
**LITTLE FROOME SOLAR FARM,
BROMYARD,
HEREFORDSHIRE**

GEOPHYSICAL SURVEY

Work undertaken for
BE Renewables

APRIL 2015

Report compiled by
Neil Jefferson BSc (Hons)

OASIS Ref: archaeo11-208691
National Grid Reference:
SO 64795 53257 and SO 65122 53928

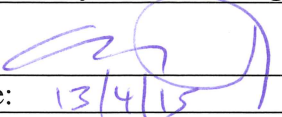
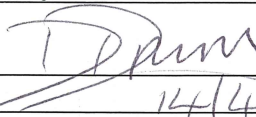
APS Report No: **37/15**

**ARCHAEOLOGICAL
PROJECT
SERVICES**



Quality Control
Little Froome Solar Farm,
Bromyard
Herefordshire
(BRLF15)

Project Coordinator	Neil Jefferson
Site Staff	Neil Jefferson, Ryan Godbold, Mary Nugent
Survey processing and report	Neil Jefferson

Checked by Senior Manager	Approved by Team Leader
 - Gary Taylor	 Denise Drury
Date: 13/4/15	Date: 14/4/15

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1. SUMMARY

Detailed magnetic gradiometer survey was undertaken for BE Renewables in connection with proposed development on land near Bromyard, Herefordshire. The survey totalled c. 25.34ha. Two separate blocks of land, Areas A and B, were surveyed.

A single positive linear anomaly of clear archaeological origin has been identified in the north-western part of Area A. This appears to form field boundaries or two sides of a possible enclosure, perhaps dating to the Roman period.

A number of discrete positive responses might represent isolated pit features but these are not strong and are difficult to interpret on the basis of form alone.

2. INTRODUCTION

2.1 Definition of an Evaluation

Geophysical survey is a non-intrusive method of archaeological evaluation. Evaluation is defined as ‘*a limited programme of non-intrusive and/or intrusive fieldwork which determines the presence or absence of archaeological features, structures, deposits, artefacts or ecofacts within a specified area or site. If such archaeological remains are present Field Evaluation defines their character and extent, quality and preservation, and it enables an assessment of their worth in a local, regional, national or international context as appropriate*’ (CIFA 2014).

2.2 Background

Archaeological Project Services was commissioned by BE Renewables to undertake detailed magnetometer survey totalling some 25.34ha on land near Bromyard, Herefordshire. This was in

advance of proposed development of a solar farm. The survey was carried out between 30th March and 9th April 2015.

2.3 Topography and Geology

Bromyard is located 20km east of Leominster and 23km northeast of Hereford, in Herefordshire (Fig. 1).

The proposed development site is split into two areas (Fig. 2). Area A is located 1.8km southwest of the centre of Bromyard, on the east side of the B4214, at National Grid Reference SO 64795 53257 (Figs 2 and 3). Area B is located 0.9km south of the centre of Bromyard, to the east of Hereford Road at National Grid Reference SO 65122 53928 (Figs 2 and 4). Area A encompasses some 15.07 hectares and slopes down to the east, and Area B is 10.27 hectares in size and is on the north side of a stream valley, declining to the south.

The solid geology consists of St Maughans Formation of interbedded Argillaceous Rocks and Sandstone formed in the Devonian Period (BGS 2015).

3. GEOPHYSICAL SURVEY

3.1 Methods

The site is divided into two Areas. The location and layout of the survey areas is shown in Figures 3 and 4. Area A was divided into four fields and contained young crop in the western three and grass in the eastern field. Area B consisted of two fields, containing a young crop (eastern field) and grass (western). All areas were in good condition for survey. Weather was generally overcast.

Survey was undertaken in accordance with English Heritage (2008) and CIFA (2014) guidelines and codes of conduct.

The magnetic survey was carried out using two dual sensor Grad601-2 Magnetic Gradiometer manufactured by Bartington Instruments Ltd. This records subtle changes in the magnetic field resulting from differing features in the soil. Changes as small as 0.2 nanoTesla (nT) in an overall field strength of c. 49,000nT can be accurately detected using this instrumentation, although in practice instrument interference and soil noise can limit sensitivity.

The mapping of anomalies in a systematic manner allows interpretation of the type of material present beneath the surface. Strong magnetic anomalies are generated by buried iron-based objects or by kilns or hearths, usually resulting in a bipolar (positive/negative) response. More subtle positive anomalies representing pits and ditches can be seen where these contain more topsoil which is normally richer in magnetic iron oxides and provides a contrast with the natural subsoil (but this can vary depending on the nature of the underlying deposits). A negative anomaly may result from upcast bank material. Wall foundations can also show as negative anomalies where the stone is less magnetic than the surrounding soil, or as stronger positive and negative anomalies if of brick, but are not always responsive to the technique. It should be noted that not all features will be responsive and absence of anomalies does not necessarily indicate absence of archaeological features (Clark 1996).

Magnetometers measure changes in the Earth's magnetic field. With two sensors configured as a gradiometer the recorded values indicate the difference between two magnetic measurements separated by a fixed distance. The Grad601-2 consists of two high stability fluxgate gradiometers suspended on a single frame with a 1m separation between the sensing elements giving a strong response to deep anomalies.

Sampling interval and data capture

Readings were taken at 0.25m centres along traverses 1m apart. This equates to 6400 sampling points in a full 40m x 40m grid. The Grad 601 has a typical depth of penetration of 0.5m to 1.0m although a greater range is possible where strongly magnetic objects have been buried in the site.

Readings are logged consecutively into the data logger which is downloaded daily either into a portable computer whilst on site or directly to the office computer. At the end of each job, data is transferred to the office for processing and presentation.

Processing and presentation of results

Processing is performed using specialist ArcheoSurveyor software. This can emphasise various aspects contained within the data but which are often not easily seen in the raw data. Basic processing of the magnetic data involves flattening the background levels with respect to adjacent traverses and adjacent grids (Destripe or zero mean traverse). Despiking is also performed to reduce the effect of the anomalies resulting from small iron objects often found on agricultural land. Further processing can then be carried out which may include low pass filtering to reduce 'noise' in the data and hence emphasise the archaeological or man-made anomalies.

