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**GARENDON PARK  
LOUGHBOROUGH  
LEICESTERSHIRE**

**GEOPHYSICAL SURVEY**

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**Work undertaken for  
SLR Consulting**

**September 2011**

**Report produced by  
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**ARCHAEOLOGICAL  
PROJECT  
SERVICES**



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## 1. SUMMARY

*Detailed magnetic gradiometer survey was undertaken for SLR Consulting, acting on behalf of Biffa Waste Services Ltd, in connection with a proposed partial restoration scheme at Garendon Park, Loughborough, Leicestershire. The surveys totalled 7ha which covered the key areas of the historic planting scheme and its proposed partial restoration.*

*Few archaeological features of direct archaeological significance were identified within the geophysical survey. A curving arc (Anomaly A), at least 55m across, on the central southern edge of Area 5 is the clearest and most convincing. This corresponded closely with a cropmark, together suggesting the presence of a ditched enclosure in this part of the field and lends more confidence that the lack of response elsewhere reflects a relative lack of features, at least of similar character, elsewhere.*

*None of the survey anomalies can be seen to match elements of the earlier tree planting scheme with any confidence. A large area anomaly (H) giving strong bipolar responses corresponds to the position of a pond or quarry on early mapping. A concentration of post-medieval debris noted during the survey presumably results from infilling of this feature.*

## 2. INTRODUCTION

### 2.1 Definition of an Evaluation

Geophysical survey is a non-intrusive component of archaeological evaluation which is itself 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*’ (IFA 2008).

### 2.2 Background

Archaeological Project Services was commissioned by SLR Consulting on behalf of Biffa Waste Services Ltd to undertake detailed magnetometer survey totalling 7ha on land at Garendon Park, Loughborough, Leicestershire. The survey was carried out between the 5<sup>th</sup> and 8<sup>th</sup> September 2011.

### 2.3 Topography and Geology

Loughborough is located 15km north of Leicester in the Charnwood District of Leicestershire. Garendon Park lies immediately west of the town adjacent to the M1 at NGR 449500 318850 (Fig. 1).

The site is situated in an undulating landscape on the northern edge of Charnwood Forest west of the valley of the River Soar, between c. 70m and 80m AOD rising from the south and east. The underlying geology is Wanlip sand and gravel over a solid geology of Mudstone.

## 3. AIMS

Archaeological site investigations are being undertaken in connection with a proposed partial restoration scheme at Garendon Park, Leicestershire (NGR 450, 319). The partial restoration would take the form of tree-planting and would be distributed within an area of 30ha in the south end of the Park. The park is a designated historic park (Grade II National Heritage List no 1000379) and contains a

number of listed buildings, including, adjacent to the SI area, White Lodge (Grade II, 1074493), The Triumphal Arch (Grade I, 1361136) and The Temple of Venus (Grade II\*, 1116109).

The aims and objectives of the SI are as follows (SLR 2011):.

### **Aims**

- to recover any available archaeological evidence for the historic park's planting scheme;
- to establish the extent and significance of any surviving archaeological remains within the proposed planting scheme area, so that necessary mitigation of the impact may be identified; and
- to provide sufficient information to permit an informed planning decision.

### **Objectives**

- to establish the exact alignments and spacing of the original tree avenues;
- to identify any other parkland features;
- to identify any currently unknown archaeological features within the application site, and establish their nature and extent; and
- to identify the extent of any areas devoid of archaeological features.

## **4. GEOPHYSICAL SURVEY**

### **4.1 Methods**

Location and layout of the survey area is shown in relation to the proposed planting scheme Figure 2. The weather and ground

conditions during the survey were dry. The survey area was throughout weathered soil, following the recent harvesting of a linseed crop.

Survey was undertaken in accordance with English Heritage (2008) and IfA (2010) guidelines and codes of conduct.

The magnetic survey was carried out using a dual sensor Grad601-2 Magnetic Gradiometer manufactured by Bartington Instruments Ltd. Although the changes in the magnetic field resulting from differing features in the soil are usually weak, 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 an estimate of the type of material present beneath the surface. Strong magnetic anomalies will be generated by buried iron-based objects or by kilns or hearths. More subtle anomalies representing pits and ditches can be seen where they contain fills which are richer in magnetic iron oxides and provides a contrast with the natural subsoil (but this can vary depending on the nature of the subsoil). Wall foundations can 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.

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 3600 sampling points in a full 30m x 30m 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 ArchaeoSurveyor 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. 'Despiking' is also performed to remove the anomalies resulting from small iron objects often found on agricultural land. Once the basic processing has flattened the background it is then possible to carry out further processing which may include low pass filtering to reduce 'noise' in the data and hence emphasise the archaeological or man-made anomalies.

The following shows 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): -5 to 5nT.

