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ONE EARTH SOLAR FARM

GEOPHYSICAL SURVEY REPORT

commissioned by One Earth Solar Farm Ltd

February 2025

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PROJECT INFO:

HA Project Code **OESF23** / HA Report No **2025-15** / NGR **SK 48213 37199** / Parish **The Rivers, Retford, Marnham, Newton-on-Trent: St Peter, North and South Clifton, Thorney with Wigsley** / Local Authority **Nottinghamshire County Council, Lincolnshire County Council** / Fieldwork Date **17.01.2024 - 28.11.2024** / OASIS Ref. **headland1-531446**

PROJECT TEAM:

Project Manager **Sam Harrison** / Author **Matthew Berry** / Fieldwork **Abigail Calvert, Eloise Turner, Emily Humphrey, Findlay Young, Jacob Adams, Jill Thistlethwaite, Lara Brennan, Matthew Harris, Neil Paveley, Richard McGregor-Edwards, Thomas Jenkins, William Lewis** / Graphics **Karolina Saxerbo Sjöberg, Leia Carter, Marc Zubia-Pons, Matthew Berry, Tom Watson**

Approved by **Sam Harrison**



Headland Archaeology Yorkshire & North
Units 23–25 & 15 | Acorn Business Centre | Balme Road | Cleckheaton BD19 4EZ
t 0127 493 8019
e yorkshireandnorth@headlandarchaeology.com
w www.headlandarchaeology.com

PROJECT SUMMARY

Headland Archaeology (UK) Ltd was commissioned by One Earth Solar Farm Ltd (the Client) to undertake a geophysical (magnetometer) survey on two contiguous parcels of land separated by the River Trent located between the villages of Darlton, Skegby, Newton on Trent and North Clifton in Nottinghamshire and Lincolnshire, at the site of the proposed One Earth Solar Farm. This geophysical survey report will inform the Environmental Impact Assessment (EIA) produced in support of a development consent order (DCO) application for the construction of the solar farm. The geophysics survey results will also inform future archaeological strategy, if required.

The survey has successfully evaluated all suitable areas within the latest proposed site boundary, and some areas now scoped out of the project but still presented herein, with the total area surveyed amounting to approximately 1260 hectares. The results of the survey generally corroborate but also greatly expand the current understanding of the archaeological potential of the site as contained within the Lincolnshire and Nottinghamshire Historic Environment Records.

Not unsurprisingly, given the size of the site, a large number and varied range of magnetic anomalies, including of agricultural, natural/geological, modern but also archaeological origin have been recorded by the survey. These are all identified against a relatively homogenous magnetic background ubiquitous across the site, (with the notable exception for fields in close proximity to the River Trent), that is likely derived from a relatively unresponsive underlying mudstone geology and overlying superficial deposits.

The main findings of the survey include as many as nineteen separate locations within the current site boundary where foci of activity and/or individual archaeological features are clearly identified and where the archaeological potential is considered locally high. The majority of these areas include patterns of enclosure with associated ditches and trackways. The largest concentrations of these that are indicative of settlement activity and that correlate well with the entries on the local historic environment record (HER) are recorded between Ragnall and the River Trent, where three or four foci of activity

could possibly identify one large extended area of activity, on the geological escarpment north of North Clifton, adjacent to Southmoor Lane and north of Moor Lane. Less dense areas of enclosure are evident in four separate locations adjacent to Feldborough Beck, south-east of Whimpton Moor medieval village, east of Crabtree Lane, adjacent to Northfield Lane and east of Roadwood Lane.

In at least twelve locations the survey has mapped archaeological features, not previously known. Conversely, the survey has not identified any anomalies of possible archaeological potential in several locations east of the River Trent, where heritage assets comprising cropmarks and findspots are recorded on the local HER. All these areas coincide with spreads of overlying superficial sand and gravel deposits. It is uncertain whether there is a visibility bias in the detection of archaeological features across these deposits, as the survey has clearly mapped archaeological features across the same recorded geological and pedological conditions west of the River Trent. Consequently, the archaeological potential of those areas containing multiple HER assets relating to cropmarks east of the River Trent, in particular east of the A1133 remains unclear, though are not considered likely to contain significant areas of archaeological settlement activity.

Outside of the areas of archaeological potential by far the most prevalent anomalies recorded by the survey are agricultural in origin, identifying systematic patterns of field drains, cultivation trends (both historic ridge and furrow and modern ploughing), and former field boundaries which typify the agricultural landscape within which the site is located. Sinuous channels and amorphous spreads of low magnitude discrete responses identifying natural/geological features caused by alluvial flood deposits are widespread within the fields adjacent to the River Trent and to a lesser extent Fledborough Beck.

The results from a contiguous survey of this size have furthered the understanding of the extent and archaeological potential of the site and wider landscape and thereby added to the current understanding of the archaeological resource as identified on the Nottinghamshire and Lincolnshire HER's. Based on the results of the survey the archaeological potential of those areas containing clearly mapped extended and more isolated archaeological activity are considered locally high. In several locations where the magnetic survey responses are too vague and/or ephemeral to offer a more confident interpretation but are indicative of possible archaeological activity, the archaeological potential is considered moderate. Outside of these areas however the archaeological potential of the site is assessed as low.

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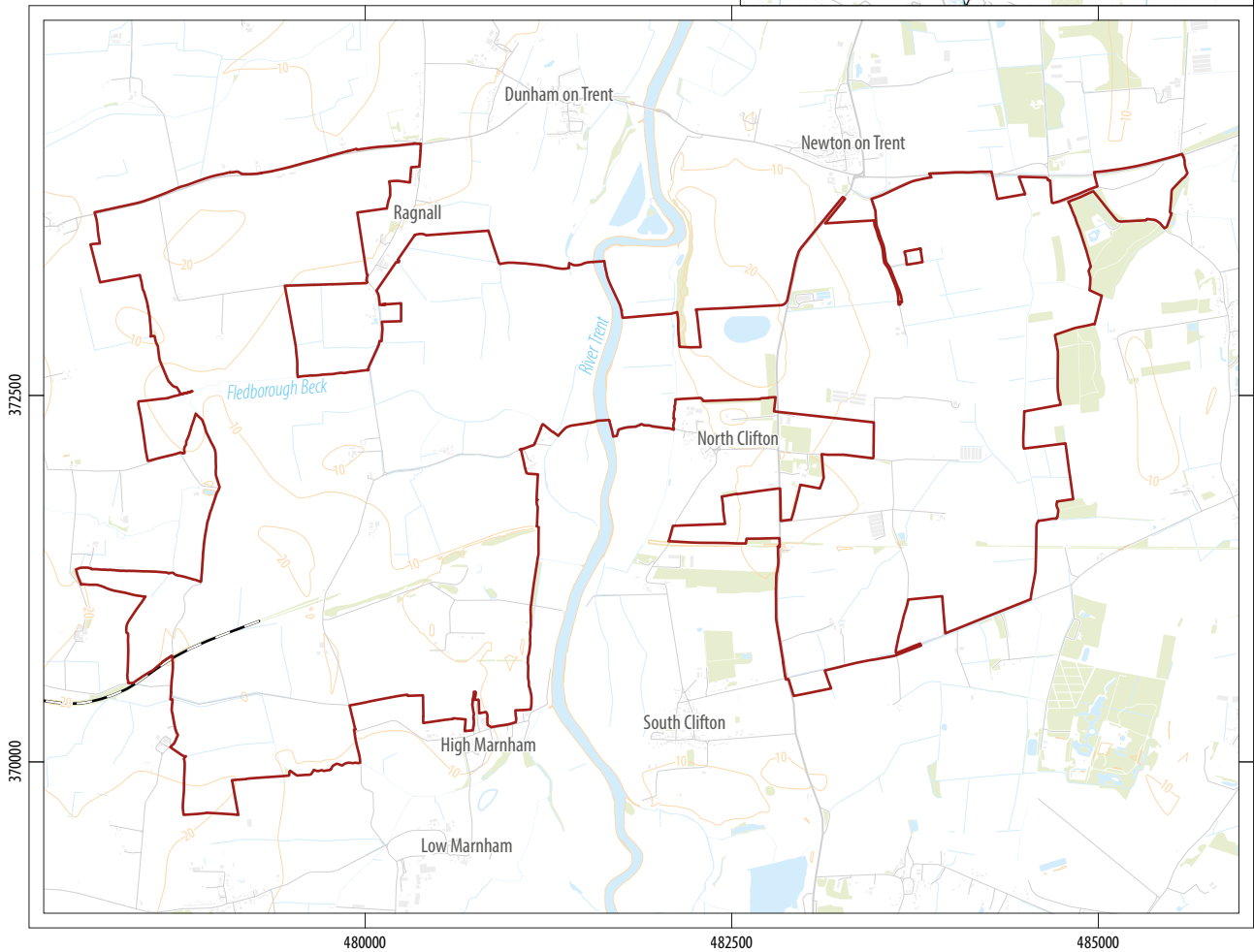
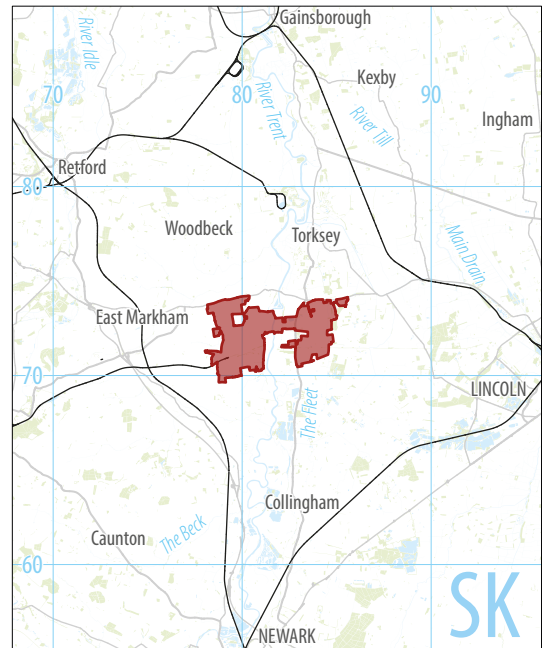
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One Earth Solar Farm
Lincolnshire and Nottinghamshire

0 200km
1:12,500,000 @ A4



0 1km
1:50,000 @ A4

site boundary



Headland Archaeology Yorkshire & North
Units 23–25 & 15 | Acorn Business Centre | Balme Road | Cleckheaton BD19 4EZ
t 01274 993 8019
e yorkshireandnorth@headlandarchaeology.com
w www.headlandarchaeology.com

ONE EARTH SOLAR FARM

GEOPHYSICAL SURVEY REPORT

1 INTRODUCTION

Headland Archaeology (UK) Ltd was commissioned by One Earth Solar Farm Ltd. (the Client) to undertake a geophysical (magnetometer) survey on land between the villages of Darlton, Skegby, Newton on Trent and North Clifton located at the county boundary between Nottinghamshire and Lincolnshire (Illus 1). The results will inform future archaeological strategy, if required.

The scheme of work was undertaken in accordance with the requirements of the National Planning Policy Framework (Department for Levelling Up, Housing and Communities DLUHC, 2023) and with the Written Scheme of Investigation for Geophysical Survey (WSI) (Headland Archaeology 2023).

The WSI was produced to the standards laid down in the European Archaeological Council's guideline publication, EAC Guidelines for the Use of Geophysics in Archaeology (Europae Archaeologia Consilium 2016), the Chartered Institute for Archaeologists' (CIfA) Standard, Guidance for Archaeological Geophysical Survey (CIfA 2020) and Lincolnshire County Council Archaeology Handbook (LCC 2024). The survey was also conducted in line with the same best practice guidelines.

The surveys were carried out across several mobilisations between January 17th and November 28th, 2024.

A design freeze after the completion of the original phase of fieldwork, saw the red line boundary (RLB) of the scheme change such that several fields within the original RLB were de-scoped. These include fields south-west of Newton on Trent, south and south-west of North Clifton and west of Thorney. The scheduled areas of Whimpton Moor medieval village and moated site (1017567) and Roman vexillation fortress and Royal Observer Corps monitoring post (1003608), both located south of the A57, were also de-scoped.

The survey data from those de-scoped areas which had already been surveyed are, however, still presented (Table 1) but are only discussed where relevant to findings from adjacent areas still within the RLB.

The total area within the current RLB (Illus 1) is approximately 1446 hectares of which 1261.5 hectares has been surveyed. Considering the scale of the survey there were relatively few areas that were unsuitable for survey, though some parts of fields were waterlogged or contained a cover or fodder crop at the time of survey and the cropping regime of three fields did not allow for survey. These included fields that were heavily ploughed or where there were strips of bird cover at the field margins.

Survey was not undertaken to the south and west of High Marnham substation. Approximately 57 hectares was previously surveyed here (Headland Archaeology 2022) the outline of which is shown on Illus 9 and Illus 10.

1.1 LOCATION, TOPOGRAPHY AND LAND-USE

The revised RLB (Illus 1) comprises a single contiguous block of land between the villages of South Clifton, Newton on Trent, Thorney and Skegby, approximately centred at NGR SJ 48213 37199, near the settlement of North Clifton. The RLB is roughly split in half longitudinally by the River Trent, is bounded to the north by the A57 and was predominantly under arable cultivation. It covers approximately 1,446 hectares and is located within three local authority areas: Bassetlaw, West Lindsey and Newark and Sherwood.

Topographically the majority of the land within the RLB east of the River Trent and in the floodplain of the river is generally flat between



ILLUS 2 SP1_A, looking WNW

approximately 6m and 10m above Ordnance Datum (AOD). One exception is where the land rises steeply between the river and the A1133 between North Clifton and Newton on Trent which rises to approximately 24m AOD around Hall Water Reservoir. The topography of the land located to the west of the River Trent is more varied, rising to approximately 20m AOD in both the north-west and south-west corners around the A57 and Skegby respectively, from 7m AOD near Fledborough.

As indicated the land within the GSA is predominantly under arable cultivation (Illus 2 to Illus 7 inclusive). Given the size of the site, the survey period spanned consecutive cropping regimes with areas surveyed during winter/spring and post-harvest across 2024. The initial phase of survey coincided with a prolonged period of wet weather during the winter/spring of 2024 which flooded several large areas across the site, particularly in close proximity to the River Trent (Illus 8). Many of these areas were subsequently surveyed later in 2024 but small blocks within these areas were still unsuitable for survey due to the poor ground conditions. Strips of set-aside and bird cover at the fringes of other fields account for other unsurveyed parcels.

1.2 GEOLOGY AND SOILS

The underlying bedrock geology is almost exclusively mudstone of the Mercia Mudstone Group, a sedimentary bedrock formed between 252.2 and 201.3 million years ago during the Triassic period. Mudstone of the Penarth Group and interbedded mudstone and limestone of the Scunthorpe Mudstone Formation partially underlie two of the easternmost fields. However, both fields, west of Thorney,

have now been de-scoped. Very narrow linear bands of dolomitic siltstone are recorded between the River Trent and Hall Water Reservoir in the westernmost fields off Farhill Lane (NERC 2024).

The distribution of superficial deposits overlying the bedrock is more complex. The site is overlain by four types of Quaternary deposits. A sinuous band of alluvium (clay, silt, sand and gravel) approximately 800m wide, follows the course of the River Trent and is recorded in those fields closest to the river. Another sinuous spread of alluvium spreads out from Fledborough Beck, a tributary of the River Trent, in the western part of the site which partially overlies several fields west of Fledborough. A large part of the site east of the River Trent and surrounding Fledborough to the west are overlain by sand and gravel deposits of the Holme Pierrepont Sand and Gravel Member. Two separate spreads of blown sand deposits are recorded east of the River Trent between South Clifton and Hall Water Reservoir. A spread of till (diamicton) overlies large parts of several fields, due west of Ragnall between the A57 and Farhill Lane (NERC 2024).

