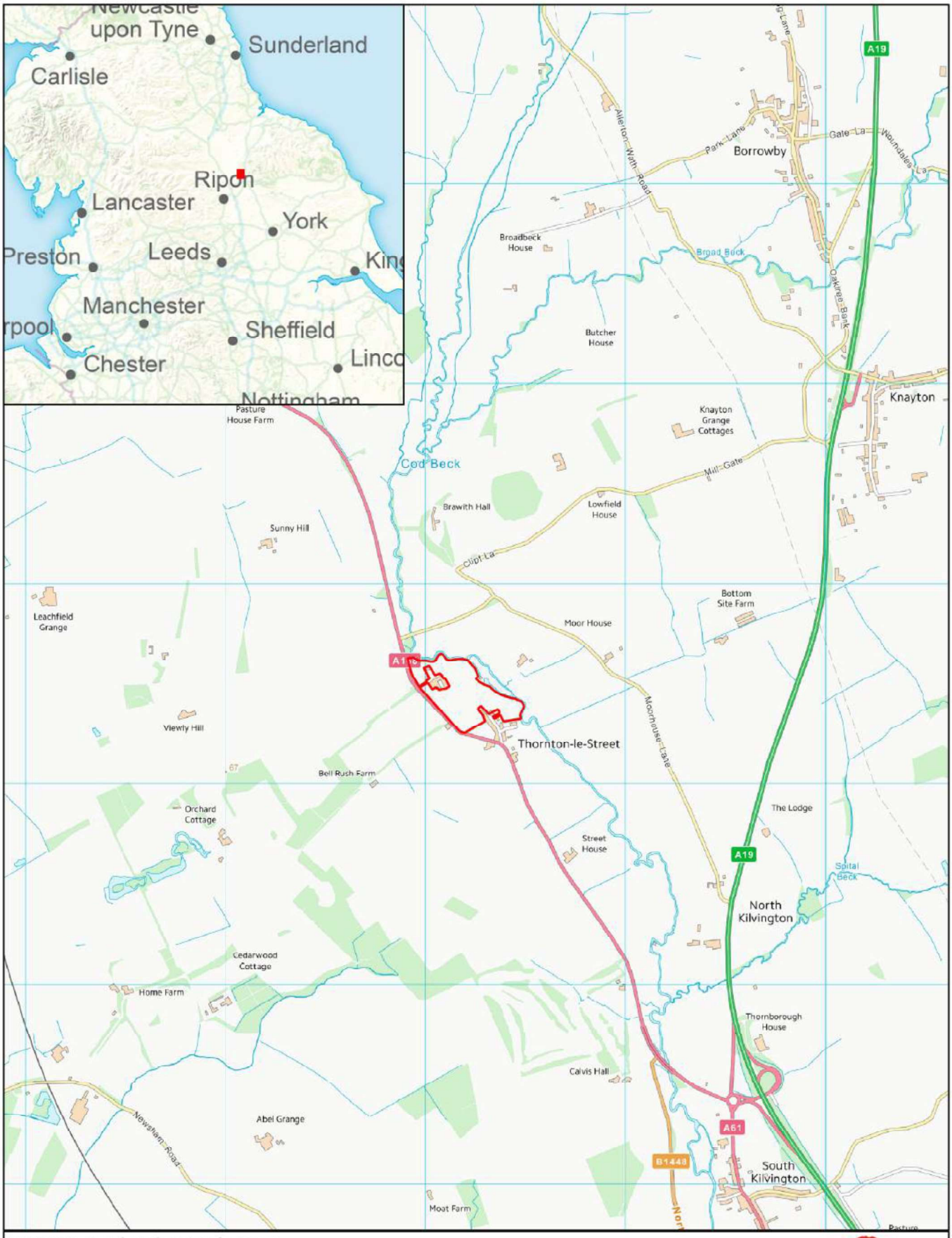



MSSE193 - Land at Thornton-le-Street
Figure 1 - Site Location
1 : 25,000 @ A4


Survey Area

N

0 0.5 1 km

magnitude surveys


MSSE193 - Old Hall Farm, Thornton-le-Street
Figure 2 - Location of Survey Areas over Satellite Imagery
1:2500 @ A3