## 4.2 Results

The presentation of the data for the site involves a print-out of the raw data as greyscale and trace plots (Figs 3, 4, 6, 7, 9, 10, 12, 13, 15, 16, 18, 19; clipped to +/- 50nT for display but otherwise unprocessed), together with greyscale plots of the processed data (Figs 5, 8, 11, 14, 17, 20, 21). Magnetic anomalies have been identified and plotted onto an interpretative drawing (Fig. 22) and are described below.

#### *Linear positive anomalies*

Positive anomalies of probable archaeological origin are confined to Area 5. The clearest is **A**, a broad curving band giving a generally positive response (stronger, but somewhat discontinuous, at the western edge, more diffuse and possibly more complex to the east with a suggestion of internal structure). This anomaly corresponds closely with the plot of a cropmark recorded in the Leicestershire County Council Historic Environment Record (MLE575) and suggests the presence of a ditched enclosure in this part of the field. Just to the west, two short lengths of parallel linear **B** may also represent archaeological features (but their alignment matches that of drainage features noted across the field; see below).

Two positive area anomalies **C** and **D** are

noted towards either end of Area 4. This survey transect is aligned on the historic and proposed restoration planting schemes but no pattern can be discerned from these isolated anomalies. A number of other localised positive anomalies – e.g. at **E** – are also highlighted. These are different in response to the strong bipolar anomalies caused by iron items but form no clear pattern (i.e. are not apparently related to the historic planting scheme).

#### *Drainage features*

A few much fainter linear anomalies are also visible – e.g. at **F**. These may relate to patterns of land drainage also identified within trial trenching .

#### *Iron spikes (discrete bipolar anomalies)*

Iron items within the topsoil give a distinctive localised bipolar (strong negative and positive) 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. These are fairly widely scattered across the survey area.

#### *Modern/magnetic disturbance*

Highly elevated positive and negative readings are evident alongside wire fences on the northern boundary of Area 1 and adjacent to the corrugated iron shed on the northern edge of Area 2. A linear feature **G** here has the appearance of a modern service (subsequent trenching identified a metal cable on this line). Very strong bipolar responses are also evident forming a large oval **H** within Area 3. A concentration of post-medieval brick, tile and other debris was evident at the field surface at this position.

## 5. DISCUSSION

Few clearly archaeological features have

been identified within the geophysical survey. The curving arc **A**, at least 55m across, on the central southern edge is the clearest and most convincing. This confirms the evidence from aerial photography for a ditched enclosure in this part of the field and lends more confidence that the lack of response elsewhere reflects a relative lack of features, certainly of similar character, elsewhere.

None of the survey anomalies can be seen to match elements of the earlier tree planting scheme with any confidence. The large area anomaly **H** corresponds to the position of a pond recorded on Ordnance Survey mapping (25in scale, 1903). A concentration of post-medieval debris evident at the field surface presumably results from infilling of this feature.

## 6. ACKNOWLEDGEMENTS

Archaeological Project Services wishes to acknowledge the assistance of Gavin Kinsley of SLR who commissioned the project on behalf of Biffa Waste Services and provided advice on site. Tom Lane edited the report.

## 7. PERSONNEL

Project coordinator: Steve Malone  
Geophysical Survey: Steve Malone, Bryn Leadbetter  
Survey processing and reporting: Steve Malone