The following are the processing techniques carried out on the processed gradiometer data used in this report:

1. DeStripe (sets the background mean of each traverse within a grid to zero and is useful for removing striping effects)

2. Despike (useful for display and allows further processing functions to be carried out more effectively by removing extreme data values)

Parameters: X radius = 1; Y radius = 1; Threshold = 3SD; Spike replacement =

mean

3. Clip (excludes extreme values allowing better representation of detail in the mid range): -3 to 3nT.

3.2 Results

The presentation of the data for the site involves a print-out of the raw or minimally processed data as greyscale plots (Figs 5 and 8; clipped for display but otherwise unprocessed), together with greyscale plots of the processed data (Figs 6 and 9). Magnetic anomalies have been identified and plotted onto interpretative drawings (Figs 7 and 10) and are described below. The identified features have been overlain onto a map of the site (Figs 11 and 12).

Positive linear anomalies (Blue Lines)

A positive anomaly of clear archaeological origin has been identified in the north-western part of Area A. This L-shaped linear probably forms the eastern and western sides of a field boundary or enclosure, with the majority of the feature extending to the north of the site.

Discrete positive anomalies (Blue Circles)

Examples of discrete positive anomalies are highlighted and possibly represent pit features. However, these are somewhat isolated, the responses are not strong, and they are difficult to interpret on the basis of form alone.

Iron spikes (discrete bipolar anomalies) (Red Circles)

Iron items within the topsoil give a distinctive localised bipolar (strong positive with associated strong negative) response. Such items usually derive from relatively recent management or agricultural use of the land – broken or discarded pieces of agricultural machinery or other modern debris.

Geological Features (Green Hatching and lines)

Irregular features probably representing undulations in the natural (hatching) and cracks in the natural bedrock (lines).

Modern magnetic disturbance (Pink Line)

Strong bipolar responses occurred in the north-western part of Area A. This represents a modern service.

Magnetic disturbance (Red Hatching)

Strong bipolar responses in the southwest corner of Area B represent a scatter of ferrous material, possibly from modern quarrying or a rubbish dump. Other magnetic disturbance represents metal fences and ferrous material along the field boundaries.

4. DISCUSSION

A positive L-shaped linear anomaly of clear archaeological origin has been identified in the north-western part of Area A. Its shape and alignment suggest it predates the existing boundaries. This feature sits on a plateau in an otherwise sloping valley. A single piece of Roman pottery was observed within the area, possibly suggesting it may date to this period.

A number of discrete positive responses across the wider site might represent isolated pit features but these are dispersed, not strong and are difficult to interpret on the basis of form alone.

A linear anomaly representing a modern service cuts across the western field in Area A.

5. ACKNOWLEDGEMENTS

Archaeological Project Services wishes to acknowledge BE Renewables who commissioned the project; Gary Taylor

and Denise Drury (APS) edited the report.

6. PERSONNEL

Project coordinator: Neil Jefferson
Geophysical Survey: Neil Jefferson, Ryan Godbold, Mary Nugent
Survey processing and reporting: Neil Jefferson

7. BIBLIOGRAPHY

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<http://mapapps.bgs.ac.uk/geologyofbritain/home.html> accessed March 2015

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CIfA, 2014 *Standard and Guidance for Geophysical Survey*.

Clark, A, 1996 *Seeing Beneath the Soil*, London, 2nd edn.

English Heritage, 2008 *Geophysical Survey in Archaeological Field Evaluation*.

