GEOPHYSICAL SURVEY REPORT G1448

Cookley Solar Park
Halesworth
Suffolk

Client:

Kinetica solar

GSB PROSPECTION Ltd

Celebrating over 25 years
at the forefront of
Archaeological Geophysics

sumo Survey Services

GSB Survey Report No. G1448

Cookley Solar Park, Halesworth

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Survey Personnel

Field Co-ordinator: James Lawton BSc MSc

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Project Assistants: Adrian Dillon BSc, Joe Perry BA, Leanne Swinbank BA

Dates

Fieldwork: 9 - 19 June 2014
Report: 3 July 2014

Report Approved: Dr John Gater MIfA FSA

Background Project Details

NGR	TM 362 756
Location	Site is located approximately 3km to the west of Halesworth and 30km to the southwest of Lowestoft within arable land north of Cookley Street.
HER/SMR	Suffolk
District	Suffolk Coastal District
Parish	Cookley
Topography	Gently rolling to flat
Current Land Use	Arable
Soils	Beccles 1 (711r): slowly permeable seasonally waterlogged fine loamy over clayey soils, associated with similar clayey soils (SSEW 1983).
Geology	Bedrock geology; crag group – sand. Superficial deposits consist of Lowestoft formation - diamicton (BGS 2014).
Archaeology	The application area shows a low potential for any archaeological activity; it is likely to have been used for agricultural purposes from the medieval period (CgMs 2014).
Survey Methods	Detailed magnetometer survey (fluxgate gradiometer)
Study Area	25ha

Aims

To locate and characterise any anomalies of possible archaeological interest within the study area. The work forms part of a wider archaeological assessment being carried out by **Kinetica Solar**.

Summary of Results

No anomalies of archaeological interest have been detected within the magnetic data. A number of old field boundaries have been recorded which correspond to the 1846 Tithe Map. Further boundaries are also apparent but are not visible on any available mapping and are therefore likely to predate the aforementioned divisions.

Field drains can be seen in Areas 1 and 2 and ploughing trends in Area 3. A number of anomalies have been categorised as *Uncertain Origin*; there is a possibility that a small enclosure is located in the southwest of Area 1; however, this is also likely to be associated with agriculture.

Method

All survey grid positioning was carried out using Trimble R8 Real Time Kinematic (RTK) VRS Now GNSS equipment. The geophysical survey areas are georeferenced relative to the Ordnance Survey National Grid by tying in to local detail and corrected to the site survey plan provided by the client. These tie-ins are presented in Figure T1. Please refer to this diagram when re-establishing the grid or positioning trenches.

Technique	Instrument	Traverse Interval	Sample Interval
Magnetometer	Bartington Grad 601-2	1m	0.25m

All survey work is carried out in accordance with the current English Heritage guidelines (EH 2008).

Data Processing

Data processing was performed as appropriate using an in-house software package (GeoSuB) as outlined below.

Magnetic Data

Zero Mean Traverse, Step Correction (De-stagger) and Interpolation (on the Y axis).

Interpretation

When interpreting the results several factors are taken into consideration, including the nature of archaeological features being investigated and the local conditions at the site (geology, pedology, topography etc.). Anomalies are categorised by their potential origin. Where responses can be related to very specific known features documented in other sources, this is done (for example: *Abbey Wall*, *Roman Road*). For the generic categories levels of confidence are indicated, for example: *Archaeology – ?Archaeology*. The former is used for a confident interpretation, based on anomaly definition and/or other corroborative data such as cropmarks. Poor anomaly definition, a lack of clear patterns to the responses and an absence of other supporting data reduces confidence, hence the classification *?Archaeology*. Details of the data plot formats and interpretation categories used are given in the Appendix: Technical Information at the end of the report.

General Considerations

Conditions for the survey were good as the topography was generally flat and the fields had a crop of young peas growing.

1.0 Survey Results - Magnetometer Survey

1.1 No anomalies of archaeological interest were detected within the survey area. Former field boundaries can be seen throughout which would have subdivided the three current fields into smaller parcels. The majority of these boundaries correspond to the 1846 Tithe Map of Cookley (CgMs 2014). A handful of similar responses are not apparent on any available mapping and therefore are likely to predate 1846.