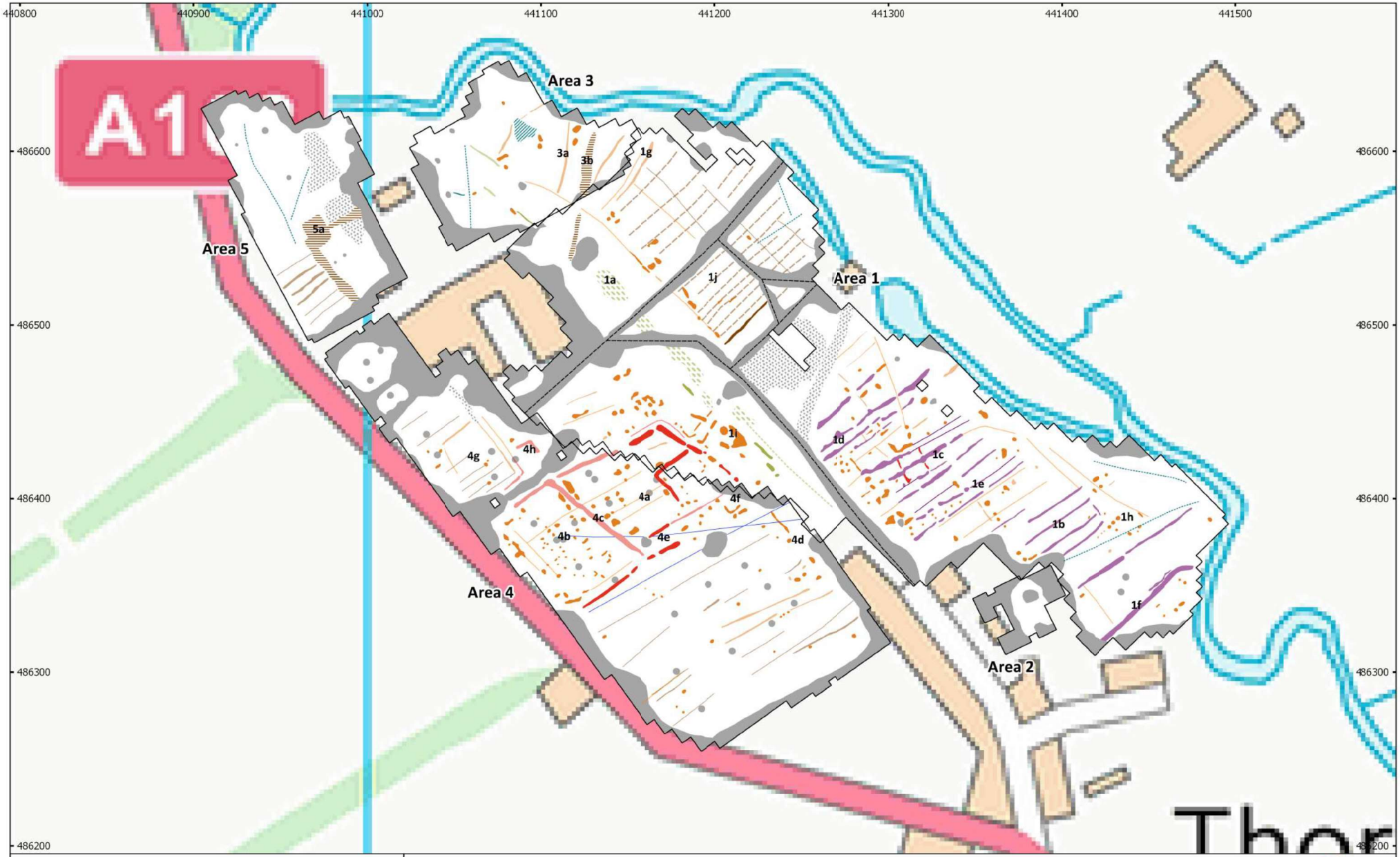

Survey Areas

N

0 25 50 75 m

magnitude surveys


MSSE193 - Old Hall Farm, Thornton-le-Street
Figure 3 - Magnetic Greyscale
1:2000 @ A3