The soils are broadly split either side of the River Trent. To the east of the river and on the west side but east of Ragnall, the soils are classified in the Soilscape 15 Association, characterised as naturally wet very acid sandy and loamy soils. Generally, to the west of the river the soils are classified in the Soilscape 8 Association, characterised as slightly acid loamy and clayey soils with impeded drainage. The exception is to the south-east of Dalton where slowly permeable seasonally wet slightly acid but base-rich loamy and clayey soils, recorded in the Soilscape 18 Association, are mapped overlying the very northwesternmost fields. Soils within close proximity to



ILLUS 3 GHS1_D, looking south-east

the River Trent are recorded as loamy and clayey floodplain soils with naturally high groundwater in the Soilscape 20 Association (Cranfield University 2023).

2 ARCHAEOLOGICAL BACKGROUND

A site-specific archaeological desk-based assessment (ADBA) detailing the archaeological potential of the site and its immediate hinterland will follow. This will include the results of this geophysical survey and will be compiled using a full HER data search and by analysing historic mapping, aerial photography, LiDAR data, previous assessments and fieldwork reports etc along with consultation with the relevant Local Authority Archaeological Advisors. The ADBA will help identify areas of the site with a higher archaeological potential, and those with a lower potential. It will also include an impact assessment, which will look at the specific below ground elements of the proposed development and the extent to which they may affect heritage assets.

The location of known heritage assets as recorded in the Nottinghamshire and Lincolnshire Historic Environment Records (HER's) are shown on the sector overviews (Illustration 11 to Illus 28 inclusive).

The results of the initial scoping document (One Earth Solar Farm 2023) outlined the archaeological baseline conditions based on a basic search of several sources including:

- › the Lincolnshire and Nottinghamshire Historic Environment Record (HER) via Heritage Gateway;
- › geological data via the British Geological Society;
- › excavation summaries via the Archaeological Data Service (ADS); and
- › a review of current geographical and basic topographical layout via Google Maps and LiDAR imagery.

This baseline however is not intended to represent an exhaustive dossier of the known and postulated archaeological potential of the site but to give a summary of the more significant and numerous known remains in order to present a high-level baseline and identify the potential for further, currently unknown, remains.

The alluvial deposits along the River Trent have archaeological potential for the survival of palaeoenvironmental remains dating to the prehistoric Holocene (post ice-age) period. Such remains have the potential for environmental reconstruction via waterlogged seeds, pollen and macro-fossils as well as sedimentological examination. These remains may also contain indicators of human activity and early landscape management. Human activity may also be present from the terrace gravels that flank the river in the form of flint tool or tool working remains. The HER contains reference to an assessment being undertaken in the early 1990s for the future management and preservation of archaeological and palaeoenvironmental remains along the River Trent floodplain and gravel terraces.



ILLUS 4 SP3_A, looking south-east

The site includes areas of known prehistoric settlement and activity. Excavations at Newton Cliff, just to the north of North Clifton, identified significant remains spanning the late Mesolithic to late Neolithic/early Bronze Age. Remains of a late Mesolithic structure, waste pits and flint tool production debris were uncovered along with evidence for a Neolithic structure and Bronze Age features and finds. This site could be indicative of intermittent occupation, perhaps seasonal, during prehistory. Its position, on the drier escarpment overlooking the resource rich River Trent, would have made it an attractive location during the period. Neolithic and Bronze Age flint working, along with cropmarks of potentially contemporary enclosures, have also been identified in the southeastern part of the site. Aerial photography and geophysical survey in the northeastern area of the site has identified possible Iron Age enclosures visible as crop marks. Excavations on the southern part of the site, close to South Clifton, as part of the Empingham to Hannington pipeline construction, uncovered settlements dating to the Iron Age and Roman periods as well as Saxon burials and cremations.

Two Scheduled Monuments, Whimpton Moor medieval village and moated site (List Entry Number 1017567) and a Roman vexillation fortress and Royal Observer Corps monitoring post (List Entry Number 1003608) are located immediately adjacent and in close proximity to the site respectively. The areas containing both monuments have been surveyed due to their inclusion within earlier iterations of the proposed scheme boundary.

The vexillation fortress and Royal Observer Corps monitoring post are located to the south-west of Newton on Trent, on the eastern bank of the River Trent where the river bends sharply. The fortress dates from the 1st century AD, during the military conquest of Britain and is part of a rare subset of Roman defensive sites. Excavations to the north of the fortress uncovered a number of 2nd century Romano-British kilns. The Royal Observer Corps observation post, which forms part of the Scheduled Monument, was principally a Cold War era monitoring station, in use between 1961 and 1991, for spotting enemy aircraft and reporting nuclear explosions. A Roman Road was excavated just to the north of the site (south of Dunham-on-Trent) and possible Roman settlement remains have been identified on aerial photographs to the south of the road, within the central western part of the site.

The site surrounds Whimpton Moor medieval village and moated site (List Entry Number 1017567) on three sides (south, east and west), south of the A57. The monument includes earthworks and buried remains of former house platforms, boundaries, ponds, a moated dwelling and remains of ridge and furrow cultivation. Similar remains, of a shrunken medieval village, are known at Skegby Manor close to the southwestern edge of the site. In and around the site are active settlements with known Saxon or medieval origins such as Fledborough, South Clifton and High Marnham. Remnants of ridge and furrow cultivation have been noted as visible cropmarks variously across the site. Most of the site has likely continued as agricultural farmland from the post-medieval period to the present day.



ILLUS 5 CR2_B, looking south-east

To summarise, the site contains multiple, non-designated archaeological assets. These date to the Mesolithic, Neolithic, Bronze Age, Iron Age, Roman, Saxon, medieval and post-medieval periods. Given the presence of these assets, the size of the site and its undeveloped nature, there is a very high potential that further, previously unknown remains survive.

A previous magnetometer (fluxgate gradiometer) survey (Cranfield University 2011) carried out in advance of the construction of Hall Water Reservoir and Water Treatment Works, covered approximately 74 hectares either side of the A1133 north of North Clifton. Fields surveyed as part of these works included areas within the present site corresponding to WE3_B, C, WE6_A, C, WE8_A and partially within WE2_D, E and I, surrounding the Scheduled Monument of the vexillation fortress (1003608). The earlier survey identified widespread ridge and furrow, potential Iron Age enclosures east of the A1133 as well as with several possible kilns or ovens west of the A1133 and various natural/geological effects. This survey and another gradiometer survey 300m north of the GSA (WO1_B) east of Newton on Trent (PCA 2000), which produced results indicating the presence of possible archaeological features, have demonstrated that the methodology employed during the current survey would be appropriate for the detection of possible archaeological remains, if present, across the current site.

3 AIMS, METHODOLOGY & PRESENTATION

The general aim of the geophysical survey was to provide enough information to corroborate, identify and characterise sub-surface anomalies that may have an archaeological origin, including defining the spatial limits of already known or suspected heritage assets, within the site RLB. This information will form part of a much larger body of evidence from a variety of sources that, taken as a whole, will enable an assessment to be made of the impact of the proposed development on any sub-surface archaeological remains, where present and therefore help determine an appropriate mitigation strategy.

The specific archaeological objectives of the geophysical survey were:

- › to gather enough information to inform the extent, condition, character, and date (as far as circumstances permit) of any archaeological features and deposits within the site;
- › to obtain information that will contribute to an evaluation of the significance of the proposed development upon cultural heritage assets; and
- › to prepare a fully illustrated report on the results of the survey that is compliant with all relevant standards, guidance, and good practice.



ILLUS 6 CR7_A, looking east

3.1 MAGNETOMETER SURVEY

It is acknowledged that magnetometry has limitations and that certain types of sub-surface remains may, under certain circumstances, be more likely to be identified by other survey techniques such as earth resistance, ground penetrating radar (GPR) or electro-magnetic (EM) methods which measure different geophysical properties. However, magnetometry was the best general-purpose methodology for assessing the site given the sub-surface remains most likely to be encountered, and the size and aims of the project.

3.2 METHODOLOGY

Magnetic survey methods rely on the ability of a variety of instruments to measure very small magnetic fields associated with buried archaeological remains. A feature such as a ditch, pit or kiln can act like a small magnet, or series of magnets, that produce distortions (anomalies) in the earth's magnetic field. In mapping these slight variations, detailed plans of sites can be obtained as buried features often produce reasonably characteristic anomaly shapes and strengths (Gaffney & Gater 2003). Further information on soil magnetism and the interpretation of magnetic anomalies is provided in Appendix 1.

The surveys were undertaken using three types of fluxgate gradiometer sensors in both hand carried and ATV towed configurations.

Hand carried survey was predominantly undertaken using four Bartington Grad601 sensors mounted at 1m intervals (1m traverse interval) onto a rigid carrying frame. The system was programmed

to take readings at a frequency of 10Hz (allowing for a 10–15cm sample interval) on roaming traverses (swaths) 4m apart. These readings were stored on an external weatherproof laptop and later downloaded for processing and interpretation. The system was linked to a Trimble R12 Real Time Kinetic (RTK) differential Global Positioning System (dGPS) outputting in NMEA mode to ensure a high positional accuracy for each data point. MLGrad601 and MultiGrad601 (Geomar Software Inc.) software was used to collect and export the data.

Hand carried and cart-based ATV towed survey was undertaken using four and five sensor arrays deploying Sensys FGM650/10 sensors mounted at 1m intervals (1m traverse interval) onto a rigid frame. The system was programmed to take readings at a frequency of 100Hz (allowing for a 1–2cm sample interval) on roaming traverses (swaths) 4m apart. These readings were stored on an external weatherproof laptop and later downloaded for processing and interpretation. The system was linked to a Leica GS18 Real Time Kinetic (RTK) differential Global Positioning System (dGPS) outputting in NMEA mode to ensure a high positional accuracy for each data point. MonMX (Sensys Ltd) software was used to collect and export the data.

ATV towed survey was also undertaken using five Foerster Ferex 4.035 sensors mounted at 1m intervals (1m traverse interval) on a wheeled non-magnetic cart. The system was programmed to take readings at a frequency of 300Hz (allowing for a 10–15cm sample interval) on roaming traverses (swaths) 5m apart. These readings were stored on an external weatherproof laptop and



ILLUS 7 EH2_B, looking ENE

later downloaded for processing and interpretation. The system was linked to a Trimble R12 Real Time Kinetic (RTK) differential Global Positioning System (dGPS) outputting in NMEA mode to ensure a high positional accuracy for each data point. DATAMONITOR 4 (Institut Dr. Foerster GmbH & Co. KG) software was used to collect and export the data.

Anomaly GeoSurvey v1.12.8 software package (© 2018 Robbie Austrums) was used to process and export all of the data plots from each survey system. Subsequent data interpretation and illustration work was all undertaken using QGIS v 3.34.6-Prizren.

An overall location plan of the site RLB is presented at a scale of 1:50,000 in Illus 1. Due to the size and geographic spread of the site, it has been split into six Sectors from west to east and from north to south. An overall illustration detailing the location of these six Sectors is shown at a scale of 1:30,000 in Illus 9 and Illus 10. Fully processed greyscale data plots and corresponding interpretation plans for each of the six Sectors are shown at a scale 1:10,000 in Illus 11 to Illus 28 inclusive. The survey data is shown in fully processed (greyscale) format, minimally processed (XY trace plot) format with accompanying interpretation plots at 1:2,500 across Illustrations 29 to 211 inclusive. Individual fields are referred to using nomenclature provided to Headland Archaeology by One Earth Solar Ltd.

Technical information on the equipment used, data processing and magnetometer survey methodology is given in Appendix 1. Details of the survey location information are in Appendix 2. A note on the format of the geophysical data archive is present in Appendix 3. Data processing details for the magnetometer survey are presented in Appendix 4. The OASIS Archive entry is included as Appendix 5.

The survey methodology, report and any recommendations comply with guidelines outlined by Europae Archaeologia Consilium (EAC 2016) and by the Chartered Institute for Archaeologists (CIfA 2020).

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The illustrations in this report have been produced following analysis of the data in 'raw' (minimally processed) and processed formats (see above) and over a range of different display levels. All illustrations are presented to display and interpret the data from this site to best effect based on the experience and knowledge of Headland management and reporting staff.



ILLUS 8 WE7_A (unsuitable for survey), looking east

4 RESULTS

Obviously non-archaeological anomalies, such as those caused by recent agricultural or modern activity and geological variation are described by category under their respective generic headings relating to their cause in Sections 4.2 to 4.4 inclusive. These anomalies are not described individually or commented or referenced in Table 1 unless they clearly correlate with extant features, such as electricity pylons and overhead wires, or are recorded on first edition or other map sources, such as former boundaries, quarries and ponds, or have an impact or effect on the visibility of other anomalies of archaeological potential (pylons and overhead cables).

The anomalies described in Table 1 are those interpreted as of archaeological origin (possible and probable) or uncertain origin. Anomalies caused by ridge and furrow cultivation are also considered to be of archaeological interest and are therefore also referenced in Table 1 wherever they have been recorded.

In Table 1 (Column 2) anomalies are classified as either possibly archaeological (yes?) or probably archaeological (yes). For the purposes of this report ridge and furrow cultivation is also considered to be of archaeological interest and so is also classified (yes). An uncertain classification is preferred where anomalies which could possibly be archaeological have been recorded and these are classified as (yes?).

Within each Overview window fields have been grouped based on their geographic proximity for presentational and organisational reasons. Many of the broader geological anomalies extend beyond

the modern field boundary limits and therefore grouping of fields was required to best describe and define the characteristics of these features. The list of associated archaeological assets (from the Nottinghamshire and Lincolnshire Historic Environment Records) included in the Table 1 is not exhaustive and only includes those assets within or immediately adjacent to those fields which have been surveyed.

During the course of the survey the site RLB was amended. This meant that some fields/areas which had already been surveyed have effectively been descoped as they are now outside the revised RLB. Most notably this included the fields containing the Scheduled Monuments of Whimpton Moor medieval village and moated site (List Entry Number 1017567) (SP1_A) and Roman vexillation fortress and Royal Observer Corps monitoring post (List Entry Number 1003608) (WE2_D-H inclusive). Although these sites, or parts of sites are no longer included within the new scheme RLB the data has been presented and they have been described in Table 1 to ensure due diligence and public dissemination of new archaeological data.

4.1 SITE CONDITIONS

Magnetometer survey is generally recommended over any sedimentary bedrock but the average response on mudstone geologies can be poor with variable results depending on the presence of overlying superficial deposits, as mapped here (English Heritage 2008; Table 4). Despite this generality, the geology has largely proved receptive to magnetometer survey in this instance (discussed below) and magnetometry was consequently still

considered the most appropriate non-intrusive geophysical technique for evaluating the site, taking account of the limitations noted in Section 3.2 and above.

The fieldwork programme almost spanned a calendar year providing a wide variety of weather and ground conditions. The early survey programme was affected by flooding around the River Trent and several parcels contain gaps in data due to waterlogged fields (BR1_C, CR9_E, CR9_F, WAC1_H, WO1_A and WO1_E). Several other areas remained overgrown or under crop for the duration of the fieldwork (DHG2_C east, WAT4_A and WAP3_A).

Where survey was undertaken surface conditions ranged from adequate to good and consequently data quality was also mostly generally good with only minimal post-processing required. Some individual parcels were surveyed in sub-optimal conditions, such as WACP4_A which contained a maize crop and CR9_E and CR9_F which were very heavy underfoot after prolonged periods of rain which did affect data quality. The proximity of electricity pylons and low hanging overhead cables also caused localised problems.

Against a generally homogenous magnetic background (except for adjacent to the River Trent), anomalies of clear archaeological potential, agricultural, modern and to a lesser extent natural causes, have been recorded. The detection of a range of magnetic anomalies confirms that there was broadly sufficient magnetic contrast, for the detection of potentially archaeological features, notwithstanding the limitations of magnetometer survey to identify the types, sizes, and period of archaeological features as described in Section 3.2 and keeping in mind the generally average to poor response to magnetometer survey on the prevailing mudstone geology. The results of the survey therefore are considered to likely provide a reasonably good indication of the archaeological potential of the site.

4.2 ANOMALIES OF FERROUS AND MODERN ORIGIN

Ferrous anomalies, characterised as individual 'spikes', are typically caused by ferrous (magnetic) material, either on the ground surface or in the plough-soil. Little importance is normally given to such anomalies, unless there is any supporting evidence for an archaeological interpretation, as modern ferrous debris is common on most sites, often being introduced into the topsoil during manuring or tipping/infilling. There is no obvious clustering or pattern to suggest anything other than a random distribution of ferrous debris in the plough-soil across the site.