8. ABBREVIATIONS

BGS British Geological Survey

CIfA Chartered Institute for Archaeologists



Figure 1 - General location plan

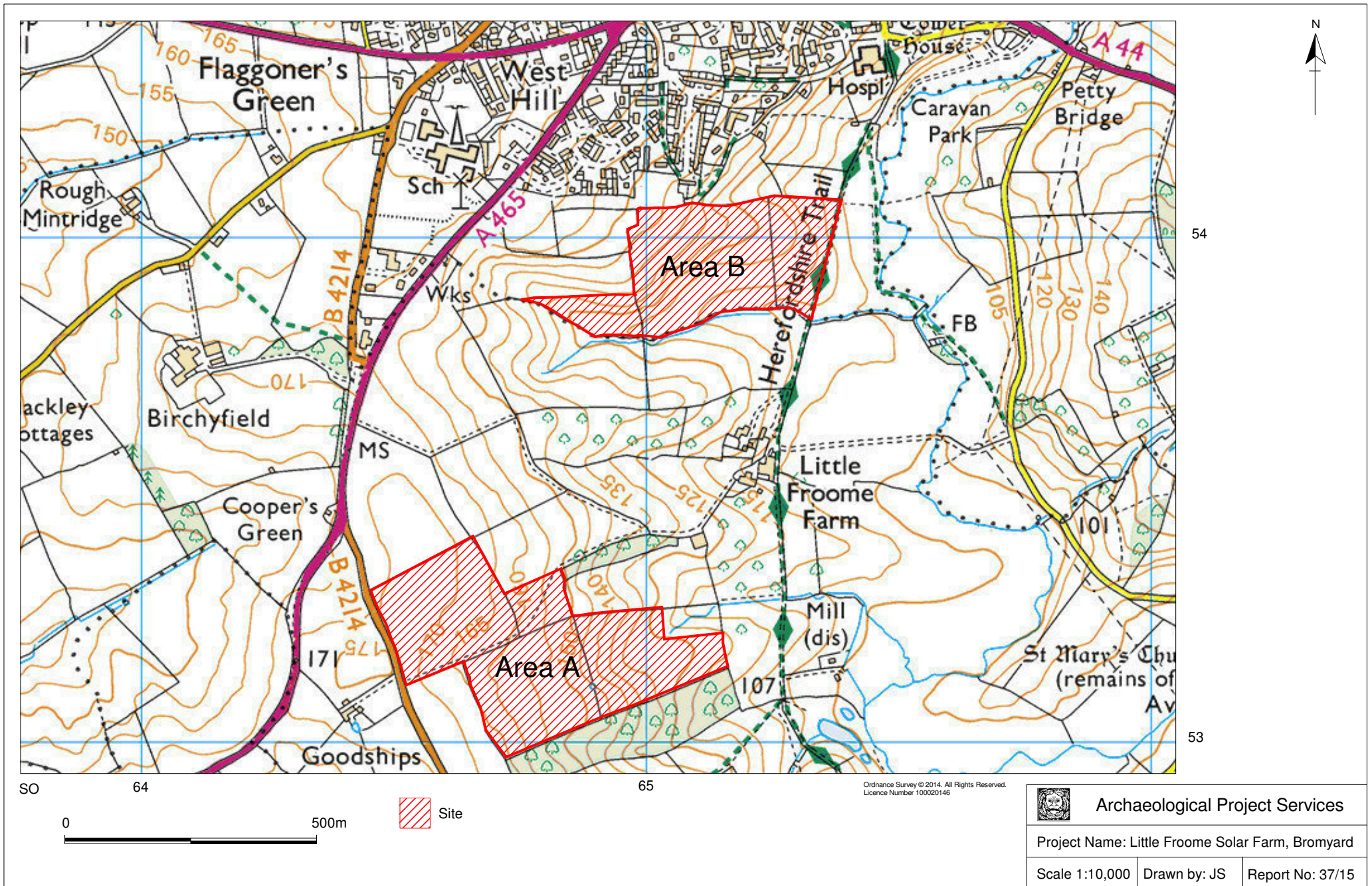


Figure 2 - Site location



Figure 3 - Area A layout

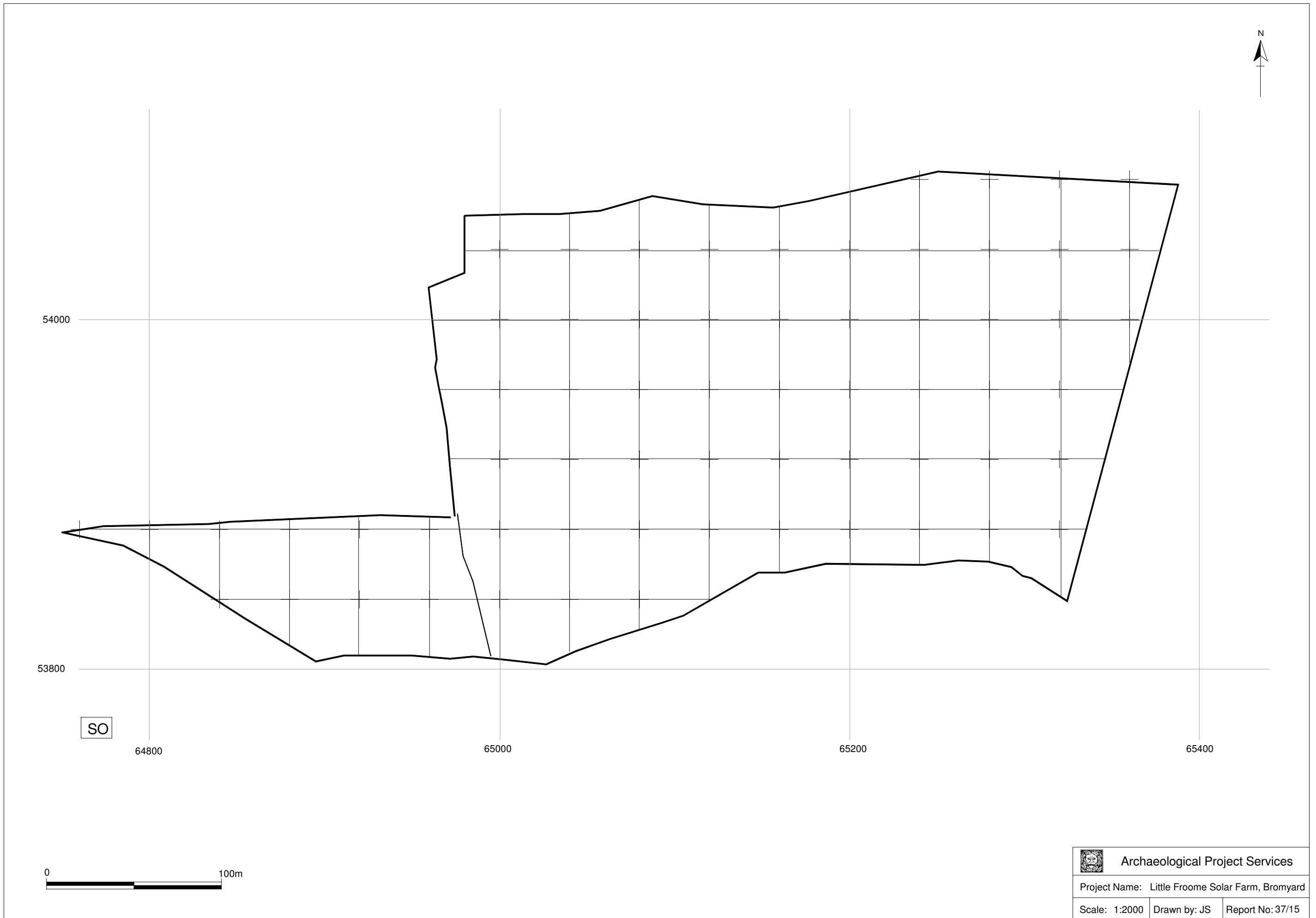


Figure 4- Area B layout

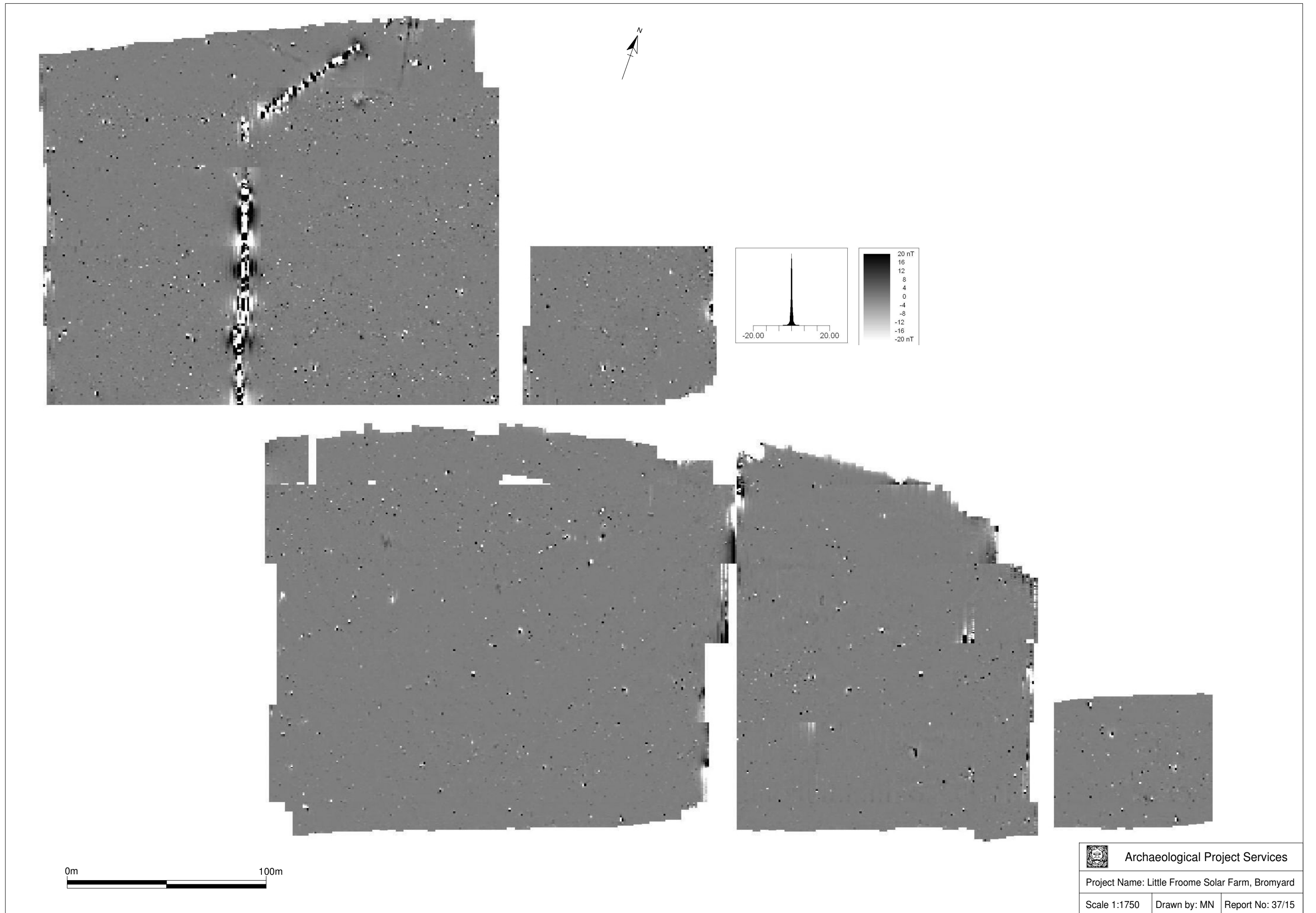