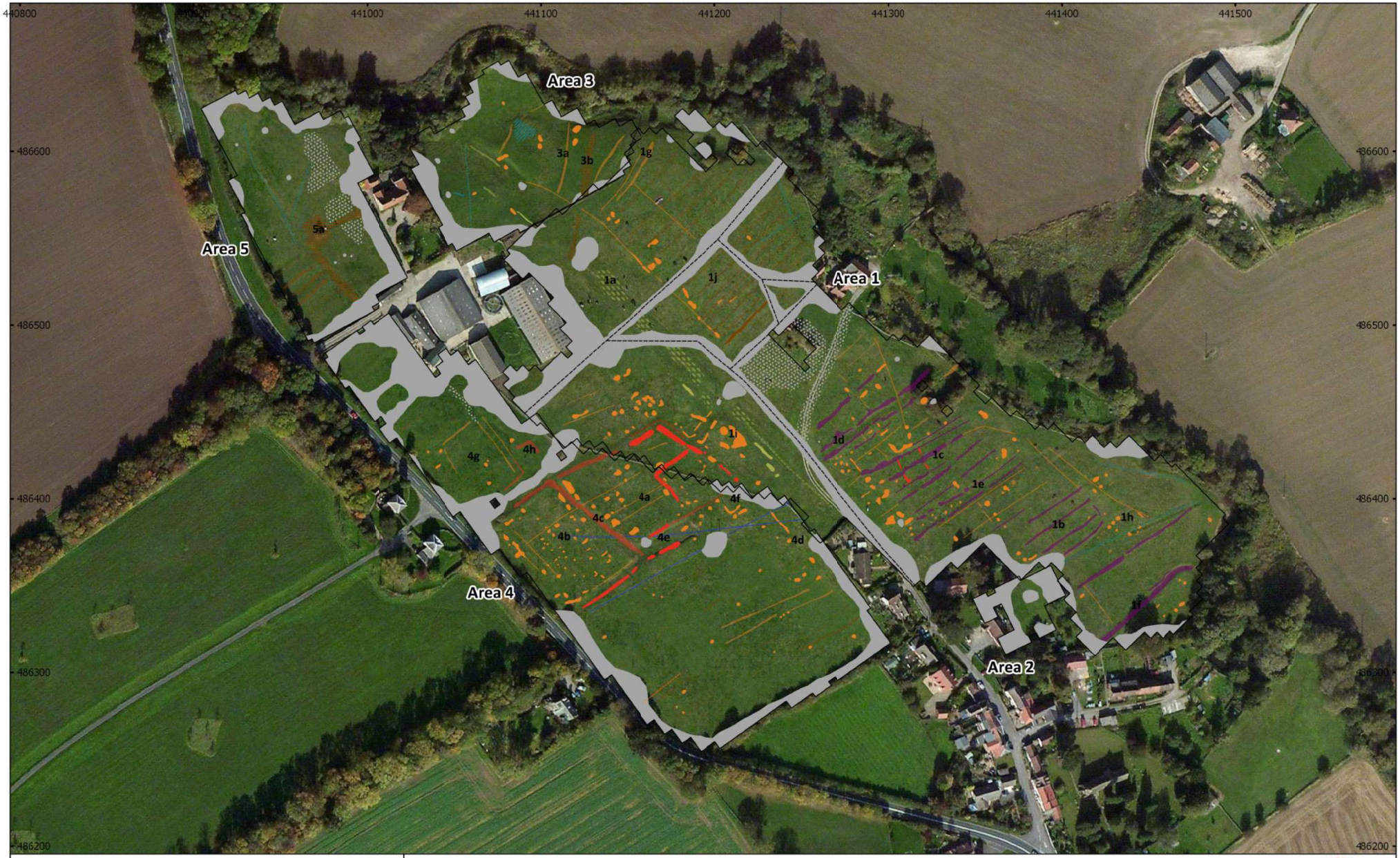

MSSE193 - Old Hall Farm, Thornton-le-Street
Figure 4 - Magnetic Interpretation
1:2000 @ A3