1.2 Linear parallel trends within the data represent field drains; ploughing trends have also been recorded.

1.3 Anomalies that are categorised as *Uncertain Origin* are likely to be associated with agriculture or natural variations within the soils. A tentative rectangular response in the southwest of Area 1 may have an anthropogenic origin, although it could equally be associated with another early field division.

1.4 An oval shaped anomaly towards the southeast of Area 3 has also been categorised as *Uncertain Origin – weak*. This may be associated with the geology / soils or it could represent a former in-filled pond. Other *Uncertain* anomalies, including trends, are likely to be agricultural in origin.

1.5 Ferrous responses ("iron spikes") can be seen throughout the data and are best seen in the XY Trace Plots (see Archive CD); these are characteristic of small pieces of ferrous debris in the topsoils or on the surface.

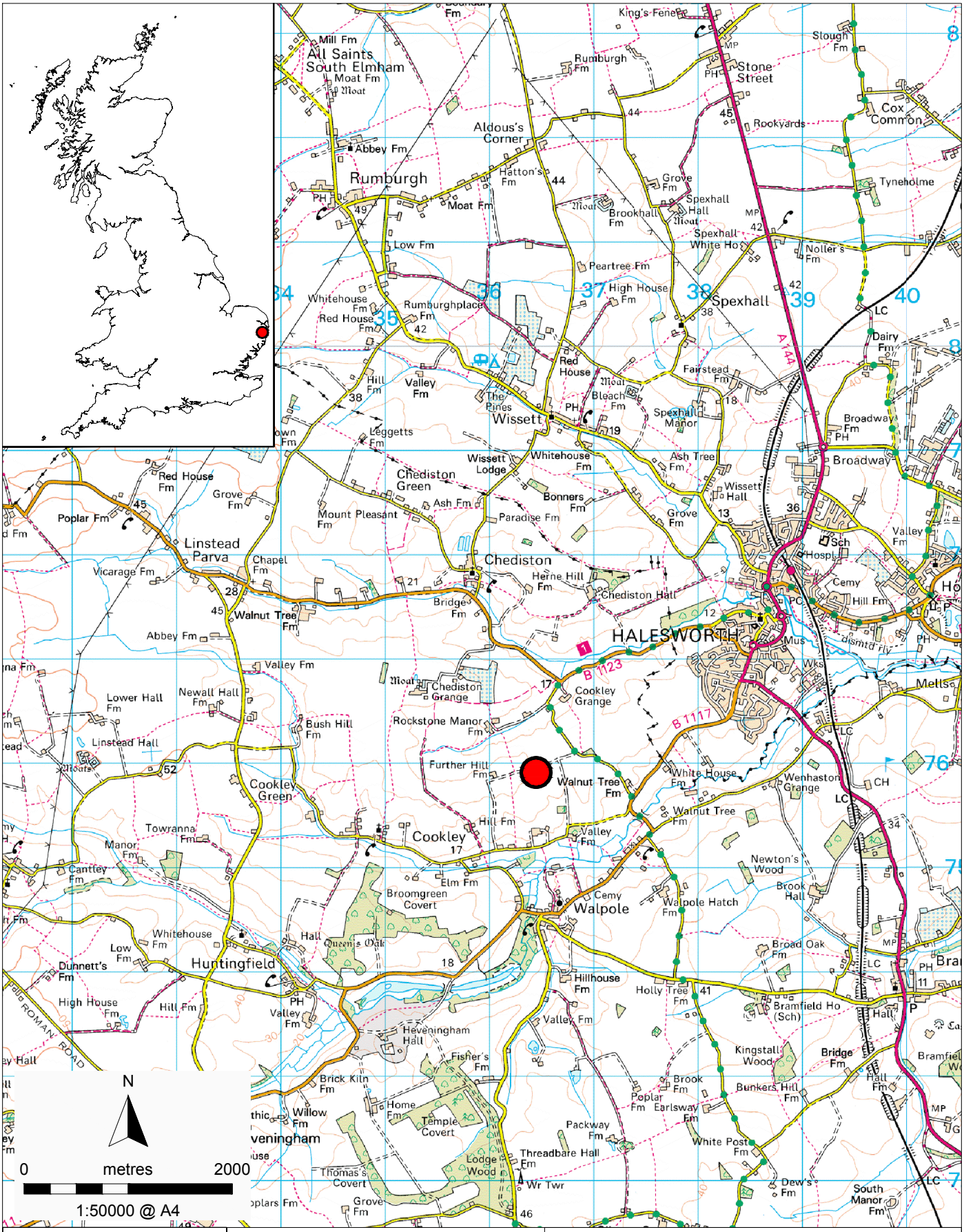
2.0 Conclusions