## 8. BIBLIOGRAPHY

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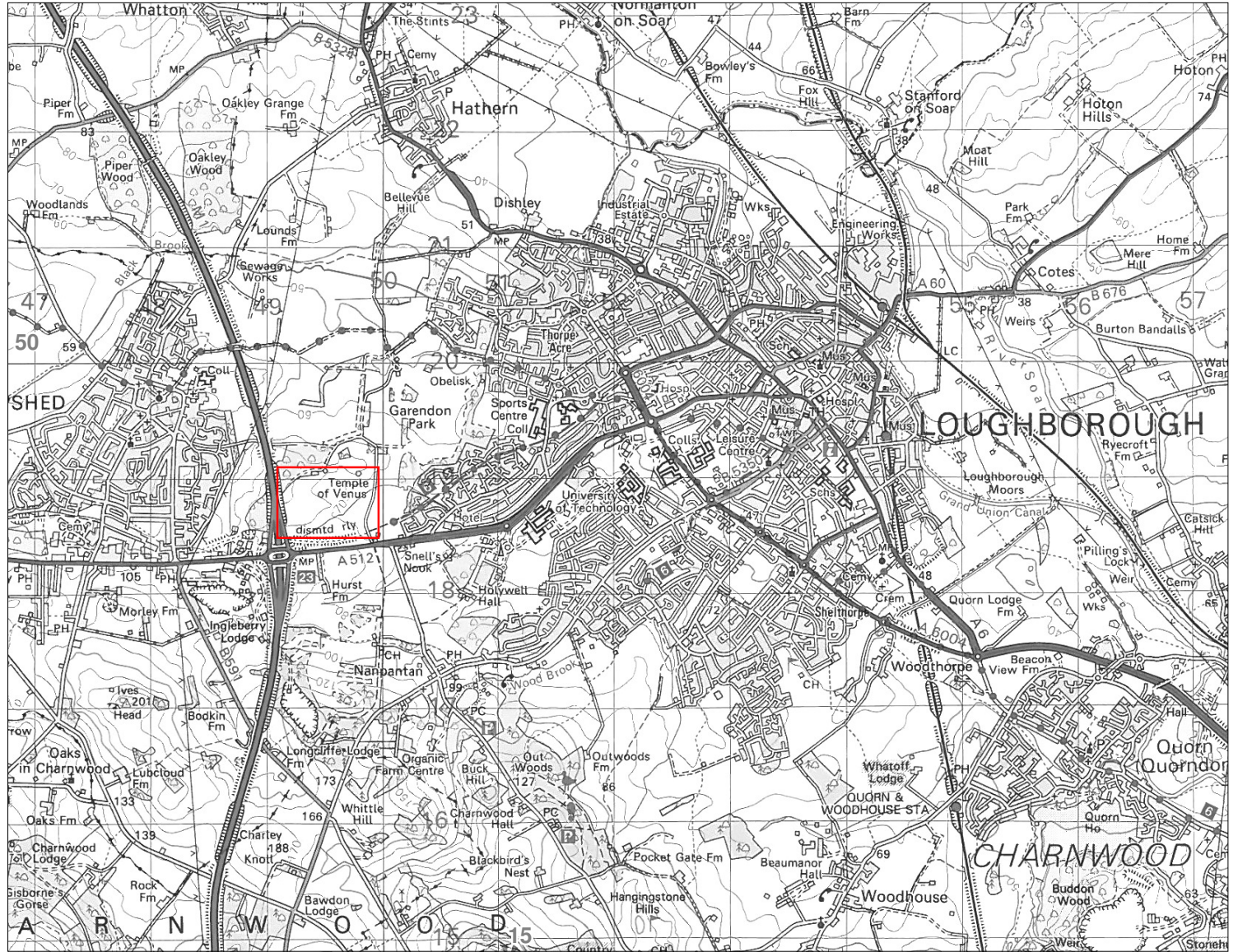
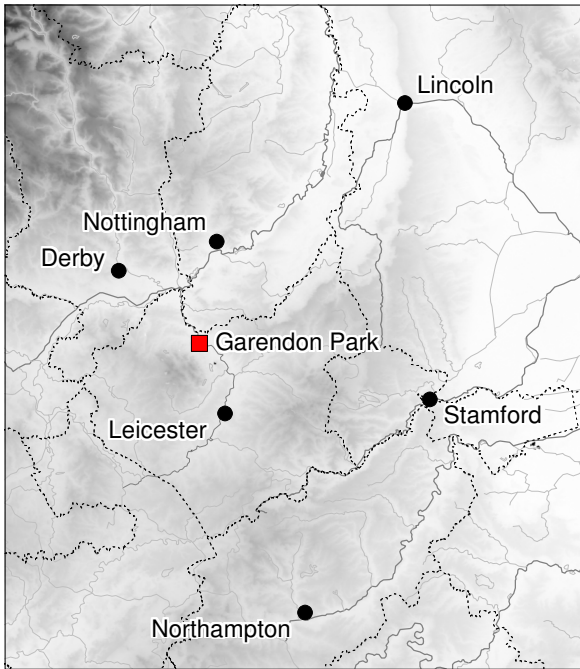
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IfA, 2010 *Draft Standard and Guidance for Geophysical Survey*

## **9. ABBREVIATIONS**

APS	Archaeological Project Services
BGS	British Geological Survey
EH	English Heritage
IfA	Institute for Archaeologists
HER	Historic Environment Record
SM	Scheduled Monument