Figure 5 - Area A Minimally processed data greyscale plot

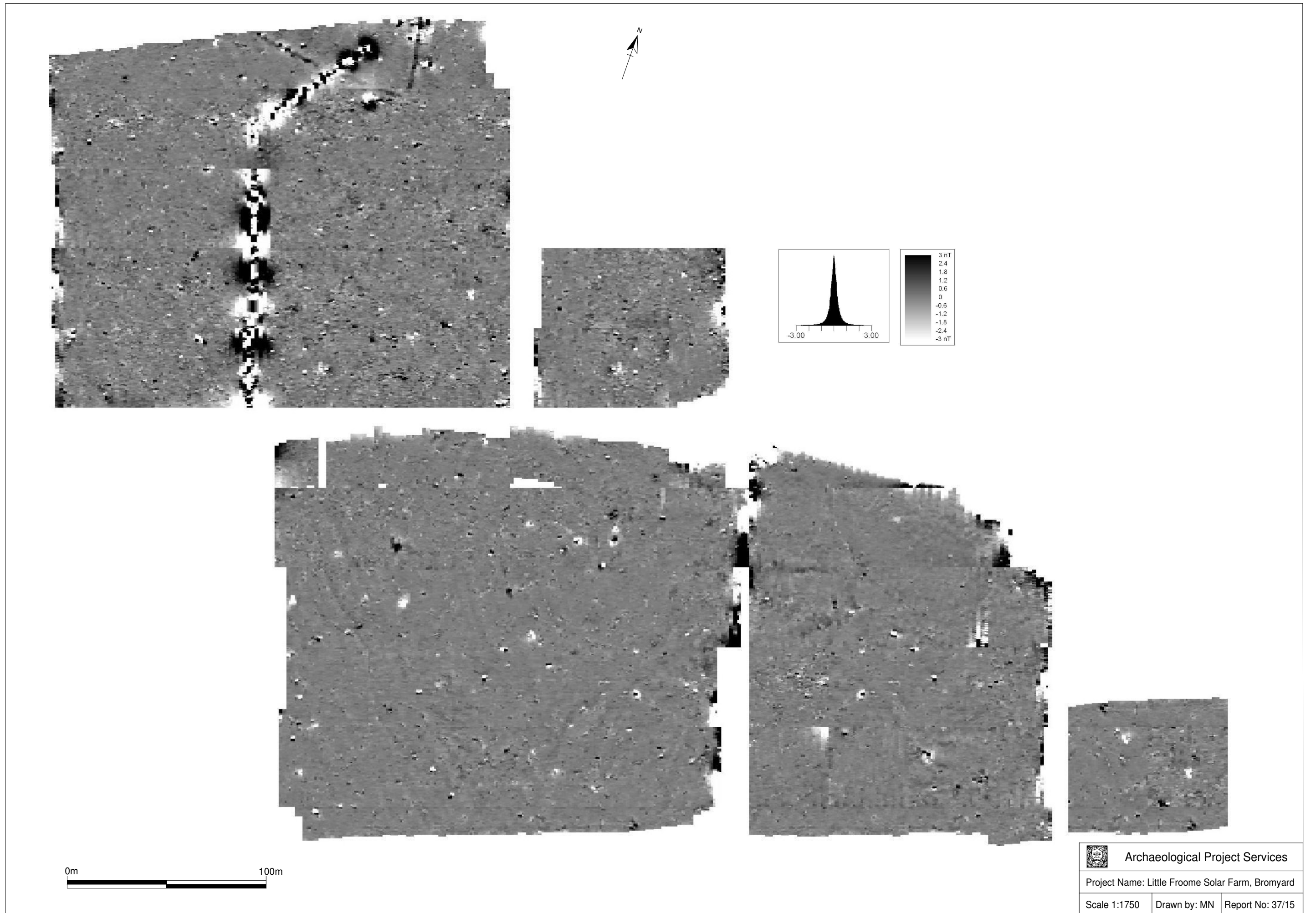



Figure 6 - Area A Processed data greyscale plot

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Project Name: Little Froome Solar Farm, Bromyard		
Scale 1:1750	Drawn by: MN	Report No: 37/15