2.1 Former field divisions can be seen throughout the data, dividing the current field layout into smaller parcels of land. The majority of these are shown on the 1846 Tithe Map; a handful do not appear on any mapping and are therefore likely to predate 1846.

2.2 Field drains and ploughing trends have been recorded along with some anomalies categorised as having an uncertain origin, bust are most likely to be agricultural.

References

BGS 2014	British Geological Survey, Geology of Britain Viewer http://mapapps.bgs.ac.uk/geologyofbritain/home.html 1:50,000 scale geology, centred on 636200,275600. Accessed 02/07/2014
CgMs 2014	*Land at Hill Farm, Halesworth, Suffolk*. CgMs Consulting, June 2014
EH 2008	*Geophysical Survey in Archaeological Field Evaluation.* English Heritage, Portsmouth.
SSEW 1983	*Soils of England and Wales. Sheet 4, Eastern England*. Soil Survey of England and Wales, Harpenden.



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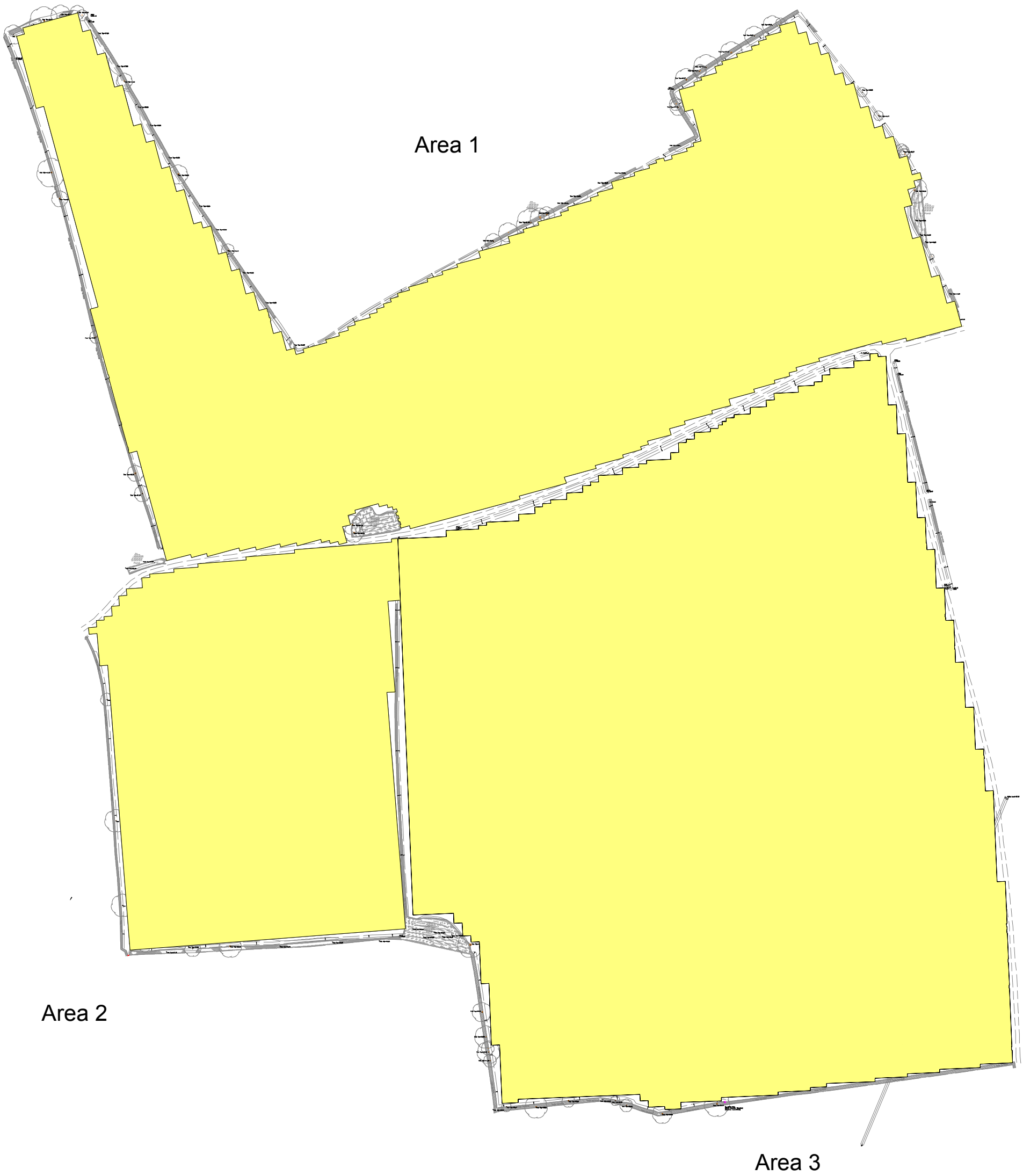
Site Location