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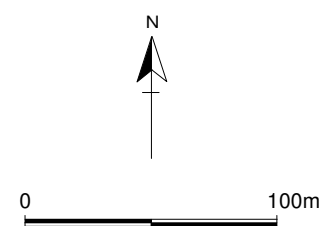
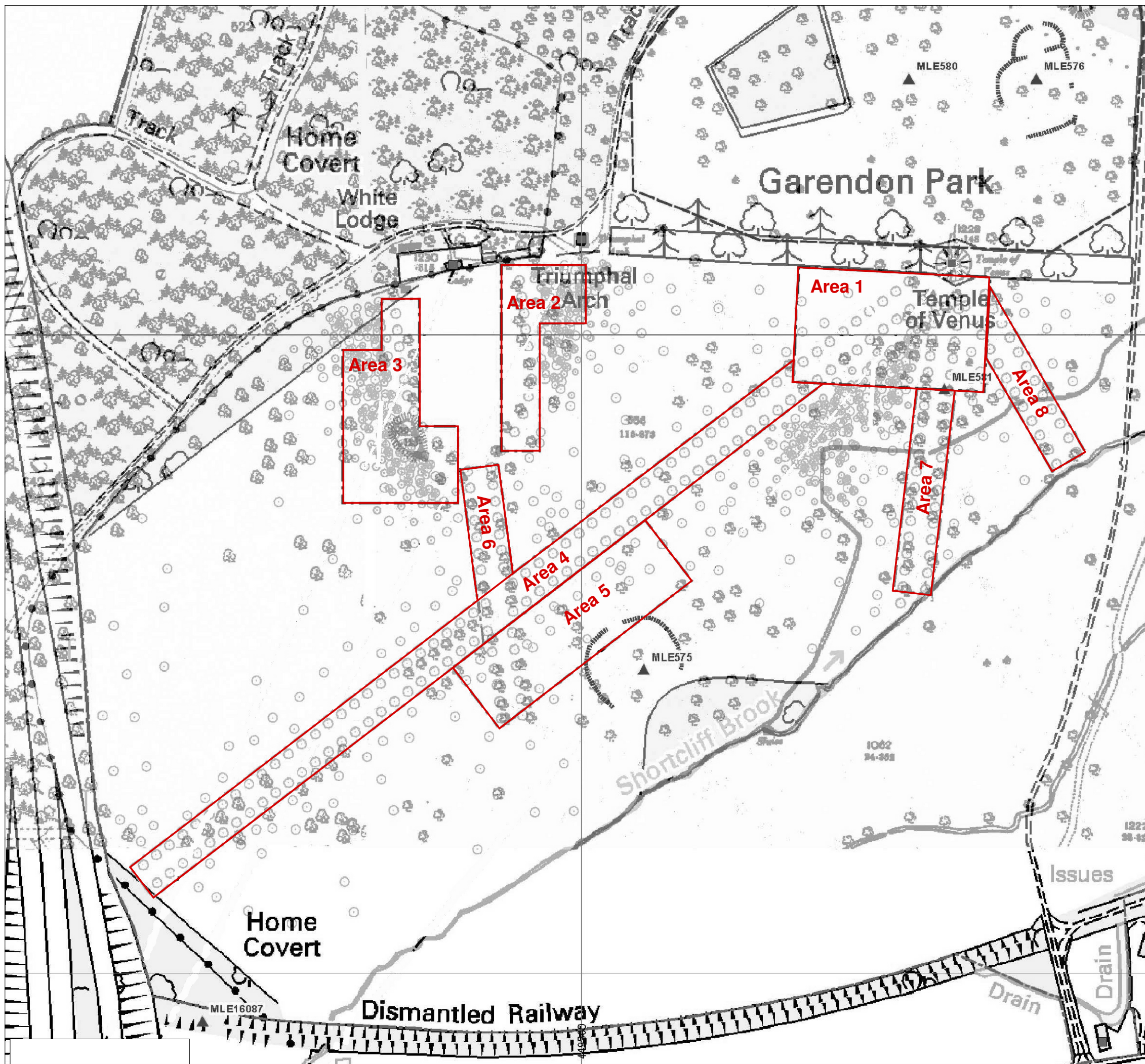
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Figure 1 Site location map