- Possible Plot Boundary
- Archaeology Probable (Strong)
- Archaeology Probable (Weak)
- Archaeology Possible (Strong)
- Archaeology Possible (Weak)
- Causeway (Strong)
- Causeway (Spread)
- Agricultural (Strong)
- Agricultural (Weak)
- Agricultural (Spread)
- Ferrous (Dipolar)
- Ferrous (Spread)/Magnetic Disturbance
- Undetermined (Spread)
- Undetermined (Strong)
- Possible Plot Boundary (Trend)
- Archaeology Probable (Trend)
- Archaeology Possible (Trend)
- Causeway (Trend)
- Ridge and Furrow (Trend)
- Agricultural (Trend)
- Undetermined (Trend)
- Service
- Drainage Feature

N

0 25 50 75 m

magnitude surveys



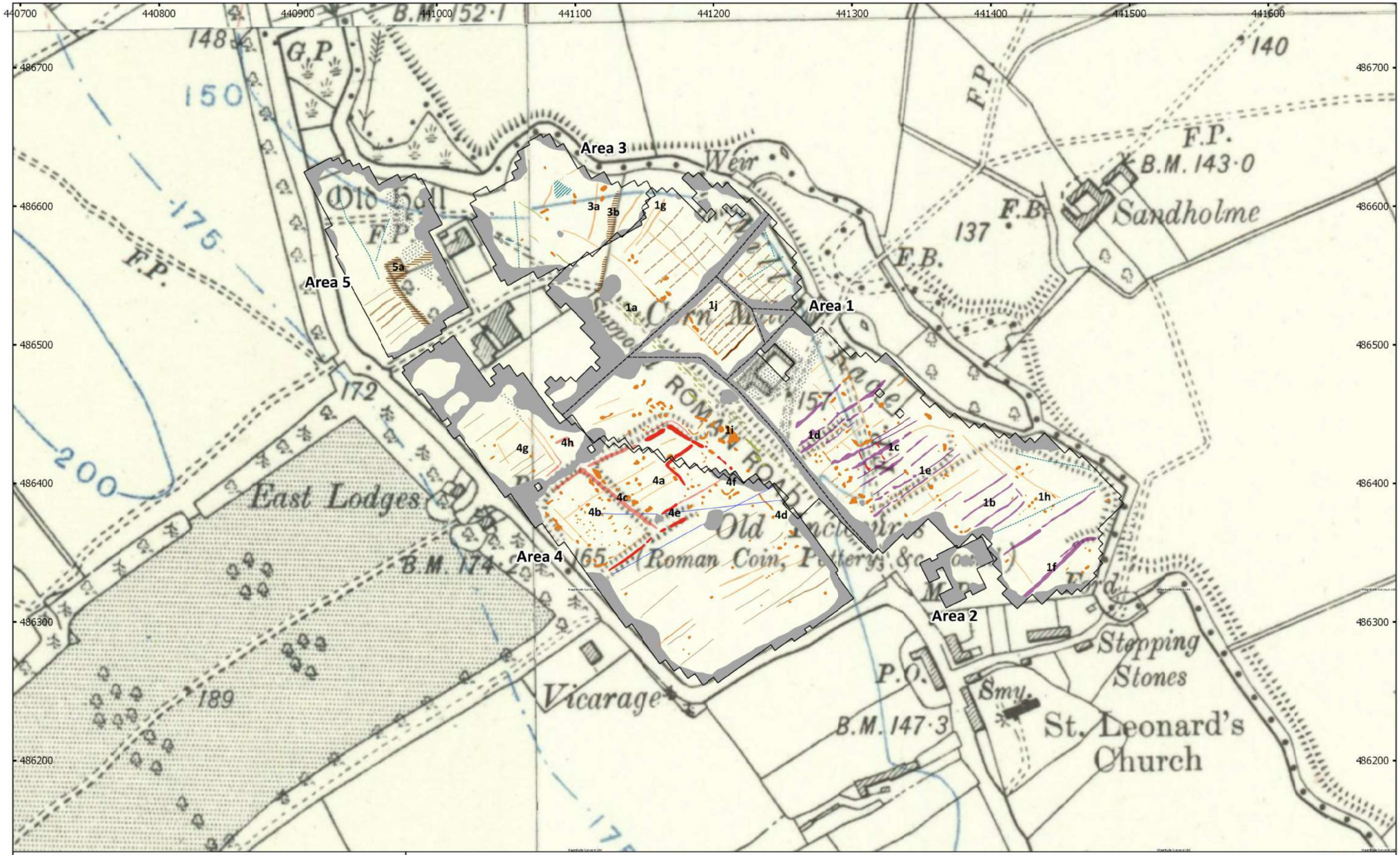

MSSE193 - Old Hall Farm, Thornton-le-Street
Figure 5 - Magnetic Interpretation Over Satellite Imagery
1:2000 @ A3


- Possible Plot Boundary
- Archaeology Probable (Strong)
- Archaeology Probable (Weak)
- Archaeology Possible (Strong)
- Archaeology Possible (Weak)
- Causeway (Strong)
- Causeway (Spread)
- Agricultural (Strong)
- Agricultural (Weak)
- Agricultural (Spread)
- Ferrous (Dipolar)
- Ferrous (Spread)/Magnetic Disturbance
- Undetermined (Spread)
- Undetermined (Strong)
- Possible Plot Boundary (Trend)
- Archaeology Probable (Trend)
- Archaeology Possible (Trend)
- Causeway (Trend)
- Ridge and Furrow (Trend)
- Agricultural (Trend)
- Undetermined (Trend)
- Service
- Drainage Feature

N

0 25 50 75 m

magnitude surveys




MSSE193 - Old Hall Farm, Thornton-le-Street
Figure 6 - Magnetic Interpretation Over Historic Mapping
1:2500 @ A3