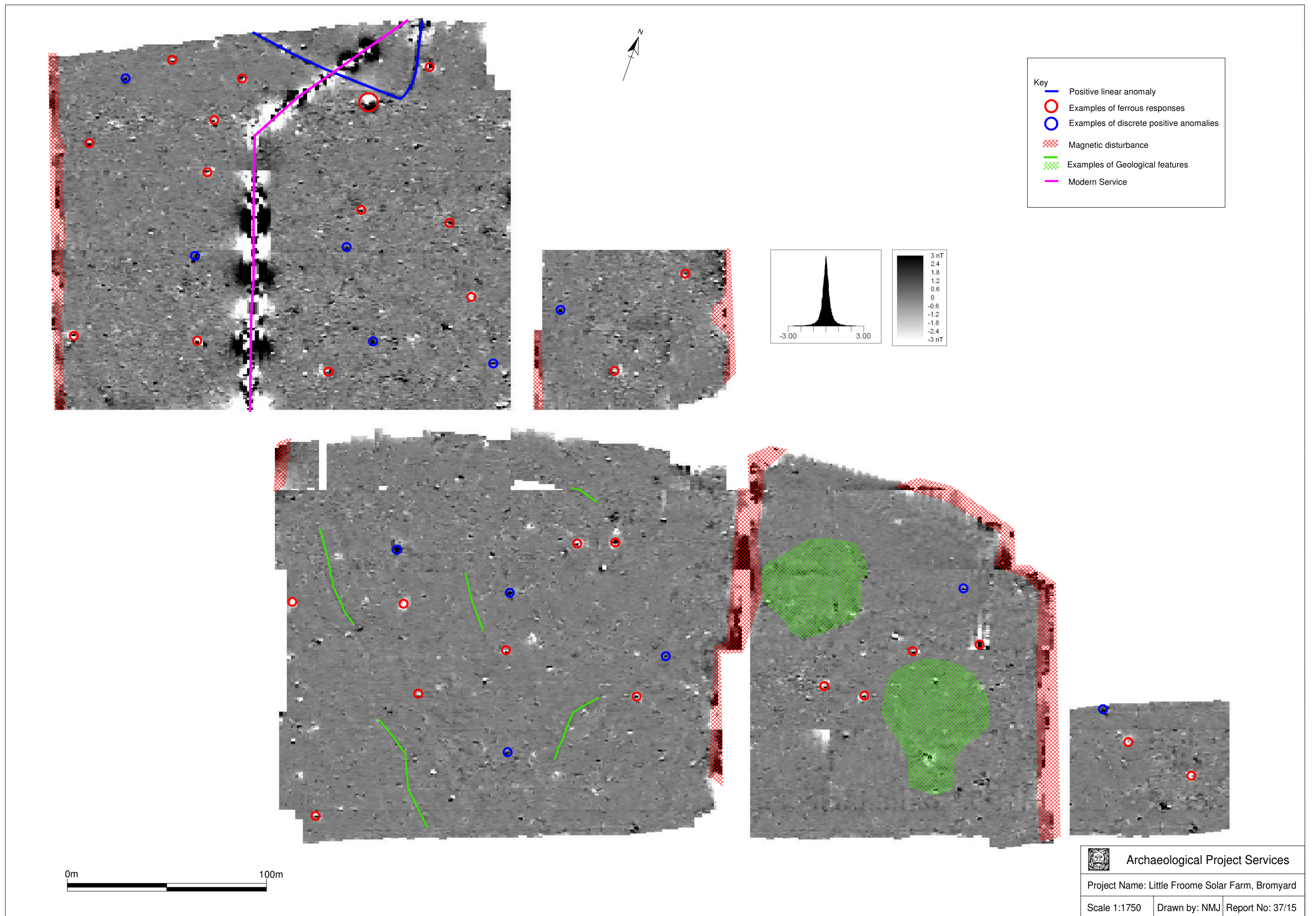
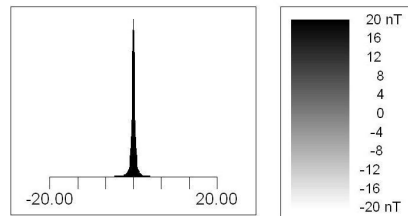
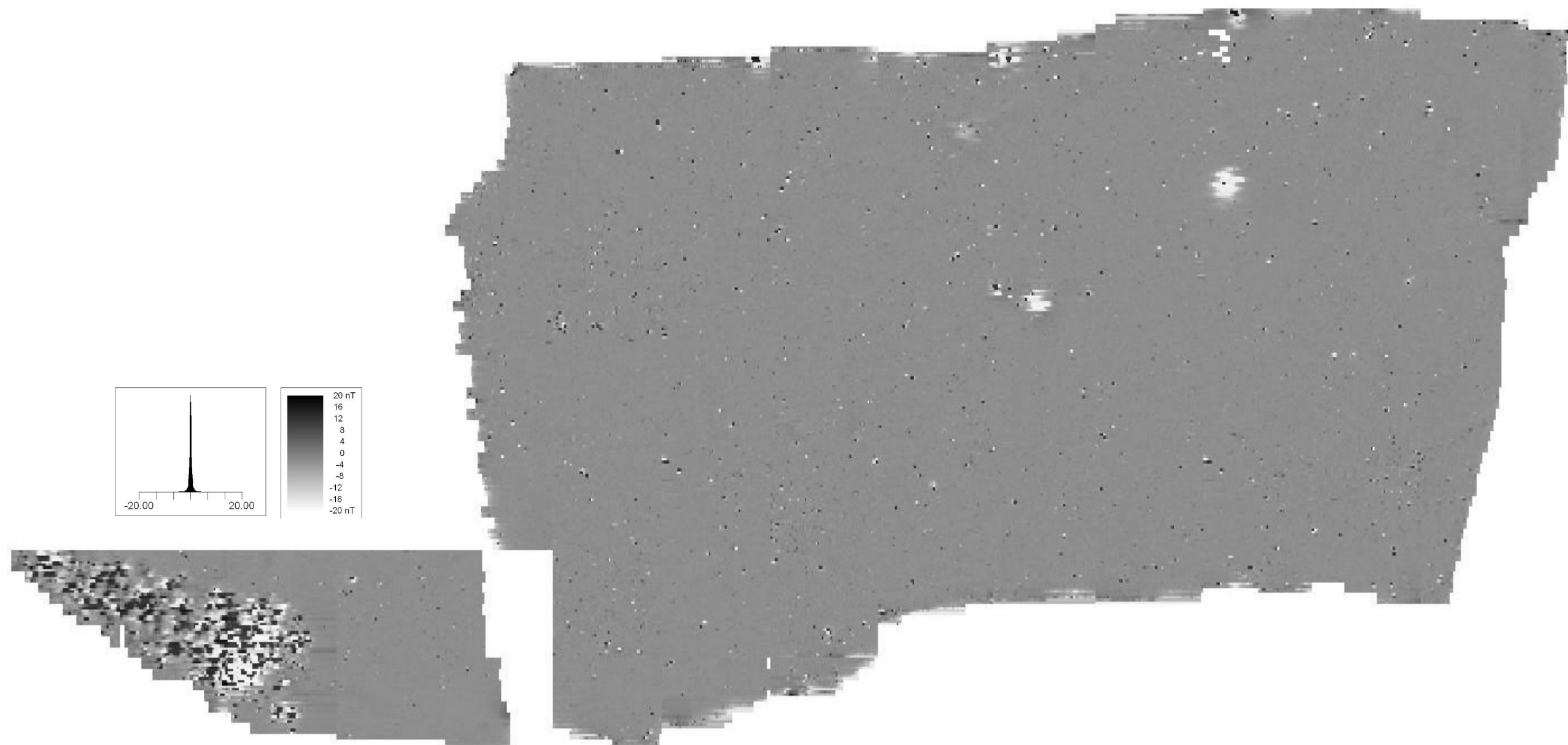