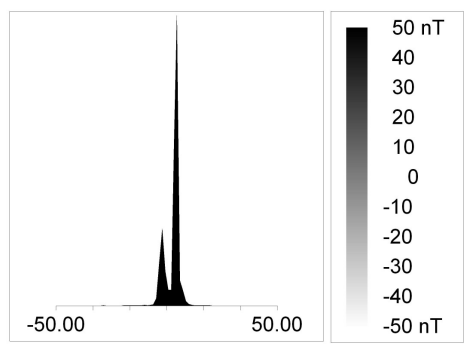
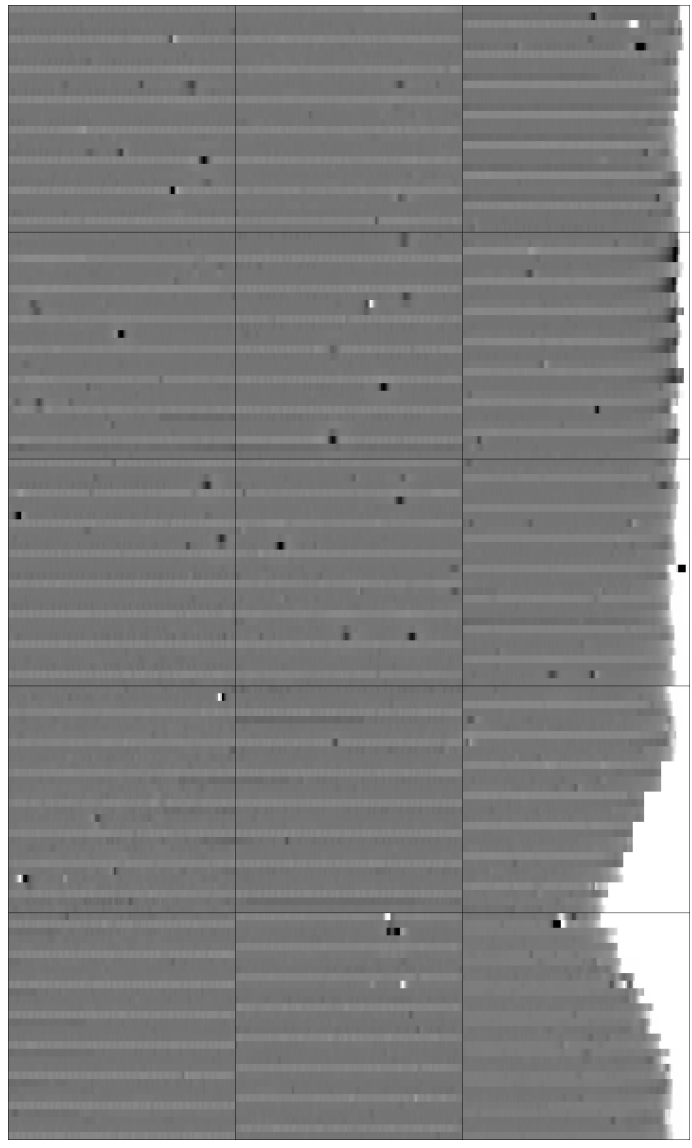
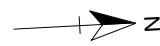
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Figure 2 Key to geophysical survey areas




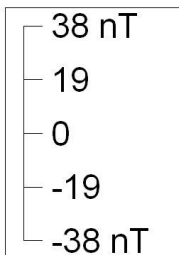
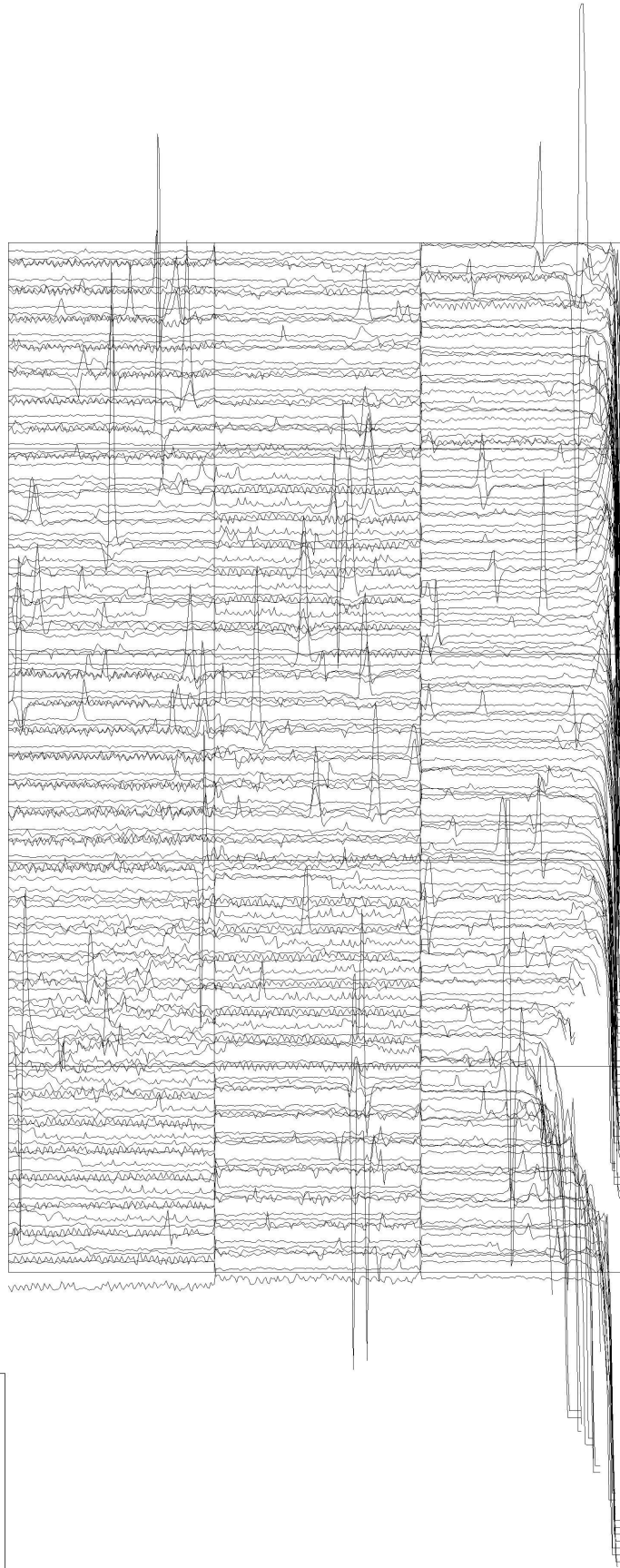
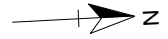
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Figure 3 Area 1: unprocessed data greyscale plot - clip +/-50nT