Linear dipolar anomalies are also ubiquitous across the site being indicative of sub-surface pipes, drains or services.

Bands or small areas of magnetic disturbance are recorded in various locations along field boundaries and are likely a result of the accumulation of ferrous debris around field margins or to ferrous material in the boundary itself.

Other larger areas of disturbance are due to infilled former features such as extraction pits and ponds, proximity to electricity pylons and other modern infrastructure. Where areas of disturbance correlate with former features recorded on historic maps, they are described in Table 1.

4.3 ANOMALIES OF AGRICULTURAL ORIGIN

Not unexpectedly given the size of the site many field boundaries have been removed over the last 150 years as hedges were grubbed out and ditches filled in to create larger fields that could be more efficiently farmed. Many of these former boundaries have been recorded as linear trends in the data.

Linear anomalies interpreted as field drains have been recorded in several fields.

Linear trends in the data parallel with or orthogonal to the current field boundaries are indicative of modern cultivation.

4.4 ANOMALIES OF GEOLOGICAL ORIGIN

Not unexpectedly geological anomalies are common in several parts of the site largely reflecting natural variations in the upper soil horizons from changes in superficial deposits (windblown sand, sands and gravels, till and alluvium) and different pedologies (naturally wet very acid sandy and loamy soils, slightly acid loamy and clayey soils with impeded drainage and loamy and clayey floodplain soils with naturally high groundwater).

The geological variations are not discussed in great detail below except where their presence might impact on the interpretation of other anomalies/features of uncertain or possible archaeological origin. One such area includes an irregular pattern of low magnitude linear anomalies identified in an area of no mapped superficial deposits in fields comprising WE3 and WE6. These anomalies occur in the location of a concentration of archaeological features adjacent to Southmoor Lane but are thought to be natural in origin defining a spread of periglacial effects rather than ditch-like features of archaeological potential.

TABLE 1 Description of results

FIELD	ARCHAEOLOGICAL ANOMALIES	ASSOCIATED ARCHAEOLOGICAL HER ASSETS AND EVENTS IN/ ADJACENT RLB LIMITS	SURVEY INTERPRETATION
SECTOR 1 ILLUS 11–13 AND ILLUS 29–70			
STJ1_A, STJ1_C, STJ1_H, STJ1_I, STJ1_J (Illus 35–37, 47–52 and 62–64)		MNT6150 MNT26142	<p>These fields located along the north-west fringe of the site are grouped together as they all exhibit a much more variable magnetic background indicative of the spreading of ‘green waste’ as a soil improver. Although this has had a detrimental effect on the data, by introducing magnetic ‘noise’ creating a more variable magnetic background, it is argued not to be of a density or magnitude to entirely preclude the identification of anomalies of possible archaeological potential.</p> <p>The western half of a rectangular enclosure approximately 60m x 75m is recorded at the intersection of parcels STJ1_I, STJ1_J and STJ1_K (Illus 50–52). The anomaly response is less clear within these parcels due to likely effect of ‘green waste’ and also due to the presence of a buried service that heads north to Far Hill Farm Barn (MNT26142).</p> <p>A very faint partial circular anomaly approximately 16m in diameter and tentatively interpreted as a possible ring ditch, is also recorded within STJ1_I approximately 150m west of the rectangular enclosure at the south-east corner of the field (Illus 50–52).</p> <p>Traces of ridge and furrow cultivation aligned north to south in STJ1_C. No anomalies of archaeological potential have been recorded in fields STJ1_A and STJ1_C adjacent to earthworks (MNT6150) recorded in the HER at Darlton or STJ1_H.</p>
STJ1_B, STJ1_D and STJ1_E (Illus 38–40 and 50–52)	Yes?	1017567	<p>Low magnitude ditch-like anomalies that mark a continuation of a trackway and enclosure features associated with Whimpton deserted medieval village (1017567) recorded in adjacent SP1_A, are mapped extending approximately 150m west into STJ1_B (Illus 38–40). A more confident interpretation of these features is restricted however by ridge and furrow cultivation aligned north to south which truncates these archaeological features. The survey has likely identified the western extent of anomalies associated with the medieval site as constrained to the south-east corner of STJ1_B, although traces of ridge and furrow are recorded across the field.</p>
	Yes		<p>A small cluster of low magnitude linear and curvilinear anomalies at the northern end of STJ1_D (Illus 38–40) likely identify a pattern of three or more adjoining archaeological enclosures with a trackway to the south and west, aligned roughly on a north/south/east/west axis. The anomalies are clearly defined against a relatively homogenous magnetic background and could extend south-east into neighbouring STJ1_E. It is not clear whether these anomalies are associated with the deserted medieval village (List Entry Number 1017567) recorded 150m to the north-east in SP1_A. No anomalies of archaeological potential are recorded in the southern part of STJ1_D.</p>
SP1_A (Illus 38–40)	Yes	1017567 MNT15307 MNT4584 ENT120 ENT2181	<p>This area no longer falls within the revised RLB</p> <p>This field includes corresponds to the Scheduled area of Whimpton Moor medieval village and moated site (1017567) located immediately south of the A57. There is generally a good correlation between linear and curvilinear ditch-like anomalies recorded by the survey and transcribed cropmark data which gives a good indication of the overall plan of the village. The settlement is aligned at right angles and on the north side of a probable trackway aligned ENE to WSW across the field (SP1_A). The trackway extends west into STJ1_B but is not recorded in SP1_B to the east. The survey has added relatively little additional detail to the cropmark transcription with the exception of a few discrete pit-like anomalies and two discrete responses possibly identifying localised burning. Ridge and furrow cultivation is identified south of the trackway crossing the field.</p> <p>The survey has probably defined the extent of the deserted medieval village which is confined to SP1_A and the eastern part of STJ1_B. An association with the small cluster of enclosures and ditches which share an alignment at the northern end of STJ1_D, 160m away to the south-west cannot be dismissed.</p>
SP1_B (Illus 29–34, 41–46 and 53–55)	Yes?	1017567 MNT15326 MNT26615 MNT15978	<p>This large field (60 hectares) is largely devoid of archaeological anomalies, with the exception of parts of two possible enclosures recorded at the north-east corner of the field (Illus 32–34 and Illus 44–46) and traces of multiple alignments of ridge and furrow cultivation. A large strongly magnetically enhanced vaguely rectilinear anomaly, centre north in the field is of uncertain origin, though is considered most likely to locate a modern brick kiln inaccurately recorded in the HER 100m further to the east (Illus 29–31).</p> <p>Low magnitude linear and curvilinear anomalies locate a trackway shown on historic mapping. Spreads of magnetic disturbance record the former location of a now infilled pond and former structure at the south-eastern limits to the field.</p>

FIELD	ARCHAEOLOGICAL ANOMALIES	ASSOCIATED ARCHAEOLOGICAL HER ASSETS AND EVENTS IN/ ADJACENT RLB LIMITS	SURVEY INTERPRETATION
STJ1_F, STJ1_G and STJ1_M-P (Illus 38–43, 50–55 and 62–67)	Yes	MNT26143	Findings either side of Farhill Lane are limited to ridge and furrow cultivation.
DHG2_A-C north (Illus 59–67)	Yes	MNT6701	Two small clusters of ditches and enclosure are recorded at the western and south-western boundary of the field at NGR 478975 372325 and NGR 479100 371925 respectively. The survey does not record much detail beyond the basic plan of the ditches and enclosures, though the southernmost cluster may contain a ring ditch (See Sector 4 for DHG2_C south, Illus 137–139). No heritage assets were previously identified in these locations.
	Yes		In addition, a linear trend correlates with the recorded location of an earthwork bank (MNT6701) at the northern edge of the field. Other anomalies locate patterns of land drains, former field boundaries, a buried service and modern ploughing trends. The easternmost part of this field was overgrown and unsuitable for survey.
SP2_A-D, SP3_A (Illus 44–46 and 56–58)	Yes	MNT15374 MNT46914	This group of fields covers a large area of Roman activity recorded on the HER as MNT15374 (possible settlement) and MNT46914 (cropmark complex).
	Yes?		Clusters of low-magnitude, regular, linear trend anomalies interpreted as ditches forming adjoining enclosures and which likely define areas of settlement activity are mapped in three locations; the south-eastern corners of SP3_A, SP2_D and SP2_A/SP2_E respectively (Illus 56–58), see also Sector 2 for SP2_E Illus 86–88). The concentration of features in SP2_A/SP2_E corresponds to the possible Roman settlement (MNT15374) and a cropmark complex (MNT46914) recorded in the HER. It is evident from the data that the archaeological activity possibly extends as far south as the enclosures identified in BR1_E and in field SP2_D to the north.
			In SP2_B the survey has identified a series of parallel and perpendicular ditch-like anomalies roughly aligned north-northeast to south-southwest and east-southeast to west-northwest that possibly form a rectilinear enclosure, or series of enclosures. The regular morphology of these anomalies and the proximity (175m) to possible Roman settlement (MNT15374) makes an archaeological cause likely. The resolution of the potentially archaeological anomalies across this field (and to a lesser extent SP2_D and SP3_A) is somewhat reduced due to an amorphous spread of magnetic disturbance indicative of modern activity. A former field boundary recorded as a high magnitude linear anomaly, aligned east to west, is also recorded.
			Analysis of historic mapping shows a former pond in the northern part of the field and a path also previously crossed the parcel linking Chestnut Farm (outside the site) to the south-east corner of field SP2_B. The magnetic disturbance probably results from the spreading of modern material associated with these features through modern agricultural practice and is not assessed as of any archaeological potential.
PL1, BR1_A-E west (Illus 44–46, 56–58 and 68–70)	Yes	MNT15374	The archaeological activity identified at the southern boundary of SP2_A extends into the north-east corner of adjoining field PL1 (Illus 56–58). However, the survey has likely recorded the extent of this activity and consequently the archaeological potential of the rest of the field is assessed as low.
	Yes		A spread of magnetic disturbance correlating with the location of former structure shown on historic mapping has also been recorded.
			Ridge and furrow cultivation aligned north to south across BR1_B. No anomalies of archaeological potential have been recorded in BR1_A, BR1_B, BR1_E west and PL1 south.
			BR1_C was waterlogged and unsuitable for survey at the original attempt to survey. Widespread interference from overhead lines in adjacent BR1_E was determined to negate revisiting the area.

[illegible]

FIELD	ARCHAEOLOGICAL ANOMALIES	ASSOCIATED ARCHAEOLOGICAL HER ASSETS AND EVENTS IN/ ADJACENT RLB LIMITS	SURVEY INTERPRETATION
CR2_B, CR2_D and WE8_A (Illus 92–94 and 104–106)	Yes	MLI99362 MLI50546 MLI52576 MLI52577 MLI52578 MLI99362 MLI125733 MNT864 MNT10549 MNT10550	Survey within adjacent parcels CR2_B and CR2_D, located in an area of high archaeological potential identified by the HER, has confirmed the presence of a likely settlement site comprising a series of enclosures and ditches aligned north to south contained predominantly within CR2_D but possibly extending into the easternmost part of CR2_B, centred at NGR 482600 372550. High magnitude discrete anomalies located within some of the enclosures are of a form and magnitude that suggest sites of possible localised burning. Two parallel linear anomalies extending to the east from the enclosures towards the field boundary could be ditches although they are on the same alignment as modern ploughing trends also recorded across the field. These features are very likely to be associated with the various multi-period prehistoric assets recorded in the HER (MLI52576, MNT4689, MLI52577, MNT8643, MLI52578, MNT864) identified from a dense concentration of flint scatters (MNT10550) and a Late Neolithic/Early-Bronze Age pit (MNT10549) recovered from fieldwalking and during excavations in the 1970s and 1980s respectively. Four isolated discrete high magnitude anomalies located towards the northern and eastern field boundaries are of uncertain origin. Their magnetic signature is indicative of an anthropogenic cause and proximity to the archaeological activity is noteworthy, but an agricultural or modern cause is considered to be most likely.
	Yes		Despite the high archaeological potential of this area the survey findings from WE8_E are limited to east to west aligned traces of ridge and furrow.
WE3_A-C (Illus 83–85 and 95–97)	Yes	MLI52579 MLI52581	WE3_A is no longer included in the revised RLB. Only traces of ridge and furrow cultivation have been recorded in this field.
	Yes	MLI99028	Survey across adjacent parcels WE3_B and WE3_C has recorded further archaeological settlement activity west of Southmoor Lane that is likely associated with cropmarks that record a series of enclosures, ditches and possible trackway (MLI52579) across fields WE3_B, WE3_C, WE4_A, WE4_D, WO1_G and PR1. The settlement activity comprises a series of appended enclosures and ditches aligned broadly north to south, centred at NGR 483525 373355, in field WE3_C. The settlement activity almost certainly extends southwards into field PR1 (which is not being surveyed) and into the north-east corner of field WE6_B. It is not clear whether a ditch-like anomaly links this activity further south still to elongated enclosures spanning several more fields immediately adjacent to Northfield Lane and Southmoor Lane (WAC1_B, WAC1_D, WACP5_A, WAP2_A and CR3_B; Illus 107–109). The northern extent of this activity does not appear to extend into WE3_A.
	Yes		A ring ditch, approximately 13m in diameter, has been identified towards the south-east corner of WE3_B as has an isolated sub-rectangular enclosure, 30m x 45m, approximately 250m west of the settlement activity centred in WE3_C. Faint linear, ditch-like anomalies aligned north-west to south-east at the western extent of WE3_B and WE3_C have been interpreted as possibly archaeological in origin. However, it remains undetermined from the survey data alone whether they are related to the settlement activity located 350m to the east. Geological effects causing an irregular patterned magnetic background cover large parts of these parcels and complicate the interpretation of the data. The western limits of the settlement activity blur into these geological effects, and it is therefore difficult to differentiate between anomalies of geological and possible archaeological origin. This could suggest that the area of archaeological activity is more extensive than can be determined from the data. A service pipe extends across the western limits of WE3_B and WE3_C from the Anglian Water compound to the bend in the road on the A1133 adjacent WE3_B.
WE4_A-D and WO1_G west (Illus 82–85 and 95–97)		MLI52579 MLI52581	Cropmarks recorded in the HER extending north-east of Southmoor Lane into fields WE4_A, WE4_D, WO1_G have not been identified in the data. The most likely reason for this is due to a change in overlying superficial deposits which broadly coincides with the line of the lane, with sand and gravel recorded on the eastern side of the road and an absence of deposits to the west.
PR1 (Illus 95–97)	n/a	MLI52579 MLI52581 MLI99028	The cropping regime did not allow for survey within this parcel. This field is being evaluated through trenching.