Project: G1448 Cookley Solar Park, Halesworth

Title: Site Location

Drawn by: ELBrunning

Figure 1



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N

0 metres 100

1:2500 @ A3

Gradiometer Survey

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Title: Location of Survey Areas

Based on a site plan provided by the client.

Drawn by: ELBrunning

Figure 2

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0 metres 100

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-1

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Title: Magnetometer Survey - Greyscale Plot

Based on a site plan provided by the client.

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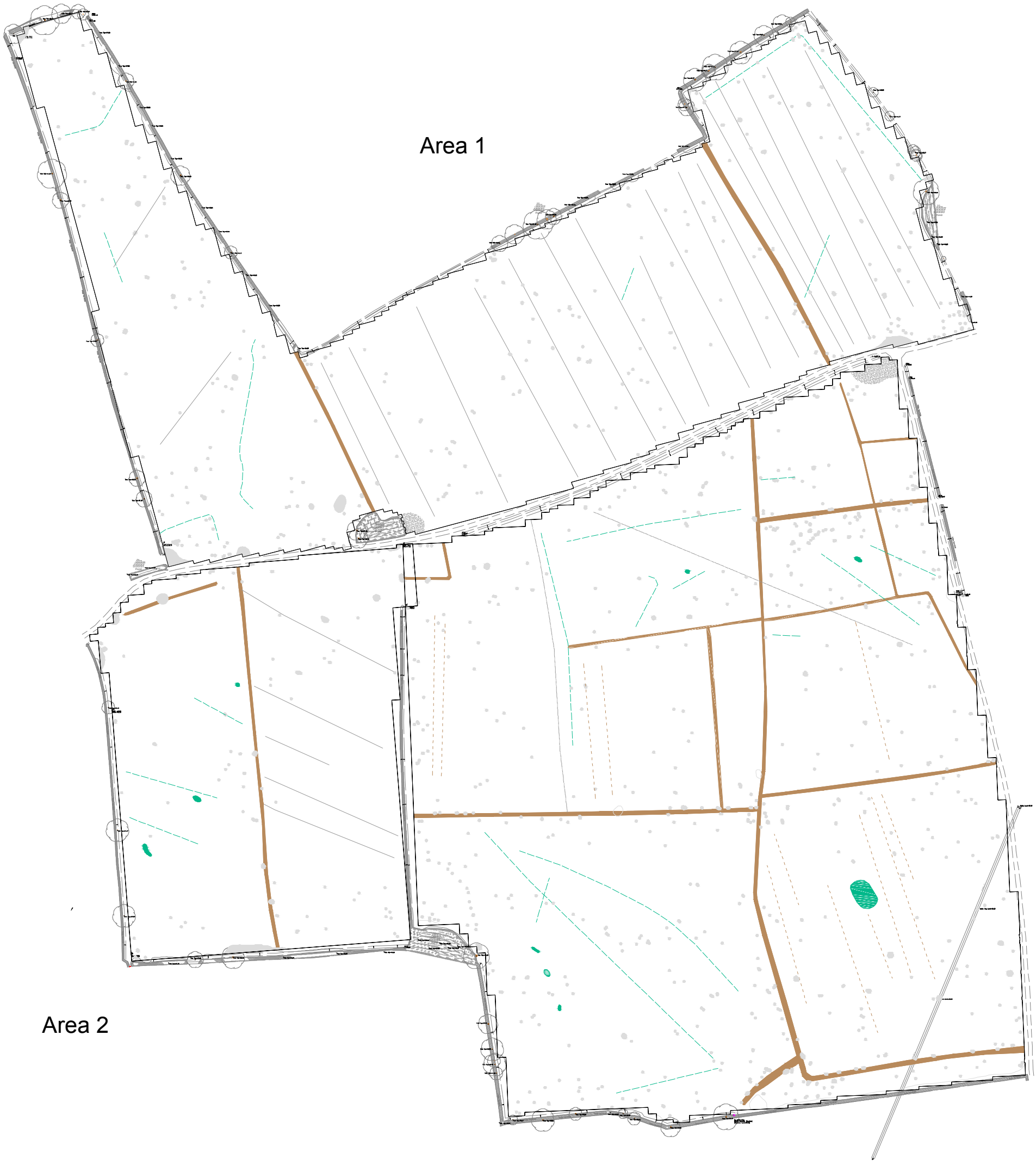
Figure 3