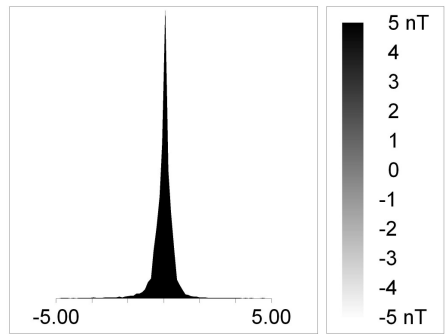
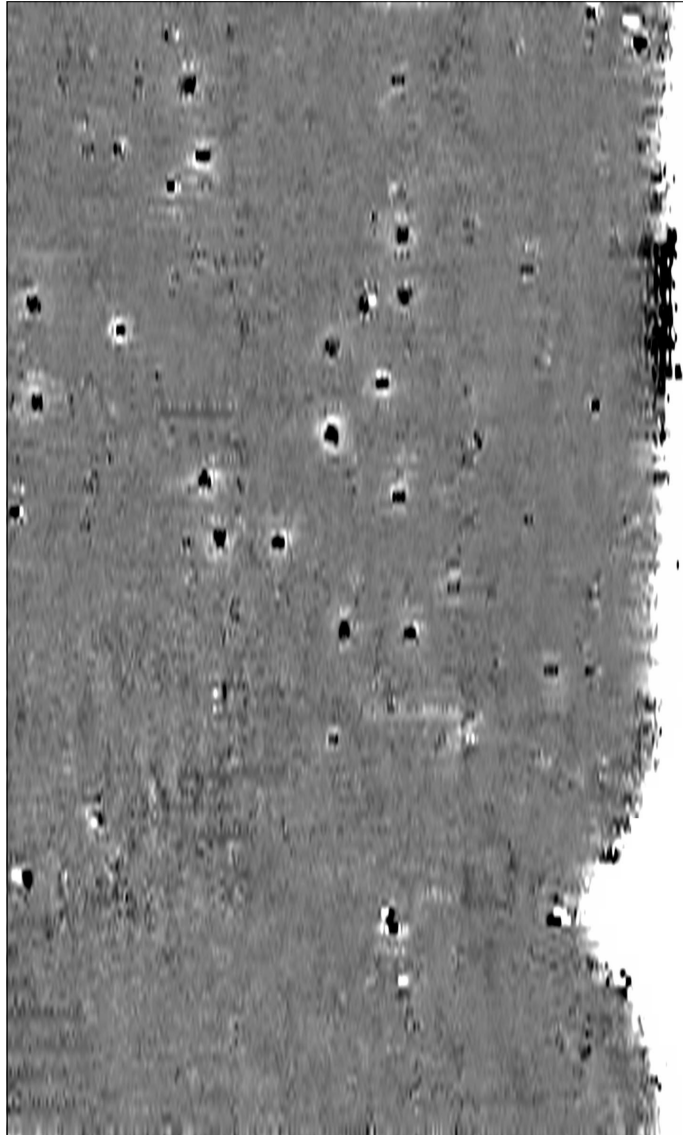
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Figure 4 Area 1: unprocessed data trace plot