FIELD	ARCHAEOLOGICAL ANOMALIES	ASSOCIATED ARCHAEOLOGICAL HER ASSETS AND EVENTS IN/ ADJACENT RLB LIMITS	SURVEY INTERPRETATION
WE6_A-D, CR3_A-B, WAC1_A-B, D, WACP5_A and WAP2_A (Illus 95–97 and 107–109)	Yes Yes?	MLI99231 MLI99027 MLI99028 MNT25856	<p>Settlement activity concentrated in WE3_C to the north, extends south into the north-east corner of WE6_B where an enclosure and neighbouring ditches have been recorded (Illus 95–97). It is unclear whether a ditch-like anomaly extending south from the apparent southern extent of this settlement activity, links to more clearly defined elongated enclosures spanning several more fields immediately adjacent to line Northfield Lane and Southmoor Lane (WAC1_B, WAC1_D, WACP5_A, WAP2_A and CR3_B; Illus 107–109), forming a possible continuous line of activity from WE3_B in the north to WAP2_A and Mill Lane in the south.</p> <p>Other anomalies of note recorded within or adjacent to these elongated enclosures comprise a possible pit alignment in WAC1_A and a circular anomaly very tentatively identified as a ring ditch in WAP2_A.</p> <p>A large square area of magnetic disturbance covering 3ha in the north-western corner of WE6_A immediately east of the A1133 and south of the Anglian Water compound is due to modern material incorporated into the topsoil during the remediation of a former compound and which is visible on satellite imagery between 2013 and 2015. The concentration and magnitude of responses precludes the identification of any possible archaeological features (if present) although it is possible that such features could survive below the modern debris.</p> <p>Traces of ridge and furrow cultivation are widespread across the WE6 parcels. A single linear anomaly of uncertain origin, aligned north to south, is recorded in the eastern part of WE6_A.</p> <p>To the east of this spread across both fields WE6_A and WE6_C is a complex arrangement of irregular linear and sinuous, low magnitude anomalies of natural origin. The anomalies extend across the adjacent fields to the east and interpreted as possible periglacial effects.</p>
SECTOR 3 ILLUS 17-19 AND ILLUS 110-136			
W01_A-I, R, WE5_A, WE7_A-F, WE9_A-B, WAR1, CR5_A-D, WAC1_C-F, H, WACP6_A and WACP7_A (Illus 113–118, 122–127 and 131–136)		MLI50099 MLI50640 MLI54251 MLI52595 MNT4647 MNT4648 MLI52588 MLI99026	<p>No anomalies of archaeological potential have been identified in this large area covering fields in the north-eastern part of the GSA east of Southmoor Lane and west of Road Wood. Findings of the survey are limited to anomalies almost exclusively of agricultural, natural and modern origin. Broad spreads of amorphous discrete responses, particularly in fields WAR1, W01_A and parts of CR5_C-D and WE7_E-F are likely natural in origin and loosely correlate to a spread of alluvium following the course of a ditch linking these parcels.</p> <p>In several areas in these parcels (CR5_D, W01_R, WE7_C-D and W01_E) the survey has not identified any anomalies of possible archaeological potential where heritage assets, predominantly cropmarks, have been recorded on the HER. The location of these assets all correlates with spreads of overlying superficial sand and gravel deposits. It is unclear whether there is a visibility bias in the detection of archaeological features across these deposits. The survey has clearly mapped archaeological features across the same geological and pedological conditions west of the River Trent south-east of Ragnall. Consequently, the archaeological potential of these areas with multiple HER assets (cropmarks) but no corresponding magnetic anomalies is undetermined.</p> <p>WE9_B and WAC1_E are no longer included in the revised RLB.</p> <p>A curving ditch-like anomaly of possible archaeological origin and a neighbouring high magnitude discrete response of uncertain origin have been recorded in WAC1_E.</p>
CR7_A-B (Illus 110–112 and 116–121)	Yes	MLI50099 MLI50640 MLI54251	A small focus of archaeological activity comprising ditches and enclosures has been recorded at the eastern boundary of CR7_A at NGR 485475 373900. A small cluster of adjoining regular enclosures appear to be appended to a parallel curving ditch anomaly, possibly representing a trackway, to the north. The archaeology is recorded in a geological pocket where no overlying superficial deposits are mapped. Elsewhere in CR7_A, ridge and furrow cultivation has been recorded on three different alignments.
CR6_B-E (Illus 119–121)	Yes?	None	<p>This area is no longer within the revised RLB.</p> <p>Survey findings were limited to two small enhanced discrete responses of uncertain origin.</p>
SECTOR 4 ILLUS 20–22 AND ILLUS 137–172			
DHG2_C south (Illus 137–139)	Yes	None	<p>A small cluster of perpendicular low magnitude ditches aligned broadly north to south and east to west, likely identify an enclosure and possible ring ditch at the southern boundary of the field close to the bend in Far Road at NGR 479100 371910. No other anomalies of archaeological potential have been recorded.</p> <p>A denser agglomeration of enclosures is recorded in DHG2_C approximately 375m to the north, though no direct association between the two groups of features can be determined.</p>

FIELD	ARCHAEOLOGICAL ANOMALIES	ASSOCIATED ARCHAEOLOGICAL HER ASSETS AND EVENTS IN/ ADJACENT RLB LIMITS	SURVEY INTERPRETATION
GHS1_A-D (Illus 146–154)	Yes	MNT4594	<p>No anomalies considered of archaeological potential have been recorded in parcels GHS1_A-C inclusive.</p> <p>A concentration of faint low magnitude linear responses likely identifies a series of archaeological ditches, a possible trackway and a pattern of enclosure aligned broadly north to south and east to west towards the centre of the field at NGR 478900 371000. Three or four rectangular enclosures have been recorded although the responses are of very low magnitude, and it is unclear whether collectively they identify a small settlement site. The anomalies are approximately 115m south-east of a stone axe head findspot (MNT4594) though no direct association is assumed. Ridge and furrow cultivation, aligned east to west is also recorded across the field. A small cluster of discrete responses mark the location of a former pond recorded on historic mapping close to the north-west corner of the field.</p>
STD1_A-C and DHG1_A, C west (Illus 140–145 and 152–157)	Yes	MNT5794 MNT5795 MNT8764	<p>An irregular shaped linear anomaly and two patches of magnetic disturbance record the location of a former field boundary, and two ponds recorded on historic mapping in ST1_A.</p> <p>A single very low magnitude possible square enclosure approximately 19m in diameter is recorded immediately north-west of the northernmost pylon in DHG1_C. It marks the only finding of possible archaeological potential within STD1_B, C, DHG1_A and C (west).</p> <p>A broad linear spread of magnetic interference crosses DHG1_A into the north-west corner of DHG1_C in the location under overhead cables. A second spread of interference caused by low slung overhead cables is recorded across the south-west corner of DHG1_C.</p>
DHG3_A (Illus 152–156 and 161–166)	Yes	None	Very faint perpendicular ditch-like anomalies located west of centre in the field possibly identify a small enclosure or enclosures, centred at NGR 479520 370700.
GHS1_E, G, H (Illus 158–172)	Yes?	MNT25791 MNT9910 MNT15325 MNT4295	<p>A row of pylons carrying a low-slung overhead cables crosses the southern half of parcels GHS1_E and H. The saturating effect of the pylons has created a large halo of magnetic disturbance around them obscuring any meaningful data. The overhead cable is recorded in the data as a broad linear spread of magnetic interference that is not of a density to preclude the identification of weak anomalies of possible archaeological potential. A small cluster of such anomalies, possibly recording ditch-like anomalies forming an enclosure is recorded towards the south-east corner of GHS1_E and are the only anomalies from these parcels of possible archaeological origin.</p> <p>A magnetically enhanced discrete response of uncertain origin that stands out against the homogenous magnetic background, has been recorded at the north of GHS1_H. The anomaly lies approximately 85m east-southeast of modern brick kiln (MNR15325). However, the anomaly response does not appear to be of sufficient magnitude and signature to be caused by a kiln that would typically exhibit higher levels of magnetic enhancement.</p> <p>No anomalies that could relate to the shrunken medieval to post-medieval village of Skegby (MNT25791) which lies immediately west of GHS1_G have been recorded.</p>
SECTOR 5 ILLUS 23–25 AND ILLUS 173–199			
DHG1_C (east) Illus 173–175)	Yes	MNT25308	A rectilinear enclosure and cluster of magnetically enhanced discrete responses has been recorded at the south-east corner of the field. The responses in this part of the field are difficult to interpret due to cultivation effects and the spread of magnetically enhanced discrete response in the same location. It is unclear whether an adjacent circular arrangement of discrete pit-like responses approximately 20m in diameter represents a unified feature or a coincidental arrangement of anomalies at the field edge.
LP1 Area_C, WAT1_A-B, WACP1_A-B and WACP2_A (Illus 176–181 and 185–187)	Yes	MNT25308 MNT7782 ENT2288	<p>This area is no longer within the revised RLB.</p> <p>Only traces of ridge and furrow cultivation in WACP1_A-B and WACP2_A and a single ditch-like anomaly and linear trends of uncertain but likely agricultural origin also within WACP2_A have been recorded.</p>
EH1_A, EH3_A and CR8_A (Illus 179–181, 188–190 and 194–196)	Yes	MNT4692	<p>This area is no longer within the revised RLB.</p> <p>A sub-rectangular enclosure, ring ditch and other ditch-like linear anomalies are tentatively interpreted against a variable magnetic background in CR8_A. A nearby linear arrangement of strongly enhanced discrete responses in the north-east corner of the field are of uncertain origin. It is not clear whether these responses may be associated with heritage asset MNT4692 approximately 100m to the south.</p> <p>Traces of ridge and furrow cultivation are noted in all three fields though no other anomalies considered of archaeological potential are recorded in EH1_A or EH3_A.</p>

FIELD	ARCHAEOLOGICAL ANOMALIES	ASSOCIATED ARCHAEOLOGICAL HER ASSETS AND EVENTS IN/ ADJACENT RLB LIMITS	SURVEY INTERPRETATION
WACP3_B-C, WACP4_A-B, WAT2_A, WAT3_A, WAT4_A, WAP3_A and WACP8_A (Illus 179–184)	Yes Yes	MNT26709 MNT25856	Findings across WACP3_B-C, which are bound to the south by the former route of the Lancashire & East Coast railway (now Skellingthorpe Walk), are limited to traces of ridge and furrow cultivation aligned east to west, linear trends recording the line of former boundaries and an oval spread of magnetic disturbance at the south-east corner that records the location of an infilled sand pit recorded on historic mapping. Traces of ridge and furrow cultivation on two separate alignments is recorded more clearly east of the A1133 in WAT3_B. No trace of the continuation of a possible oval enclosure recorded in WAT5_A is recorded on the opposing north side of Skellingthorpe Walk in WAT3_A. No anomalies indicative of a settlement recorded in WACP4_B (MNT25856), approximately 115m south of the southern extent of elongated enclosures recorded off Northfield and Southmoor Lanes, have been recorded. No survey was undertaken in WAT4_A or WAP3_A/WACP8_A which were either overgrown or under crop for the duration of the fieldwork programme.
WAT5_A, B, C (Illus 188–193)	Yes	MNT4667 MNT4669	A semi-oval shaped enclosure approximately 42m in diameter lies at the north-eastern edge of the WAT5_A. No trace of the same feature is identified in the opposing field to the north (WAT3_A) on the other side of the former railway, though parallel linear trend anomalies of uncertain origin are recorded. No survey was undertaken in WAT5_C which was overgrown throughout the fieldwork programme.
EH2_A-H (Illus 188–199)	Yes Yes	MNT4649 MNT4667 MNT4669 MNT4692 MNT10519	The survey has mapped a series of adjoining rectilinear enclosures and ditches broadly aligned north to south and concentrated in field EH2_B, centred at NGR 483500 371150, but which continue into adjacent fields WAT5_B and EH2_F to the north and south respectively. The concentration of features in this location likely indicates settlement activity associated with non-designated heritage assets of cropmarks of enclosures and linear features (MNT4669) in field CR9_A to the east. It is unclear whether the anomalies recorded in this location are associated with a large flint assemblage including arrowheads of Neolithic and early Bronze Age date, cores, scrapers and a hammerstone (ENT139) and further clusters of enclosures and linear features identified close to the GSA within field EH2_G (MNT4667) and outside the scheme boundary, south of Moor Lane (MNT10518). However, no anomalies of note were recorded in the location of ditch and enclosure cropmarks (MNT4667) within EH2_G. Ridge and furrow cultivation has been recorded in EH2_B, E and F. A service pipe aligned north-northwest to south-southeast crosses EH2_C and G. It is not clear whether a faint curvilinear trend in EH2_C relates to a field boundary asset (MNT10519) recorded in the same location.
SECTOR 6 ILLUS 26–28 AND ILLUS 200–211			
CR9_A-K and WACP7_C south (Illus 200–211)	Yes? Yes?	MNT4668 MNT4669	The only findings of note from this large parcel of land to the north and south of Skellingthorpe Walk comprise small clusters of anomalies of uncertain origin. Very faint linear and curvilinear ditch-like responses are recorded in the north-east corner of CR9_A and across the boundary between CR9_A and B in the location of enclosures (MNT4669) and adjacent a prehistoric artefact scatter (MNT4668). The anomalies also lay 250m from small scale settlement activity recorded in EH2_B though no direct link other than their general proximity can be inferred from the data. Magnetically enhanced discrete responses of uncertain origin but with a form indicative of an anthropogenic origin are recorded close to the former railway line, now Skellingthorpe Walk, in CR9_D and E. The responses coincide with a spread of magnetically enhanced background anomalies thought to be natural in origin. It is therefore unclear whether these anomalies simply recorded the strongest examples of natural variation or are, most likely, associated with the construction of the railway in the early 20th century. The remainder of the responses from this area are of agricultural and/or natural in origin, including former field boundaries recorded on historic maps.

5 DISCUSSION & CONCLUSION

The survey has covered all the site except for some small areas that were waterlogged or contained fodder crops or bird cover. Project design changes during the survey programme resulted in several areas that had already been surveyed being de-scoped. These included Whimpton Moor medieval village and moated site (1017567) and a Roman vexillation fortress and Royal Observer Corps monitoring post (1003608), both scheduled monuments, located adjacent to the A57 and south-west of Newton on Trent respectively, as well as several fields between North and South Clifton and west of Thorney.

The survey has recorded a large number and varied range of magnetic anomalies, including those of agricultural, geological and modern origin but also archaeological origin. The anomalies have been recorded against a homogenous magnetic background ubiquitous across the site that is almost certainly derived from a relatively unresponsive underlying mudstone geology and any covering superficial deposits.

Several fields located at the north-west boundary of the GSA (STJ1_A, STJ1_C, STJ1_H, STJ1_I and STJ1_J) south-west of Darlton, have probably been spread with 'green waste' applied as a soil improver. Although this has had a detrimental effect on the data, by introducing magnetic 'noise' creating a more variable magnetic background, it is argued not to be of a density or magnitude to entirely preclude the identification of anomalies of possible archaeological potential. For example, traces of two enclosures and other faint ditch-like trends are recorded in STJ1_I and STJ1_J respectively. Field drains and agricultural trends are also visible in other areas also likely spread with this material.

By far the most prevalent features recorded by the survey are agricultural in origin, identifying regular and systematic patterns of field drains, cultivation trends (both historic ridge and furrow and modern ploughing), and former field boundaries detailed on historic mapping, which typify the local agricultural landscape.

Sinuuous anomalies and amorphous spreads of low magnitude discrete responses identify natural geological features and alluvial flood deposits are widespread within the fields adjacent to the River Trent and to a lesser extent Fledborough Beck. Similar responses indicative of former channels and/or flood deposits are recorded intermittently further to the east within landlocked fields between Hall Farm and West Wood. Further geological patterning identified as widespread interconnected irregular ditch-like responses, thought to be a result of periglacial effects, are recorded north-east of North Clifton close to the A1133 where no overlying sand and gravel superficial deposits are mapped.

Though in some instances it remains difficult to define the limits of some of the extended areas of archaeological activity the survey has recorded as many as nineteen separate locations within the revised site boundary where archaeological features are clearly identified and where the archaeological potential is considered locally high.

Isolated and smaller pockets of archaeological activity, predominantly recording small agglomerations of ditches and enclosures but identified with varying levels of clarity and interpreted confidence,

have been recorded west of the River Trent; close to the western limits of the GSA (STJ1_D,I,J,K, and DHG2_C), north of Ragnall (SP1_B), south of Fledborough Beck (DHG1_B,C) and close to the river itself (SP2_E east). East of the River Trent similar pockets of archaeological activity are recorded spread across fields adjacent to Northfield Lane and Southmoor Lane (WAC1_B, WAC1_D, WACP5_A, WAP2_A and CR3_B) and adjacent to Skellingthorpe Walk (WAT5_A).

West of the River Trent more extensive foci of archaeological activity have been identified; adjacent to Whimpton Moor medieval village and moated site (STJ1_B), south-east of Ragnall (SP2, SP3_A, BR1_E east) and off Crabtree Lane (GHS1_D). East of the river, settlement activity is recorded atop the escarpment north of North Clifton (CR2_B and D), along Southmoor Lane (WE3, WE6_B), north of Moor Lane (EH2_B, and F) and east of Roadwood Lane (CR7_A).

Clusters of vague, weakly enhanced magnetic anomalies that could identify further archaeological features such as ditches and enclosures, but which are interpreted with a lower level of confidence are identified; east of Skegby under overhead powerlines (GHS1_E), north of Polly Taylor's Road (DHG3_A), south-east of Ragnall (SP2_B), south-east of Hall Farm (WE7_B) and adjacent to Moor Lane (EH2_E).