Figure 7 - Area A Interpretive greyscale plot




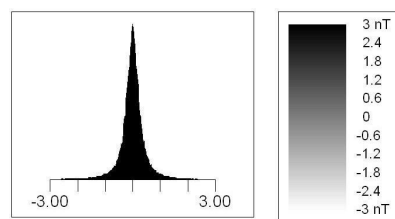
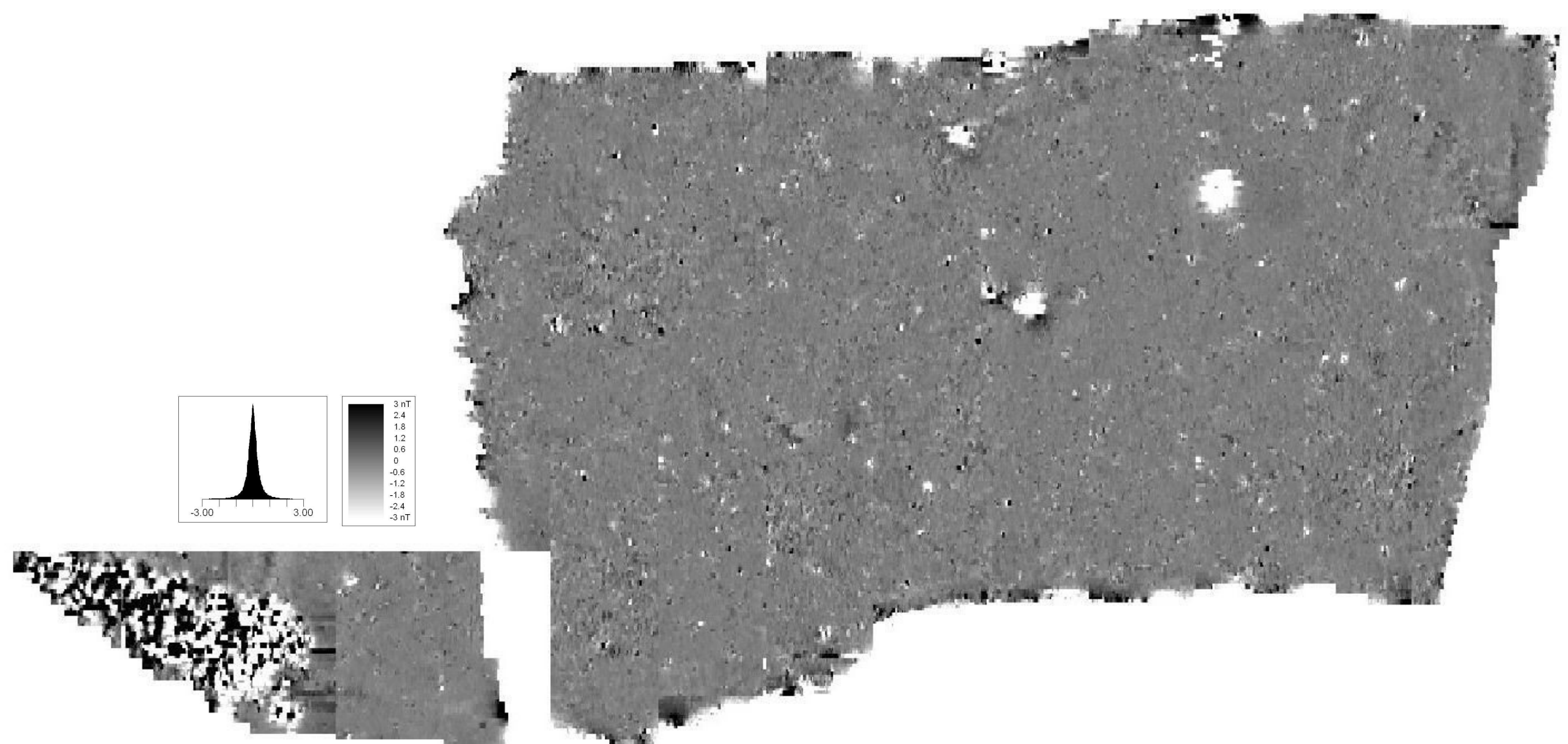
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Project Name: Little Froome Solar Farm, Bromyard		
Scale 1:1750	Drawn by: MN	Report No: 37/15