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0 metres 100

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Old Field Boundary (Tithe map / no map evidence)

Ploughing

Drain

Uncertain Origin (discrete / weak / trend)

Magnetic Disturbance

Ferrous

Project: G1448 Cookley Solar Park, Halesworth

Title: Magnetometer Survey - Interpretation Plot

Based on a site plan provided by the client.

Drawn by: ELBrunning

Figure 4

Appendix - Technical Information: Magnetometer Survey

Instrumentation: Bartington *Grad*601-2 / GSB CARTEASY^{N} Cart system

Both the Bartington and CARTEASY^{N} instruments operate in a gradiometer configuration which comprises fluxgate sensors mounted vertically, set 1.0m apart. The fluxgate gradiometer suppresses any diurnal or regional effects. The instruments are carried, or cart mounted, with the bottom sensor approximately 0.1-0.3m from the ground surface. At each survey station, the difference in the magnetic field between the two fluxgates is measured in nanoTesla (nT). The sensitivity of the instrument can be adjusted; for most archaeological surveys the most sensitive range (0.1nT) is used. Generally, features up to 1m deep may be detected by this method. The Bartington instrument can collect two lines of data per traverse with gradiometer units mounted laterally with a separation of 1.0m. The CARTEASY^{N} system has four gradiometer units mounted at 0.75m intervals across its frame – rather than working in grids, the cart uses an on-board survey grade GNSS for positioning. The cart system allows for the collection of topographic data in addition to the magnetic field measurements.

Data Processing

Zero Mean Traverse	This process sets the background mean of each traverse within each grid to zero. The operation removes striping effects and edge discontinuities over the whole of the data set.
Step Correction (Destagger)	When gradiometer data are collected in 'zig-zag' fashion, stepping errors can sometimes arise. These occur because of a slight difference in the speed of walking on the forward and reverse traverses. The result is a staggered effect in the data, which is particularly noticeable on linear anomalies. This process corrects these errors.
Interpolation	When geophysical data are presented as a greyscale, each data point is represented as a small square. The resulting plot can sometimes have a 'blocky' appearance. The interpolation process calculates and inserts additional values between existing data points. The process can be carried out with points along a traverse (the x axis) and/or between traverses (the y axis) and results in a smoother greyscale image.