0 50m


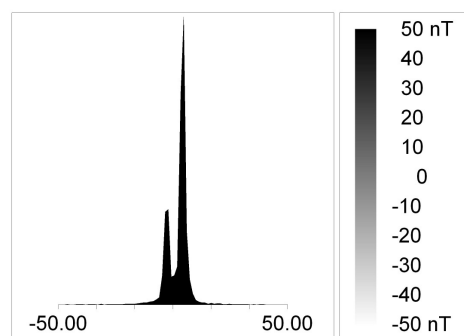
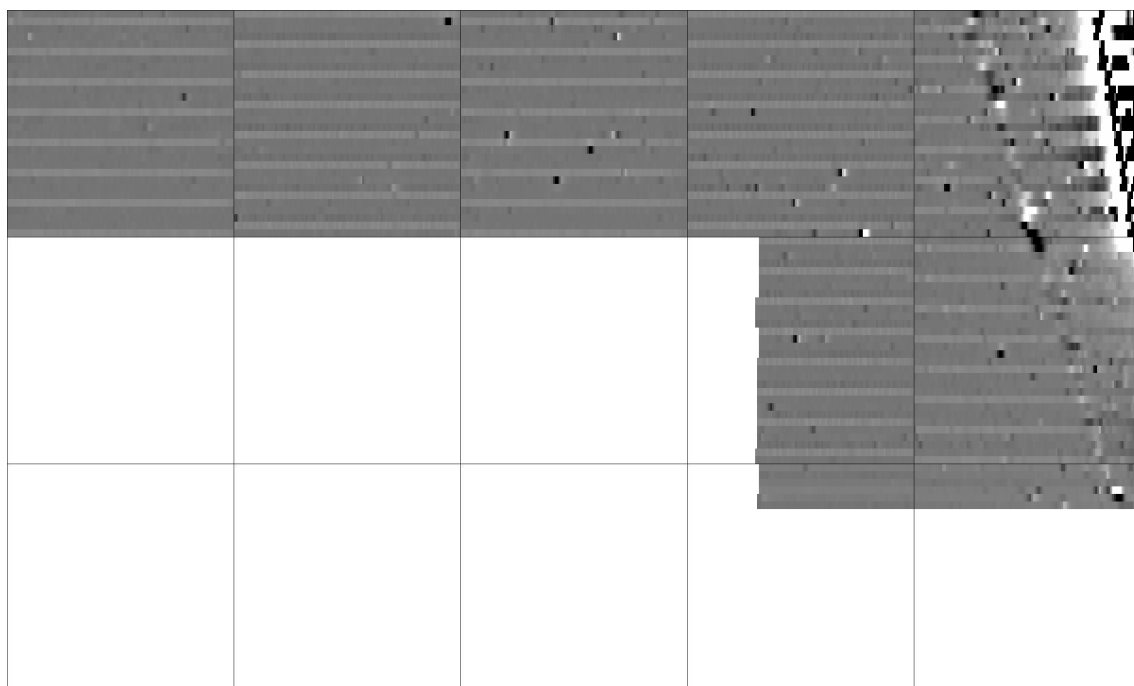
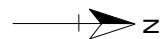
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Figure 5 Area 1: processed data greyscale plot




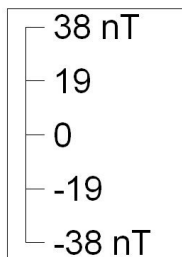
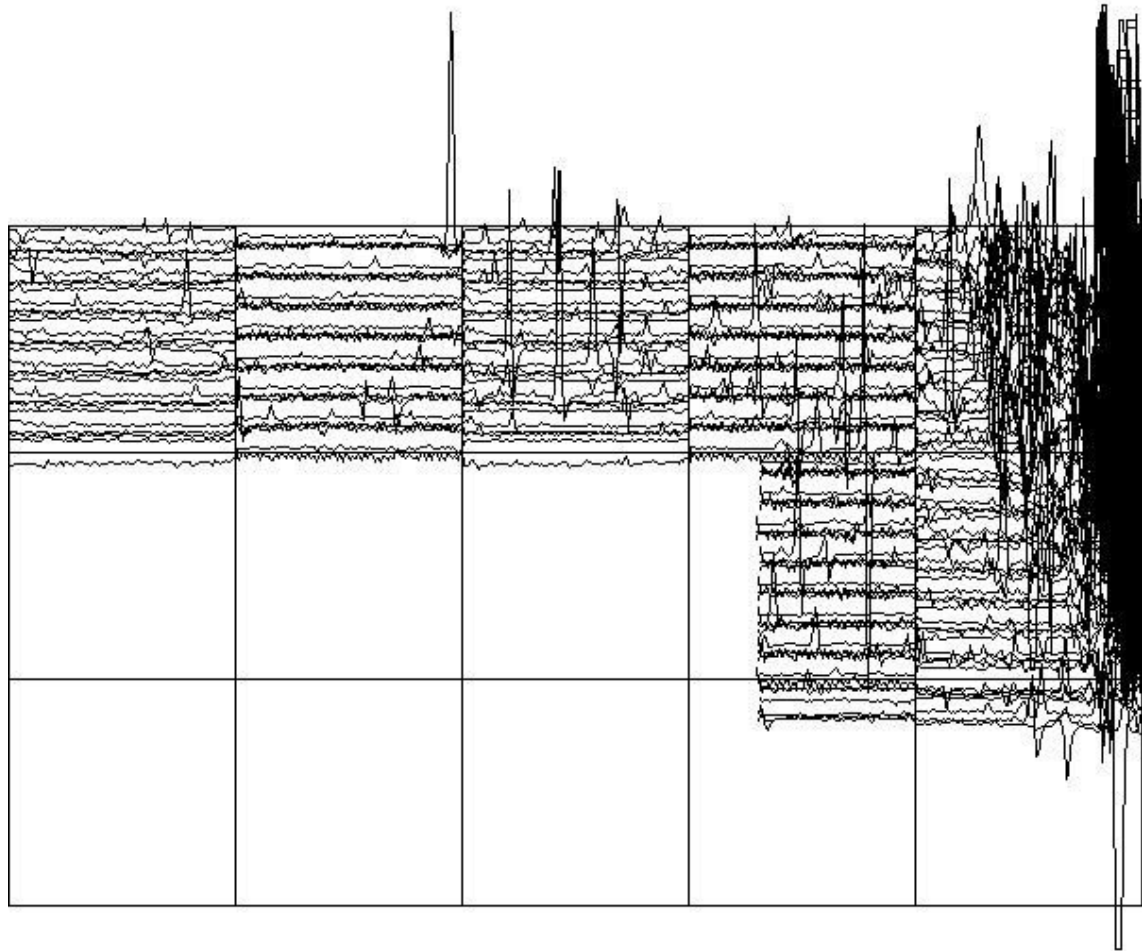
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Figure 6 Area 2: unprocessed data greyscale plot - clip +/-50nT