Figure 8 - Area B Minimally processed data greyscale plot




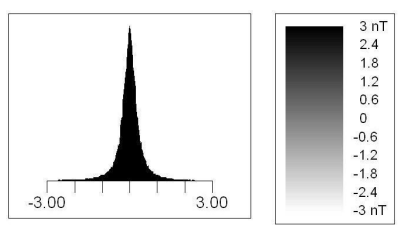
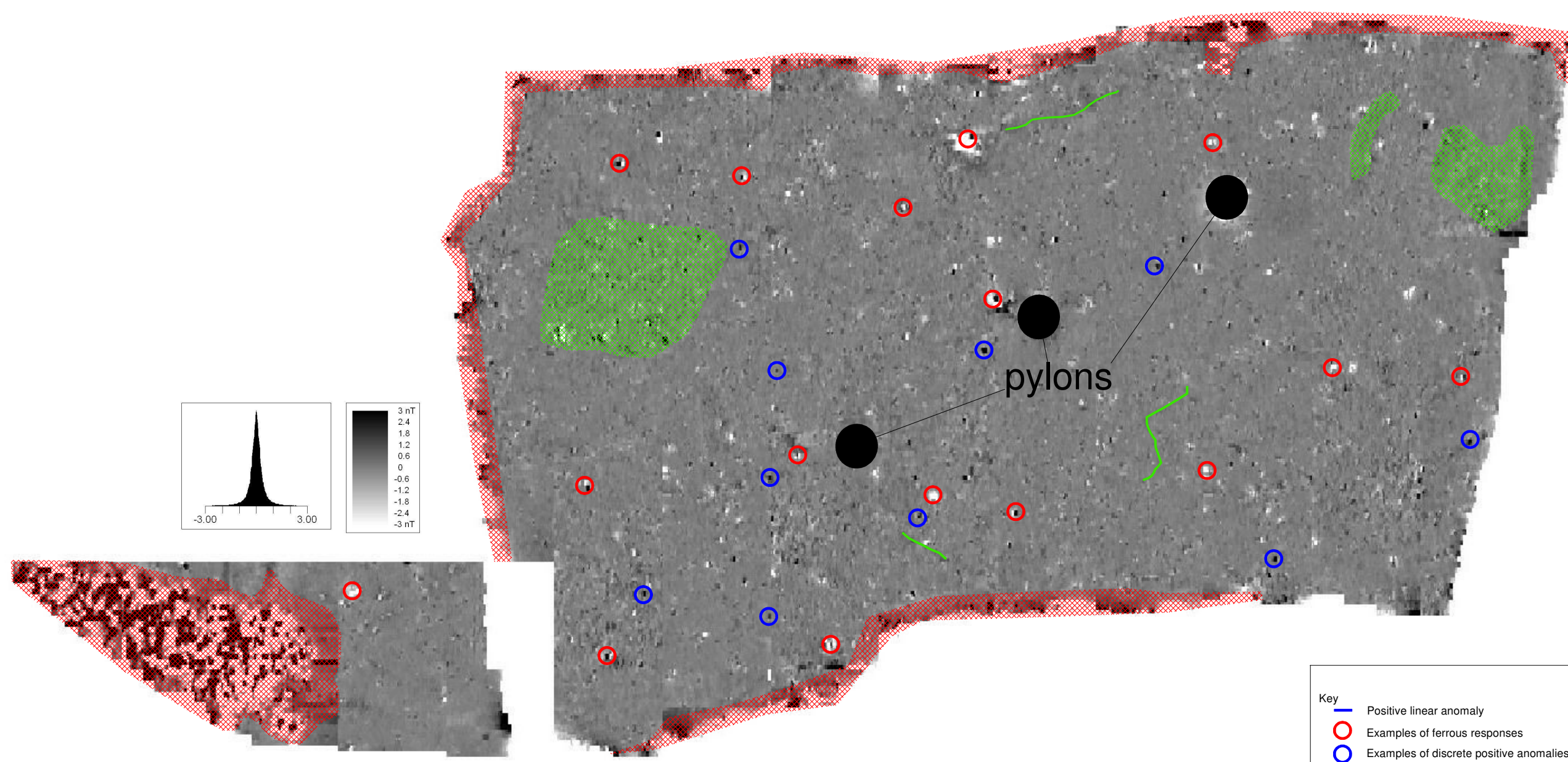
	Archaeological Project Services	
Project Name: Little Froome Solar Farm, Bromyard		
Scale 1:1750	Drawn by: MN	Report No: 37/15

Figure 9 - Area B, processed data greyscale plot



Key

- Positive linear anomaly
- Examples of ferrous responses
- Examples of discrete positive anomalies
- ▨ Magnetic disturbance
- ▨ Examples of Geological features


 Archaeological Project Services		
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Scale 1:1750	Drawn by: MN	Report No: 37/15