Display

XY Trace Plot	This involves a line representation of the data. Each successive row of data is equally incremented in the Y axis, to produce a stacked profile effect. This display may incorporate a hidden-line removal algorithm, which blocks out lines behind the major peaks and can aid interpretation. The advantages of this type of display are that it allows the full range of the data to be viewed and shows the shape of the individual anomalies. The display may also be changed by altering the horizontal viewing angle and the angle above the plane.
Greyscale/ Colourscale Plot	This format divides a given range of readings into a set number of classes. Each class is represented by a specific shade of grey, the intensity increasing with value. All values above the given range are allocated the same shade (maximum intensity); similarly all values below the given range are represented by the minimum intensity shade. Similar plots can be produced in colour, either using a wide range of colours or by selecting two or three colours to represent positive and negative values. The assigned range (plotting levels) can be adjusted to emphasise different anomalies in the data-set.
3D Surface Plot	This is similar to the XY trace, but in 3 dimensions. Each data point of a survey is represented in its relative position on the x and y axes and the data value is represented in the z axis. This gives a digital terrain, or topographic effect.

Interpretation Categories

In certain circumstances (usually when there is corroborative evidence from desk based or excavation data) very specific interpretations can be assigned to magnetic anomalies (for example, *Roman Road, Wall,* etc.) and where appropriate, such interpretations will be applied. The list below outlines the generic categories commonly used in the interpretation of the results.

Archaeology	This term is used when the form, nature and pattern of the response are clearly or very probably archaeological and /or if corroborative evidence is available. These anomalies, whilst considered anthropogenic, could be of any age.
?Archaeology	These anomalies exhibit either weak signal strength and / or poor definition, or form incomplete archaeological patterns, thereby reducing the level of confidence in the interpretation. Although the archaeological interpretation is favoured, they may be the result of variable soil depth, plough damage or even aliasing as a result of data collection orientation.
Increased Magnetic Response	An area where increased fluctuations attest to greater magnetic enhancement of the soils, but no specific patterns can be discerned in the data and no visual indications on the ground surface hint at a cause. They may have some archaeological potential, suggesting damaged archaeological deposits.
Industrial / Burnt-Fired	Strong magnetic anomalies that, due to their shape and form or the context in which they are found, suggest the presence of kilns, ovens, corn dryers, metal-working areas or hearths. It should be noted that in many instances modern ferrous material can produce similar magnetic anomalies.
Old Field Boundary	Anomalies that correspond to former boundaries indicated on historic mapping, or which are clearly a continuation of existing land divisions.
Ridge & Furrow	Parallel linear anomalies whose broad spacing suggests ridge and furrow cultivation. In some cases the response may be the result of more recent agricultural activity.
Ploughing	Parallel linear anomalies or trends with a narrower spacing, sometimes aligned with existing boundaries, indicating more recent cultivation regimes.
Natural	These responses form clear patterns in geographical zones where natural variations are known to produce significant magnetic distortions. Smaller, isolated responses which do not form such obviously 'natural' patterns but which are, nonetheless, likely to be natural in origin may be classified as *?Natural*.
Uncertain Origin	Anomalies which stand out from the background magnetic variation, yet whose form and lack of patterning gives little clue as to their origin. Often the characteristics and distribution of the responses straddle the categories of *?Archaeology* and *?Natural* or (in the case of linear responses) *?Archaeology* and *?Ploughing*; occasionally they are simply of an unusual form.
Magnetic Disturbance	Broad zones of strong dipolar anomalies, commonly found in places where modern ferrous or fired materials (e.g. brick rubble) are present. They are presumed to be modern.
Ferrous	This type of response is associated with ferrous material and may result from small items in the topsoil, larger buried objects such as pipes, or above ground features such as fence lines or pylons. Ferrous responses are usually regarded as modern. Individual burnt stones, fired bricks or igneous rocks can produce responses similar to ferrous material.

Where appropriate some anomalies will be further classified according to their form (positive or negative) and relative strength and coherence (trend: weak and poorly defined).

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