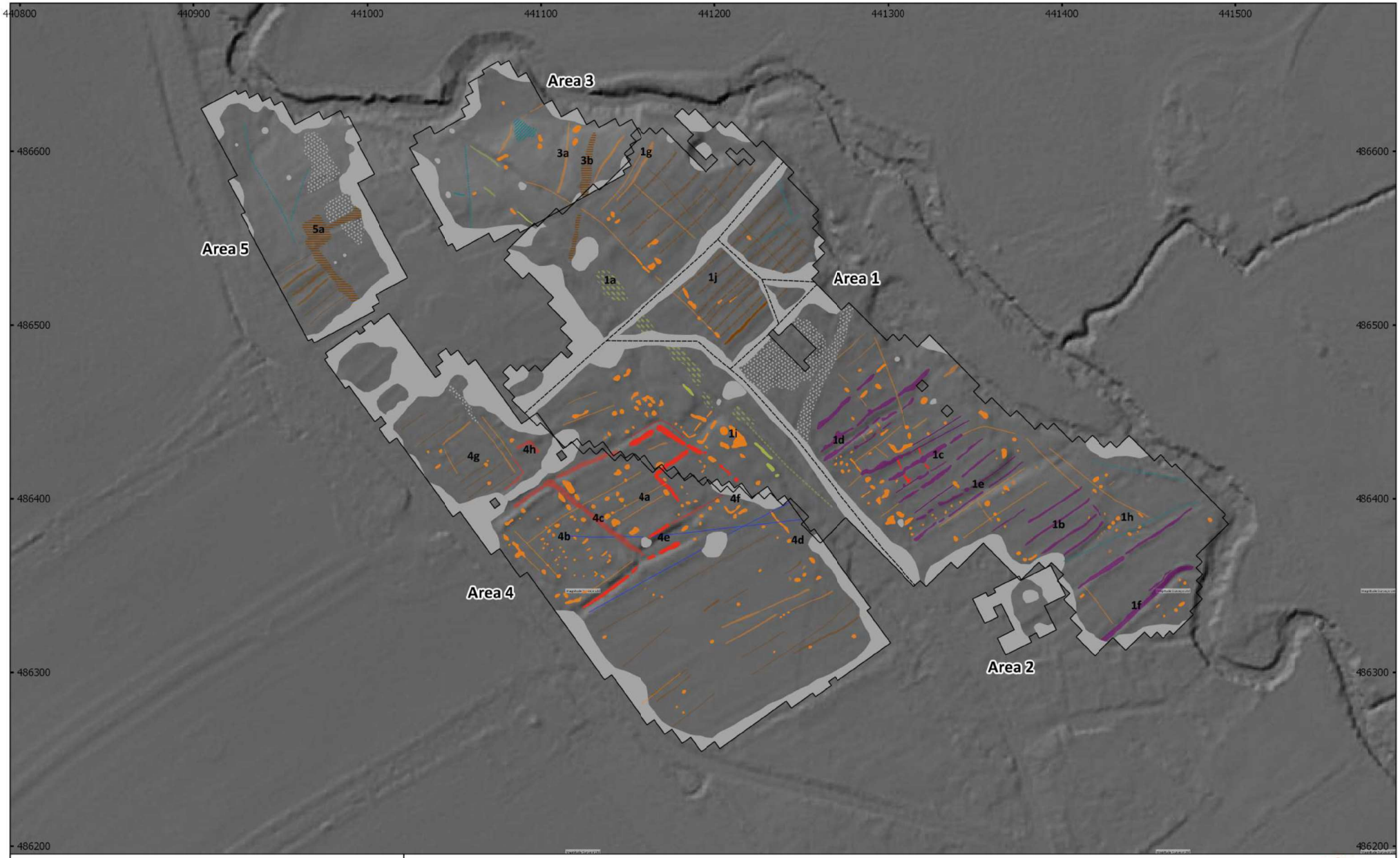
Contains historic maps: Ordnance Survey, 6" 2nd edition c. 1882-1913 © National Library of Scotland

- Possible Plot Boundary
- Archaeology Probable (Strong)
- Archaeology Probable (Weak)
- Archaeology Possible (Strong)
- Archaeology Possible (Weak)
- Causeway (Strong)
- Causeway (Spread)
- Agricultural (Strong)
- Agricultural (Weak)
- Agricultural (Spread)
- Ferrous (Dipolar)
- Ferrous (Spread)/Magnetic Disturbance
- Undetermined (Spread)
- Undetermined (Strong)
- Possible Plot Boundary (Trend)
- Archaeology Probable (Trend)
- Archaeology Possible (Trend)
- Causeway (Trend)
- Ridge and Furrow (Trend)
- Agricultural (Trend)
- Undetermined (Trend)
- Service
- Drainage Feature

N

0 25 50 75 m

magnitude surveys




MSSE193 - Old Hall Farm, Thornton-le-Street
Figure 7 - Magnetic Interpretation Over LiDAR Data
1:2000 @ A3


- Possible Plot Boundary
- Archaeology Probable (Strong)
- Archaeology Probable (Weak)
- Archaeology Possible (Strong)
- Archaeology Possible (Weak)
- Causeway (Strong)
- Causeway (Spread)
- Agricultural (Strong)
- Agricultural (Weak)
- Agricultural (Spread)
- Ferrous (Dipolar)
- Ferrous (Spread)/Magnetic Disturbance
- Undetermined (Spread)
- Undetermined (Strong)
- Possible Plot Boundary (Trend)
- Archaeology Probable (Trend)
- Archaeology Possible (Trend)
- Causeway (Trend)
- Ridge and Furrow (Trend)
- Agricultural (Trend)
- Undetermined (Trend)
- Service
- Drainage Feature

N

0 25 50 75 m

magnitude surveys


MSSE193 - Old Hall Farm, Thornton-le-Street
Figure 8 - XY Trace Plot
40nT/cm at 1:2000 @ A3