Outside the areas of archaeological potential and not including anomalies considered of geological and/or agricultural origin, the survey findings are limited to isolated discrete responses of uncertain origin, spreads of magnetic disturbance identifying the location of former ponds, extraction sites and structures evident on historic mapping, a possible brick kiln in SP1_B, several buried service pipes and magnetic disturbance from pylon bases and overhead powerlines.

Generally, there is good correlation between the survey data and HER in locations where the HER indicated there was a high archaeological potential, such as south-east of Ragnall, on part of the escarpment overlooking the River Trent north of North Clifton, west of Southmoor Lane, and in the location of the Scheduled Monuments now outside the proposed scheme boundary. The survey has likely identified that activity associated with a Roman settlement (MNT15374) located south-east of Ragnall is more extensive than recorded in the HER possibly extending as far east as the River Trent. The easternmost traces of archaeological features here lay at the edge of clearly mapped alluvial deposits, but it remains unclear whether further archaeological features are masked by these deposits or respect the edge of the flood plain.

Where they overlap, the survey findings east of the A1133, north of North Clifton (WE3_B, C), also correlate to the findings of an earlier survey (Cranfield University 2011) which recorded ditches and widespread ridge and furrow in this location. The present survey has however mapped these anomalies in much greater detail and identified the likely associated settlement activity adjacent to Southmoor Lane which lay outside the boundary of the earlier survey.

However, in at least twelve locations where the survey has mapped archaeological anomalies, no previous information is held on the HER. Conversely, the survey has not recorded any anomalies of possible archaeological potential in several locations east of the River Trent, where heritage assets have been recorded on the

HER. These areas where there is no correlation between previously recorded assets and magnetic anomalies coincides with the presence of overlying superficial sand and gravel deposits. This includes areas north of North Clifton where dense artefact scatters and cropmarks are recorded (WE8_A, WE6_A,C), east of Southmoor Lane (WE4, WO1_D), west of West Wood (CR5_D, WO1_R), north of California Farm (WE7_C,D), south of Mill Lane (WACP4_B), south of Skellingthorpe Walk (CR9_A,B) and east of the A1133 (EH2_G).

It is unclear whether there is a visibility bias in the detection of archaeological features across the sand and gravel deposits, as the survey has clearly mapped archaeological features associated with the possible Roman settlement (MNT15374) across the same geological and pedological conditions west of the River Trent, south-east of Ragnall. Consequently, the archaeological potential of those areas containing multiple HER assets relating to cropmarks east of the River Trent, in particular east of the A1133, is uncertain, although on balance these areas are not considered likely to contain significant areas of archaeological settlement activity.

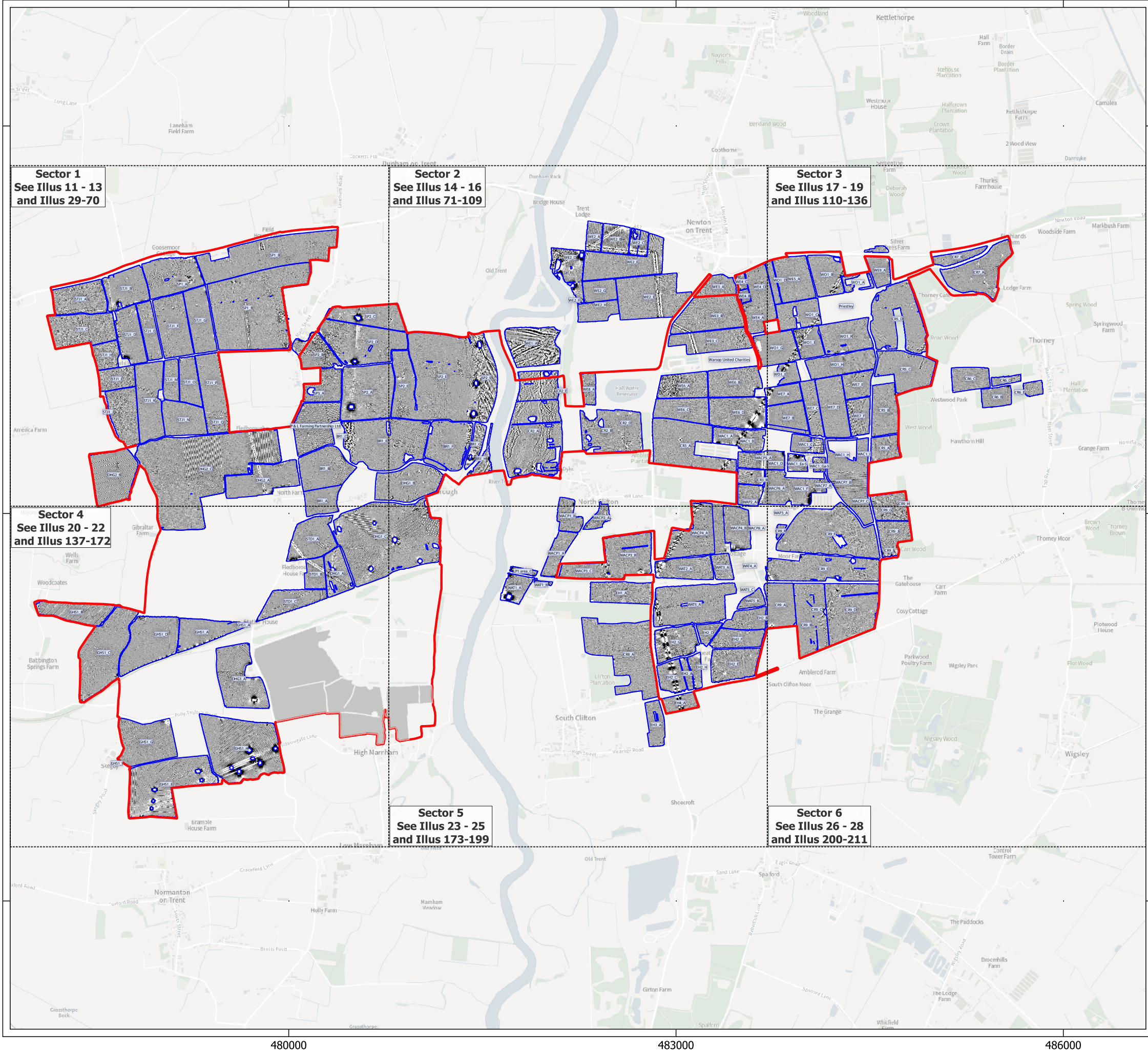
Overall, the level of detail and range of anomalies recorded is argued to provide a reasonable level of confidence in the findings and that the results accurately reflect the archaeological potential across the site having likely recorded the extent of any extensive archaeological remains, notwithstanding the limitations of magnetometer survey to identify certain types, sizes, and period of archaeological features and particularly over the prevailing geological conditions.

The results from this very large survey have undoubtedly contributed to the further understanding of the archaeological potential of the site and wider landscape.

Based on the results of the survey the archaeological potential of those areas containing clearly mapped extended and more isolated archaeological activity are considered locally high. In locations where the magnetic survey responses are too vague or ephemeral to offer a more confident interpretation but are indicative of possible archaeological activity, the archaeological potential is assessed as moderate. However, the archaeological potential of most of the site is assessed as low.

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Key

Site Boundary

Survey Extent

+2nT

-1nT

0

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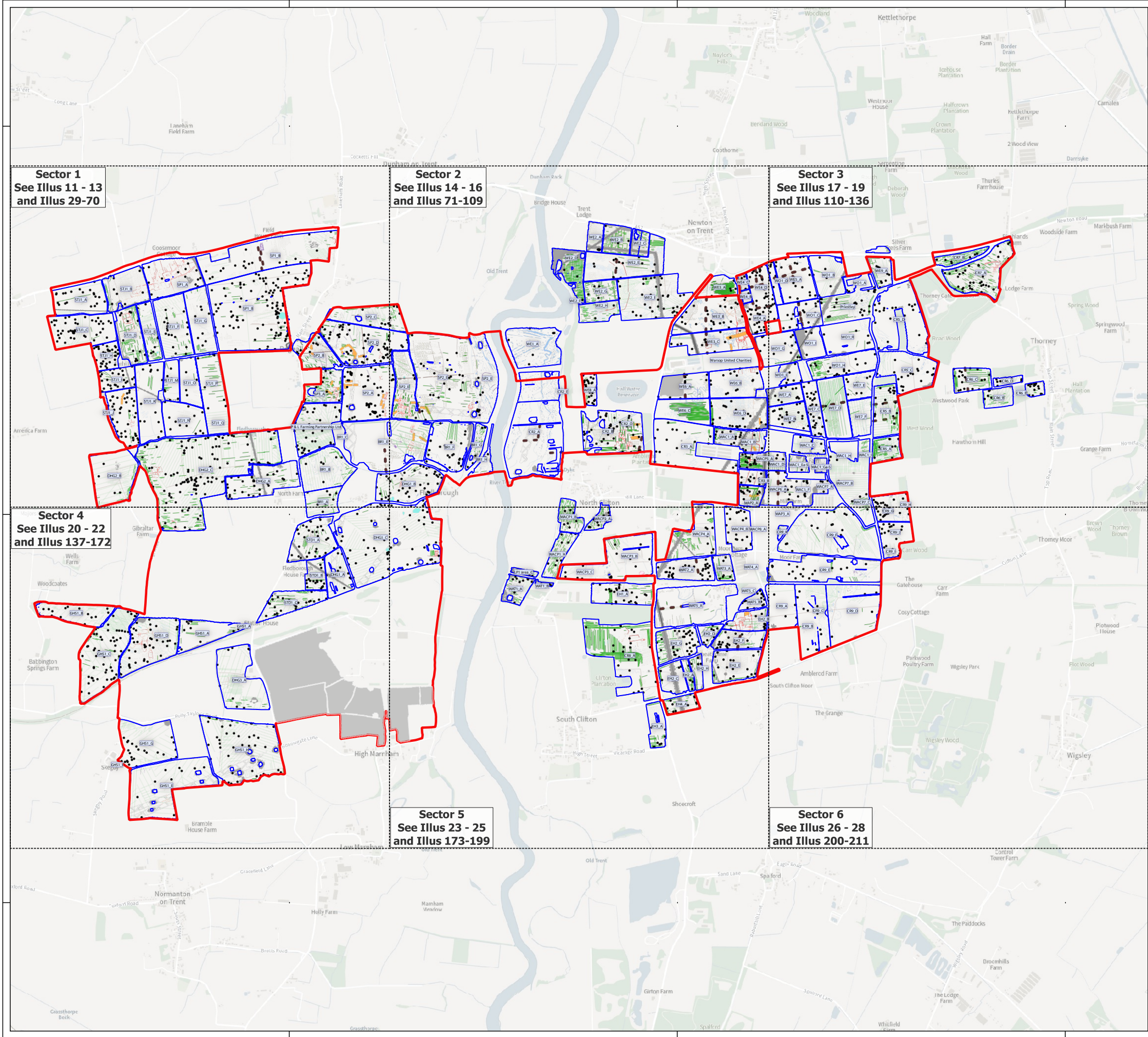
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Illus 09 - Overall greyscale plot of processed magnetometer data



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Key

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- Ferrous Objects
- Agriculture
- Field Boundary
- Possible Field Boundary
- Field Drain
- Natural
- Pipe
- Uncertain
- Ridge and Furrow
- Former Field Boundary
- Possible Archaeology
- Archaeology
- Magnetic Disturbance
- Natural
- Overhead
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- Ferrous Disturbance
- Burning?
- Former Pond
- Magnetic Disturbance Modern?
- Former Path
- Former Building

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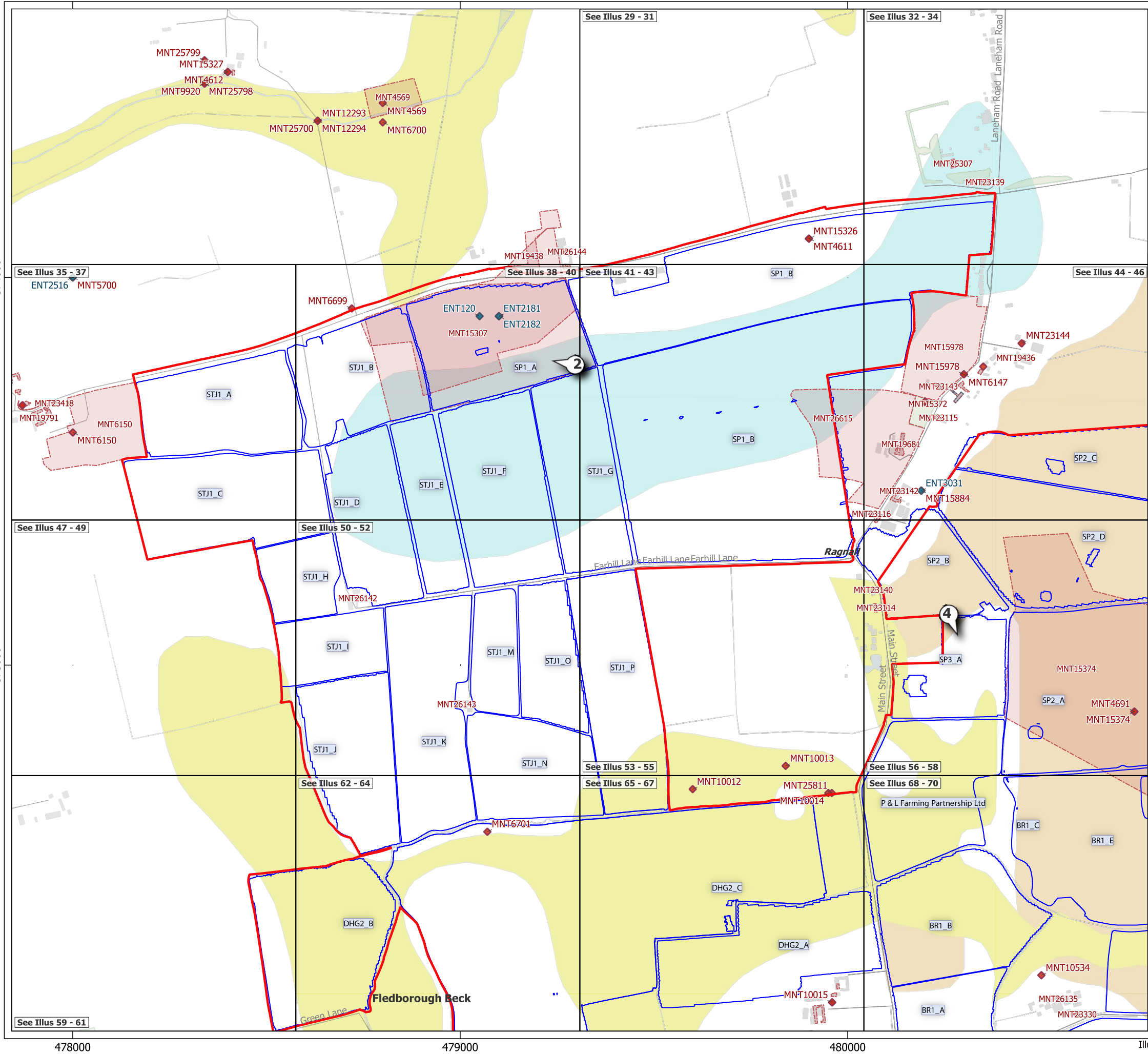
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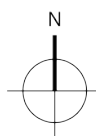
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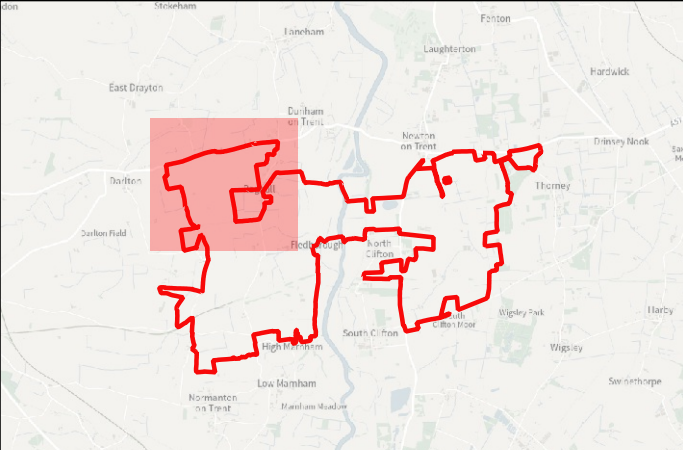
Illus 10 - Overall interpretation of magnetometer data