Figure 10 - Area B, interpretive greyscale plot

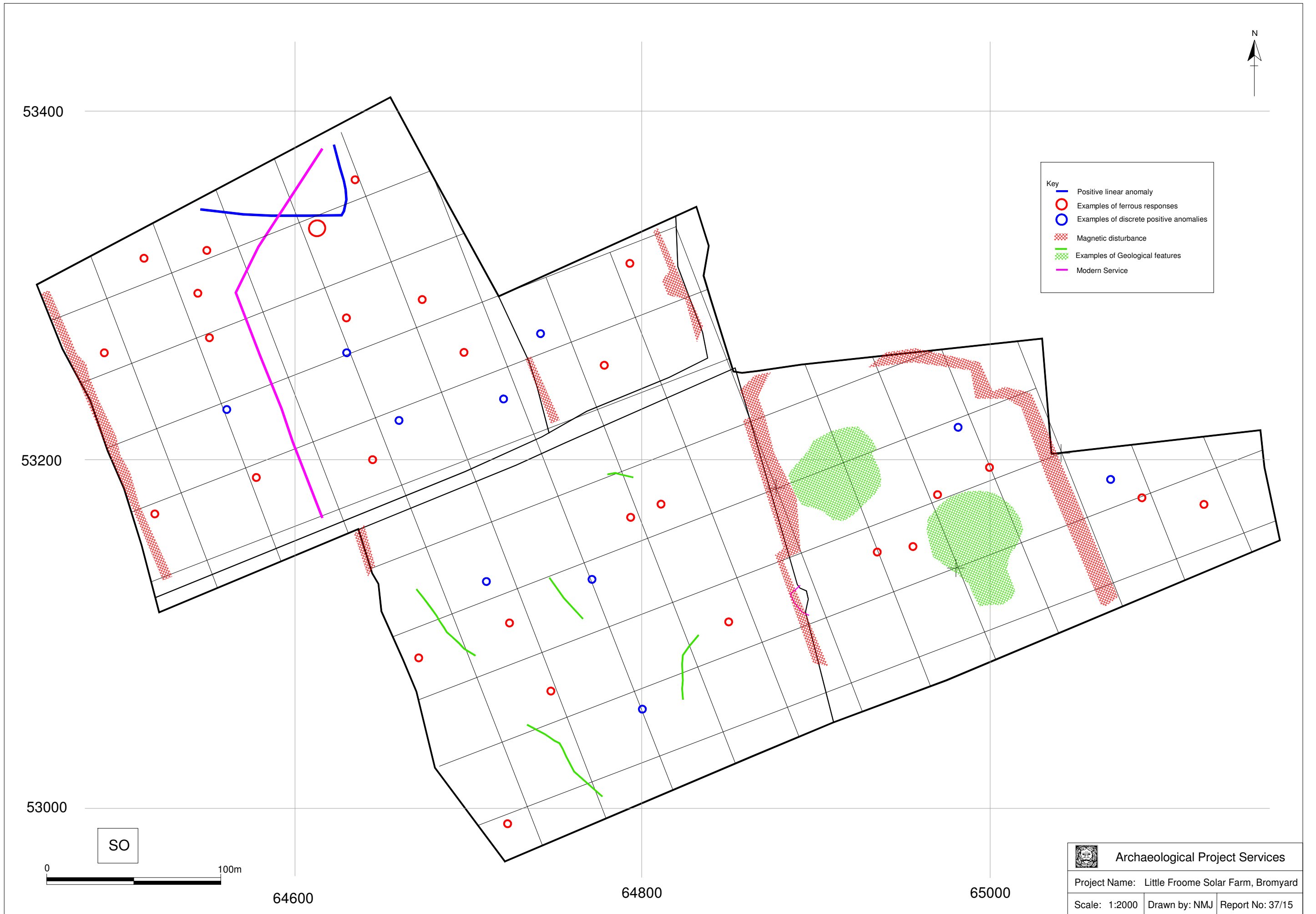


Figure 11 - Location and layout of survey area A, overlaid with interpretive plot



Figure 12 - Location and layout of survey area B, overlaid with interpretive plot

Appendix 1

THE ARCHIVE

The archive consists of:

- 6 Daily record sheets
- 1 Report text and illustrations
- Digital data

File names	BRLF 15_01-20.xgd BRLF 15_1000-1020.xgd BRLF 15_101-113.xgd BRLF 15_301-318.xgd BRLF 15_4001-4006.xgd BRLF 15_401-433.xgd	BRLF 15_w2101-w2108.xgd BRLF 15_w2301-w2314.xgd BRLF 15_w2401-w2404.xgd BRLF 15_w3001-w3007.xgd BRLF 15_y2001-y2005.xgd BRLF 15_y2201-y2209.xgd
Explanation of codes used in file names	xgd files are magnetometer grids, named with site code and number in the order surveyed. xcp files are composites containing record of all the data and processes used to produce the end product	
Description of file formats	All files are in plain text xml format with header data defining survey and processing parameters	
List of codes used in files	D indicates a "dummy" value within the composite data	
Hardware, software and operating systems	TerraSurveyor 2.5.15 running under Windows 7	
Date of last modification	13/04/15	
Indications of known areas of weakness in data		

All primary records are currently kept at:

Archaeological Project Services, The Old School, Cameron Street, Heckington, Sleaford, Lincolnshire
NG34 9RW

The ultimate destination of the project archive is:

Herefordshire Archive Service
Herefordshire Record Office
Harold Street
Hereford
HR1 2QX

Archaeological Project Services Site Code:

BRLF15

OASIS record number

archaeo11-208691

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OASIS ID: archaeol1-208691

Project details

Project name	LITTLE FROOME SOLAR FARM, BROMYARD, HEREFORDSHIRE
Short description of the project	Detailed magnetic gradiometer survey was undertaken for BE Renewables in connection with proposed development on land near Bromyard, Herefordshire. The survey totalled c. 25.34ha. A single positive linear anomaly of clear archaeological origin has been identified in the north-western part of area A. This form a possible field boundary or enclosure possibly dating to the Roman period. A number of discrete positive responses might represent isolated pit features but these are not strong and are difficult to interpret on the basis of form alone.
Project dates	Start: 30-03-2015 End: 13-04-2015
Previous/future work	No / Not known
Type of project	Field evaluation
Methods & techniques	""Geophysical Survey""
Development type	solar farm
Prompt	Direction from Local Planning Authority - PPG16
Position in the planning process	Pre-application
Solid geology (other)	st maughans formation
Drift geology (other)	none
Techniques	Magnetometry

Project location

Country	England
Site location	HEREFORDSHIRE HEREFORDSHIRE BROMYARD AND WINSLOW LITTLE FROOME SOLAR FARM, BROMYARD, HEREFORDSHIRE
Study area	25.34 Hectares
Site coordinates	SO 64795 53257 52.1760404276 -2.51488773264 52 10 33 N 002 30 53 W Point

Site coordinates SO 65122 53928 52.182094239 -2.51017445347 52 10 55 N 002 30 36 W Point

Project creators

Name of Organisation Archaeological Project Services

Project brief originator Archaeological Project Services

Project design originator Neil Jefferson

Project director/manager Neil Jefferson

Project supervisor Neil Jefferson

Type of sponsor/funding body Developer

Entered by Jonathon Smith (info@apsarchaeology.co.uk)

Entered on 12 May 2015

OASIS:

Please e-mail Historic England for OASIS help and advice

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