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Key

- Site Boundary
- Survey Extent
- Location of Illus 29 - 70
- Location and Direction of Illustration 02 to 08
- HER Monument
- HER Monument
- HER Event
- HER Event

Key for BGS Superficial Geology Layers

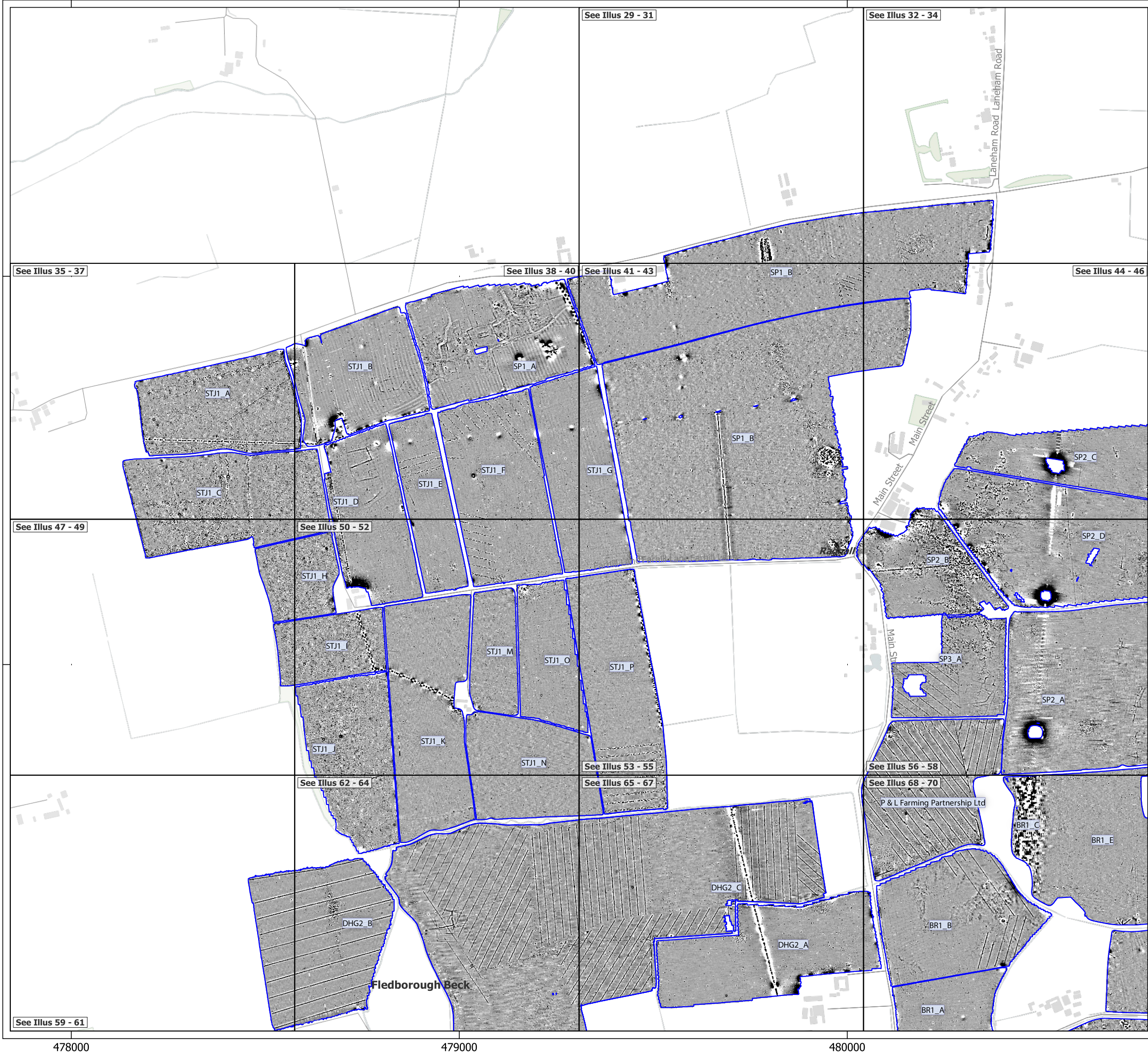
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- Alluvium - Clay, Silt, Sand and Gravel
- Till, Mid Pleistocene - Diamicton

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Illus 11 - Location map of processed Greyscale, XY trace and interpretation illustrations with HER data and photo locations; Sector 1



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-1nT

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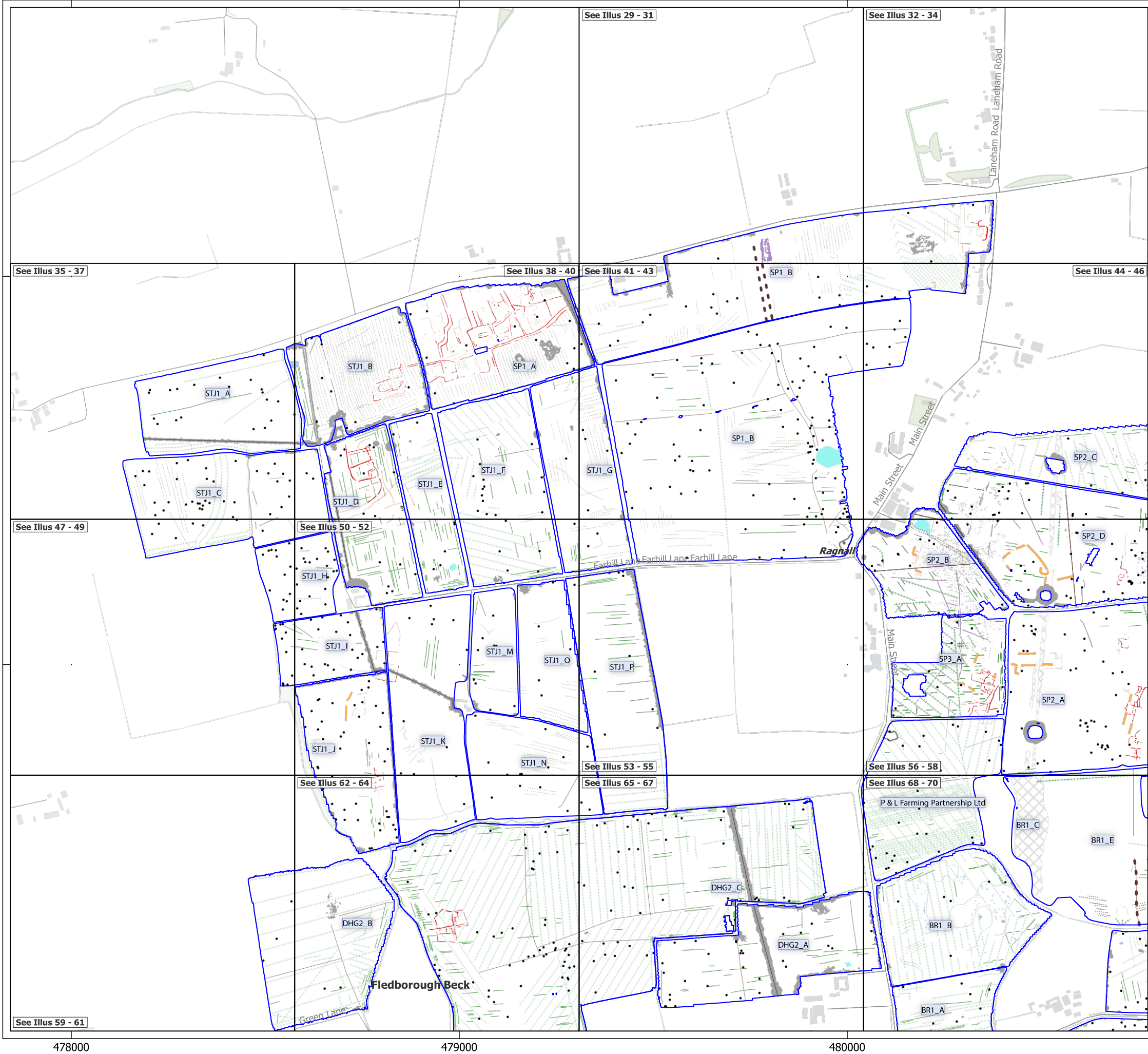
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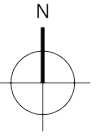
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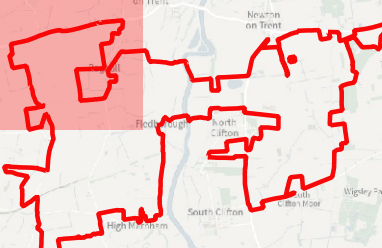






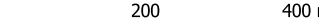
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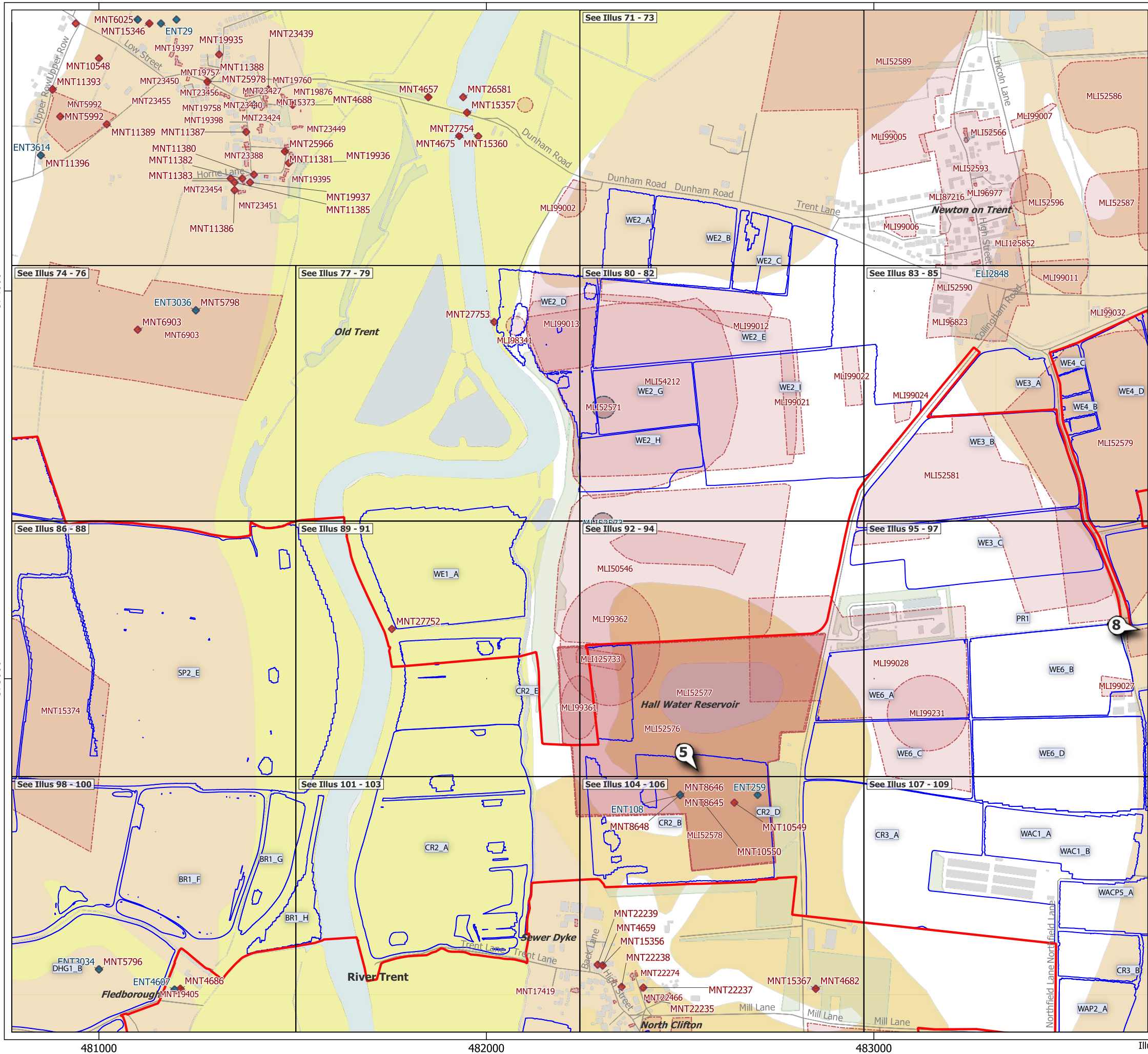
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- Location of Illus 29 - 70

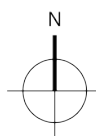



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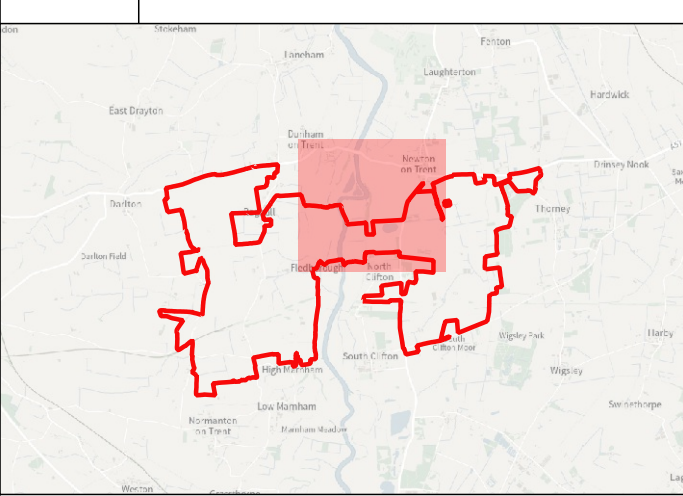
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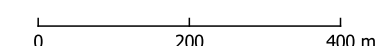


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- Survey Extent
- Location of Illus 71 - 109
- Location and Direction of Illustration 02 to 08
- HER Monument
- HER Event
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Key for BGS Superficial Geology Layers

- Holme Pierrepont Sand and Gravel Member - Sand and Gravel
- Alluvium - Clay, Silt, Sand and Gravel

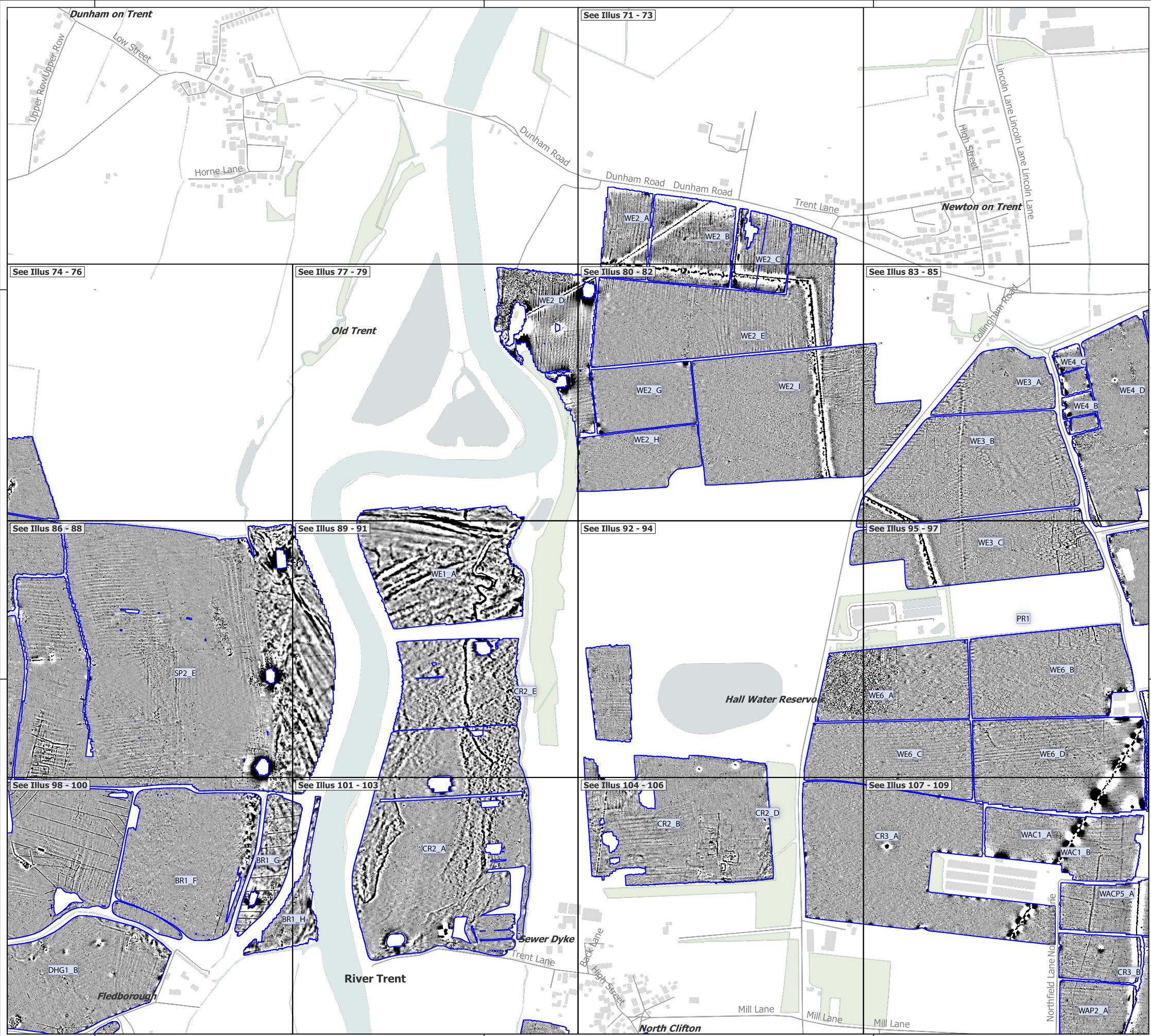


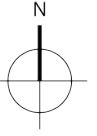
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Illus 14 - Location map of processed Greyscale, XY trace and interpretation illustrations with HER data and photo locations; Sector 2

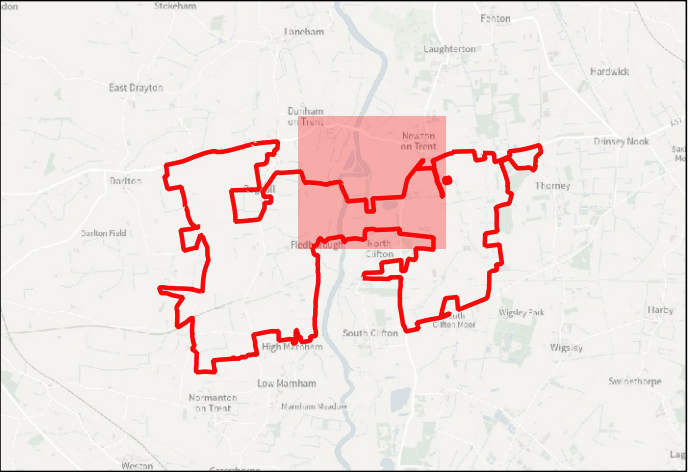






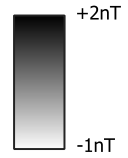
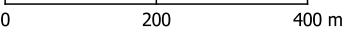


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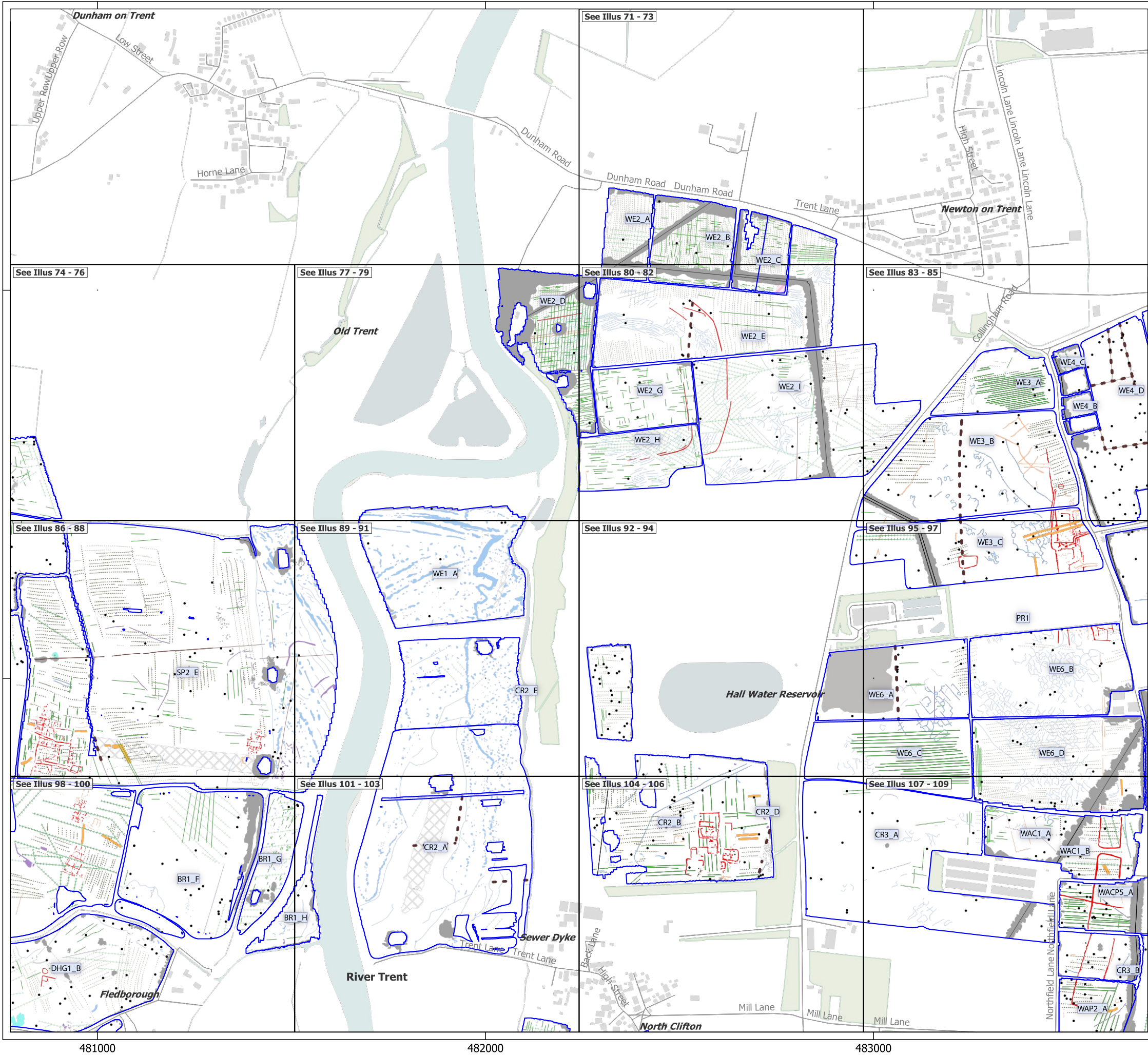


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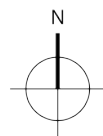
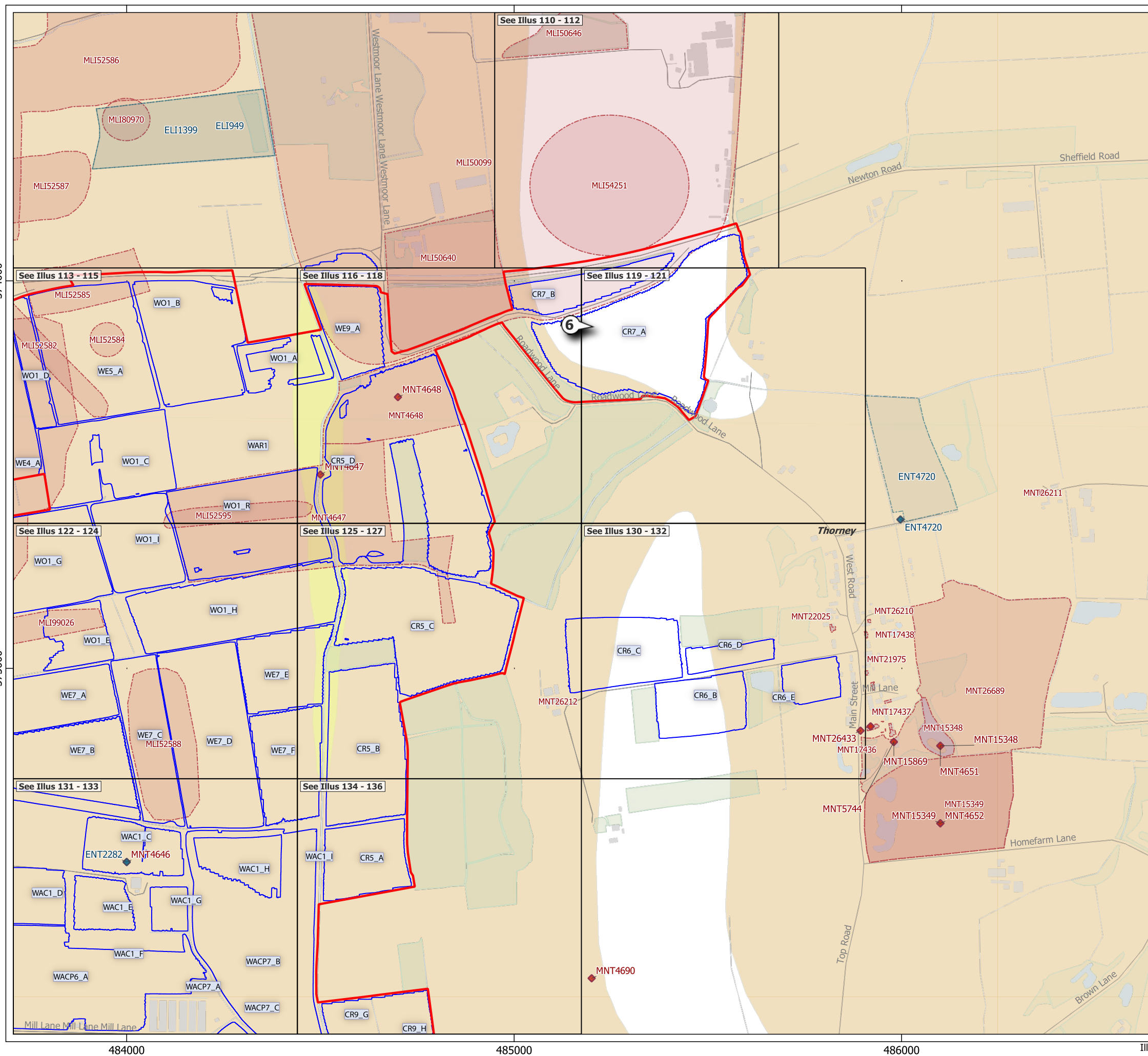
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- Former Field Boundary
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- Archaeology
- Magnetic Disturbance
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- Magnetic Disturbance Modern?
- Location of Illus 71 - 109

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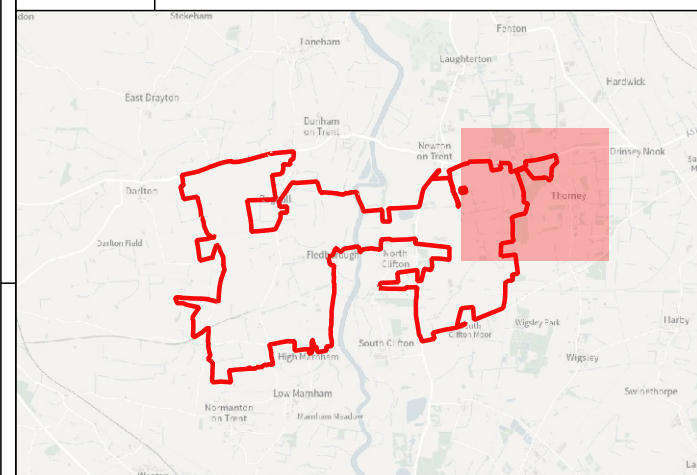
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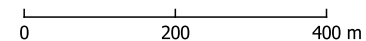


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 HER Monument
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 Alluvium - Clay, Silt, Sand and Gravel

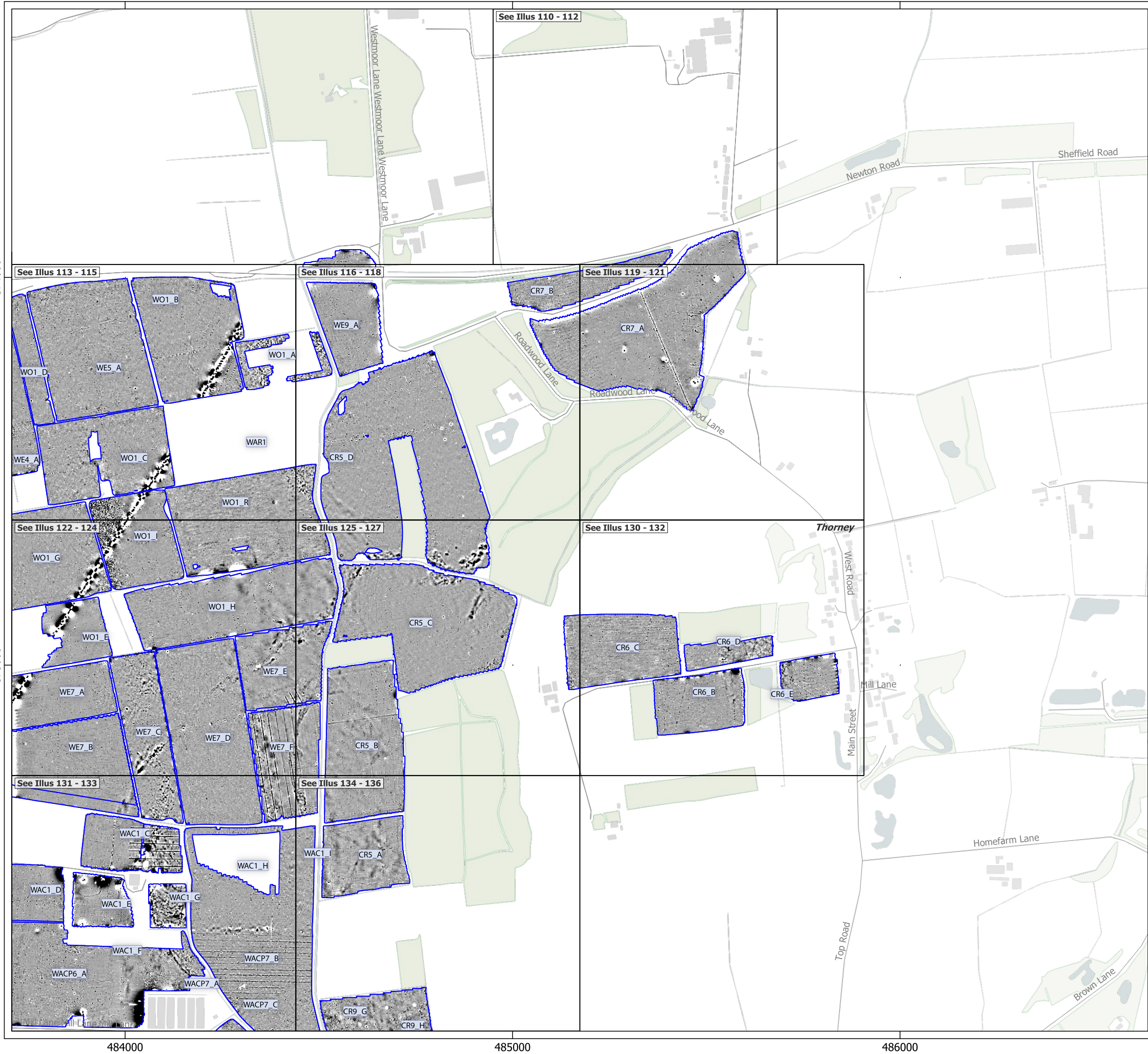


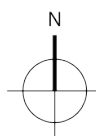
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Illus 17 - Location map of processed Greyscale, XY trace and interpretation illustrations with HER data and photo locations; Sector 3

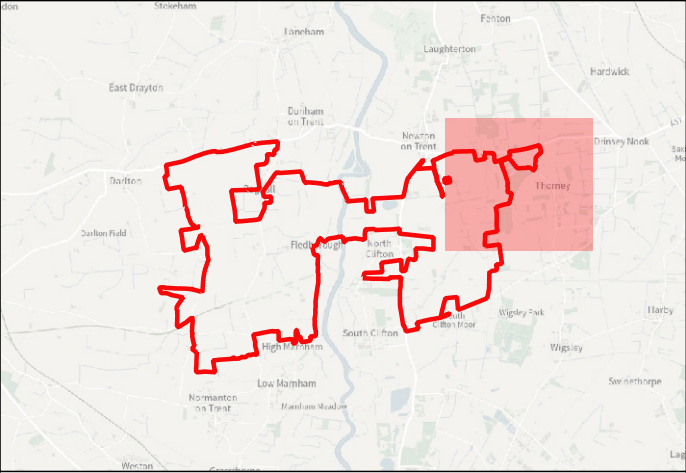








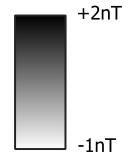
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Key

-  Survey Extent
-  Location of Illus 110 - 136

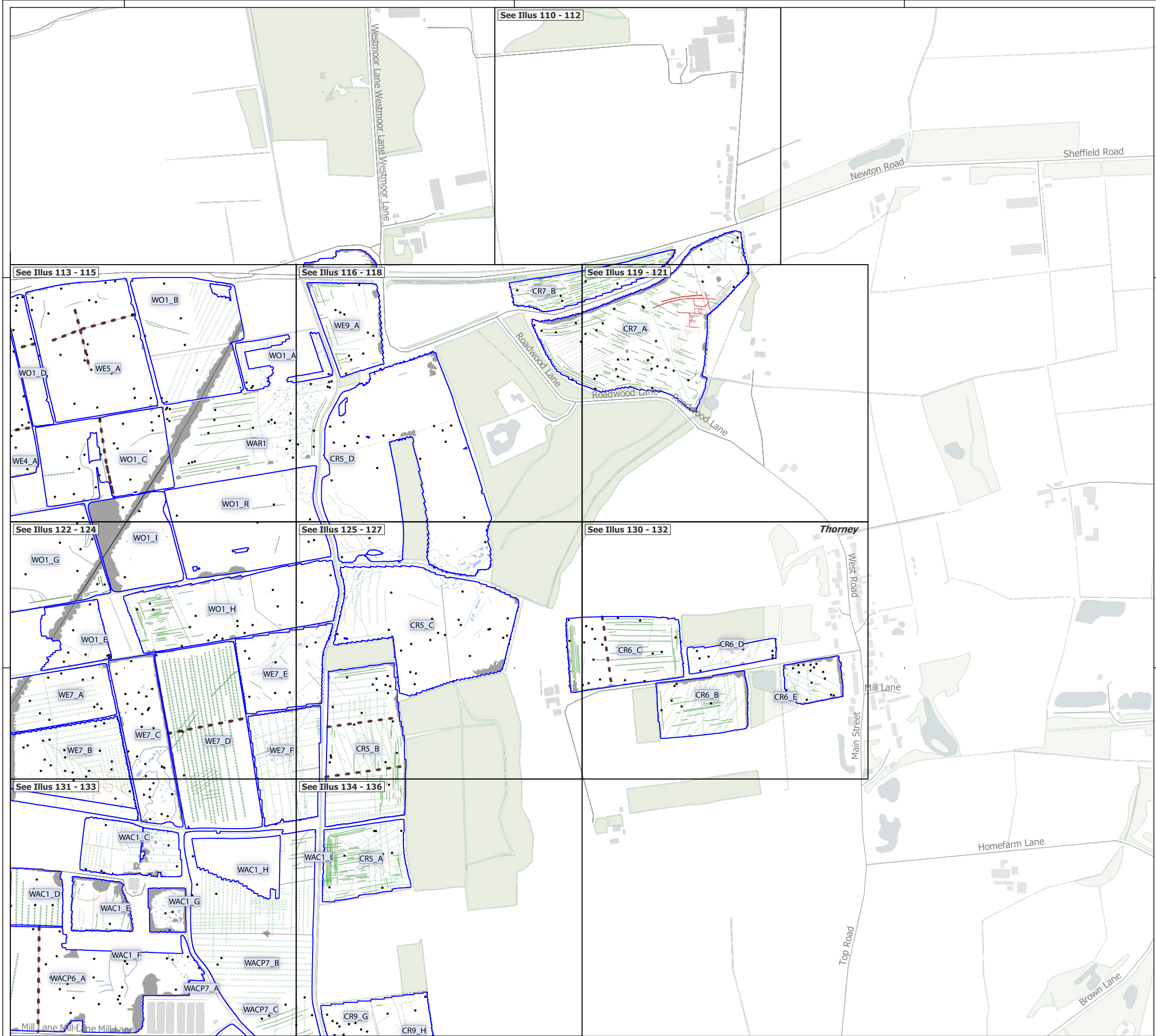


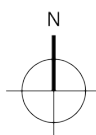
0 200 400 m


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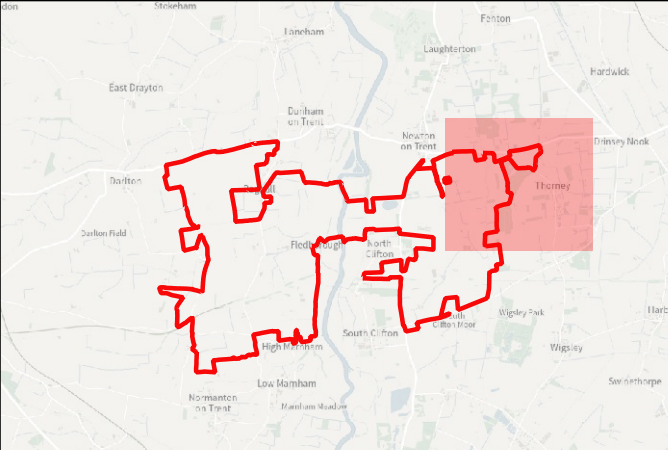






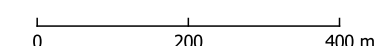
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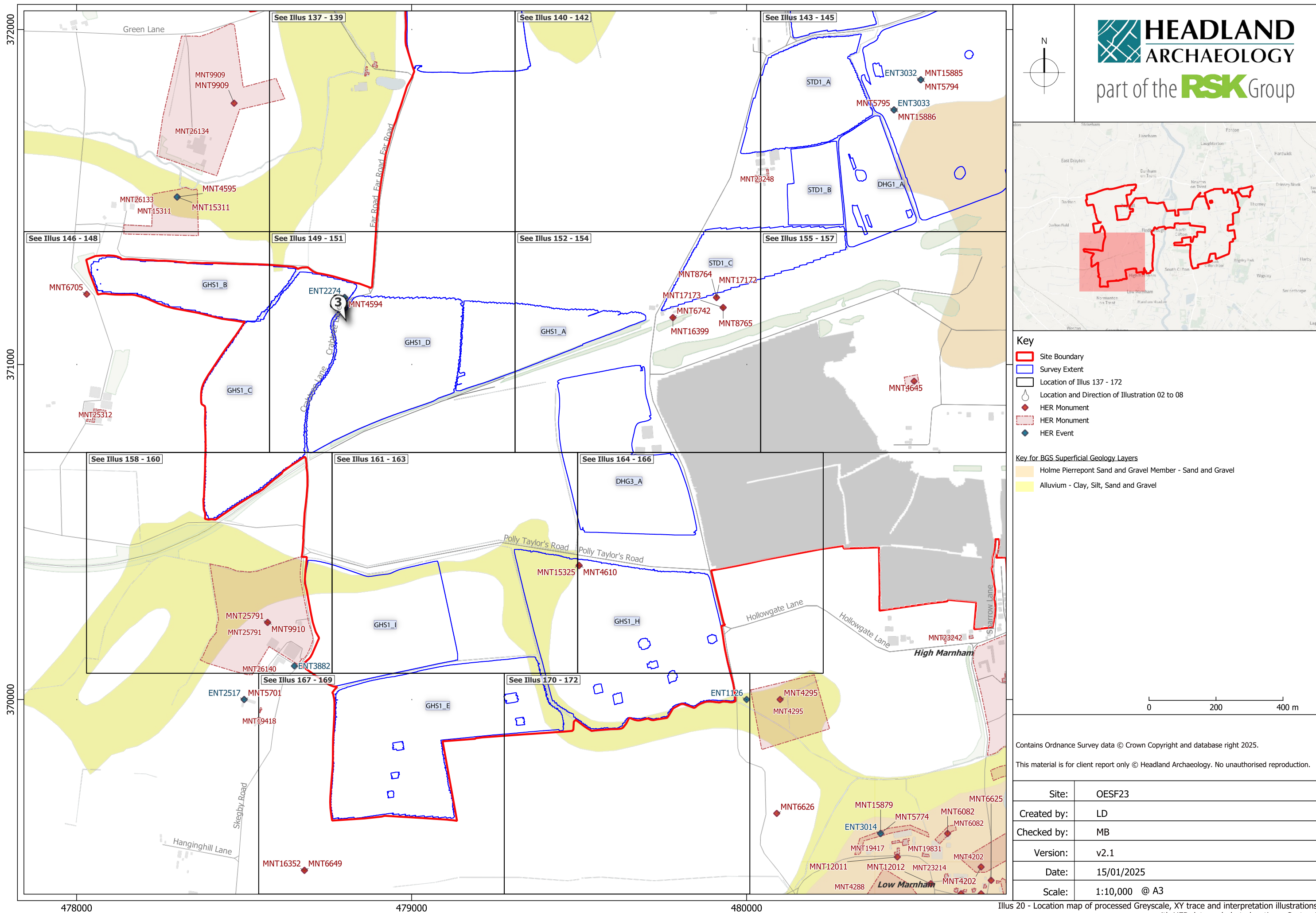
- Survey Extent
- Ferrous Objects
- Agriculture
- Field Boundary
- Possible Field Boundary
- Field Drain
- Natural
- Pipe
- Uncertain
- Ridge and Furrow
- Former Field Boundary
- Archaeology
- Magnetic Disturbance
- Natural
- Possible Archaeology
- Uncertain
- Burning?
- Location of Illus 110 - 136



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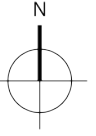
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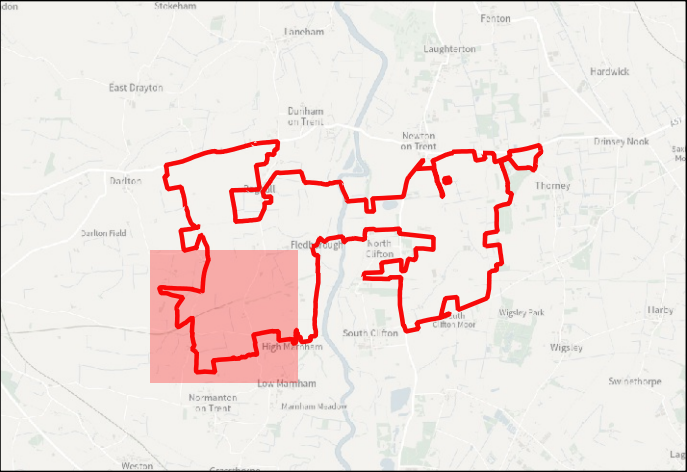
Illus 20 - Location map of processed Greyscale, XY trace and interpretation illustrations with HER data and photo locations; Sector 4







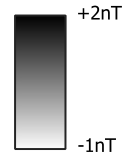
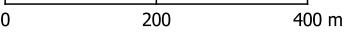


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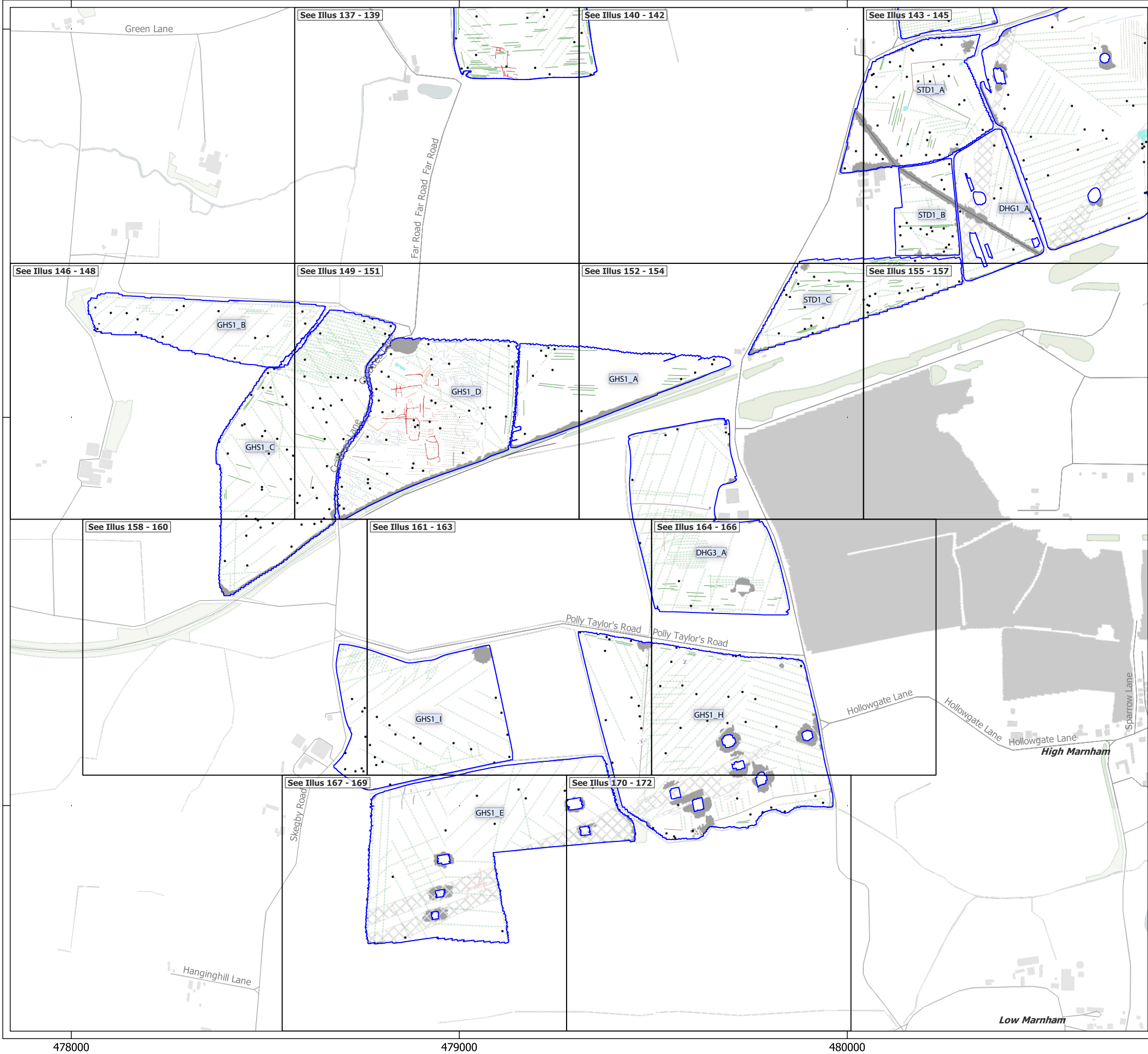
-  Survey Extent
-  Location of Illus 137 - 172



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Key

- Survey Extent
- Ferrous Objects
- Agriculture
- Field Boundary
- Possible Field Boundary
- Field Drain
- Natural
- Pipe
- Uncertain
- Ridge and Furrow
- Archaeology
- Magnetic Disturbance
- Natural
- Overhead
- Possible Archaeology
- Uncertain
- Former Pond
- Magnetic Disturbance Modern?
- Location of Illus 137 - 172

0

200

400 m

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Illus 22 - Interpretation of magnetometer data; Sector 4