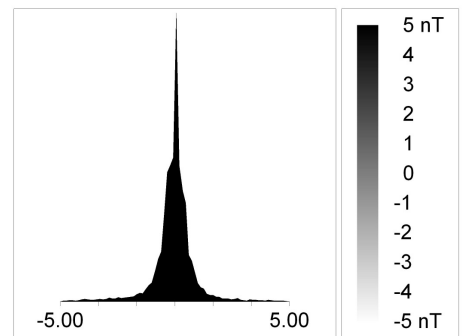
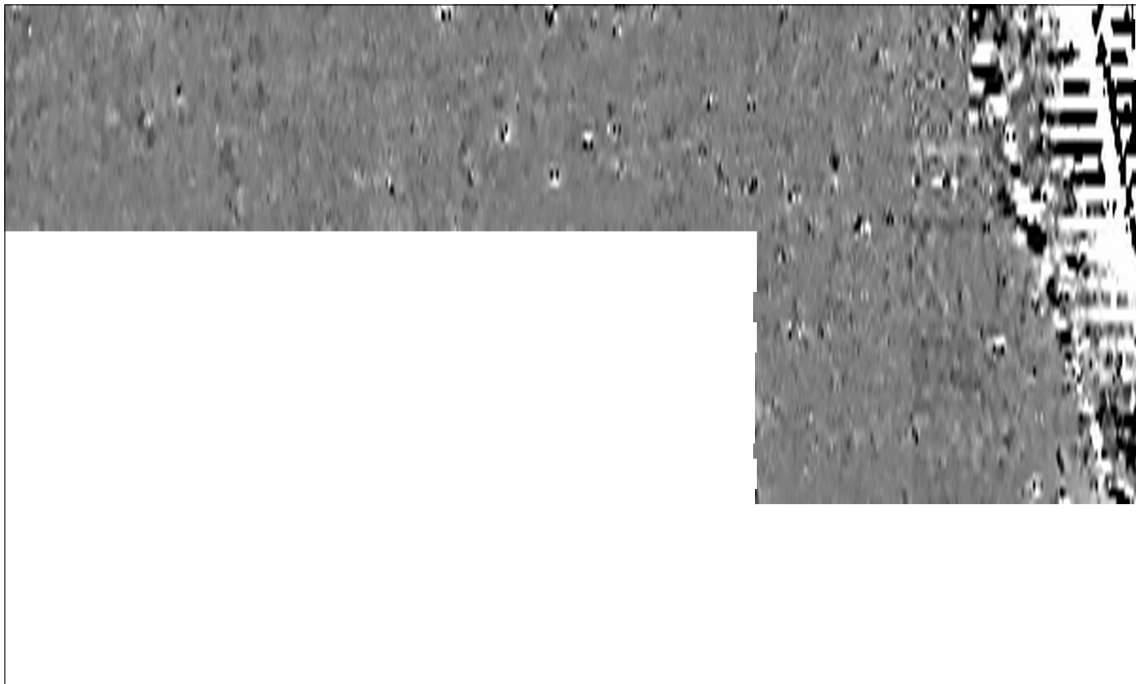
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Figure 7 Area 2: unprocessed data trace plot



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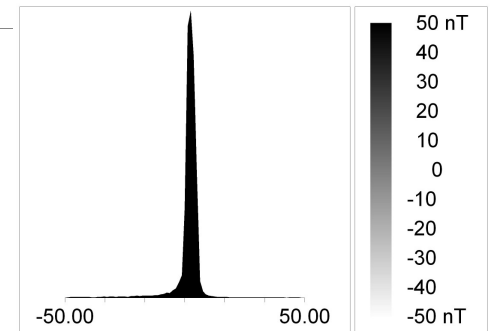
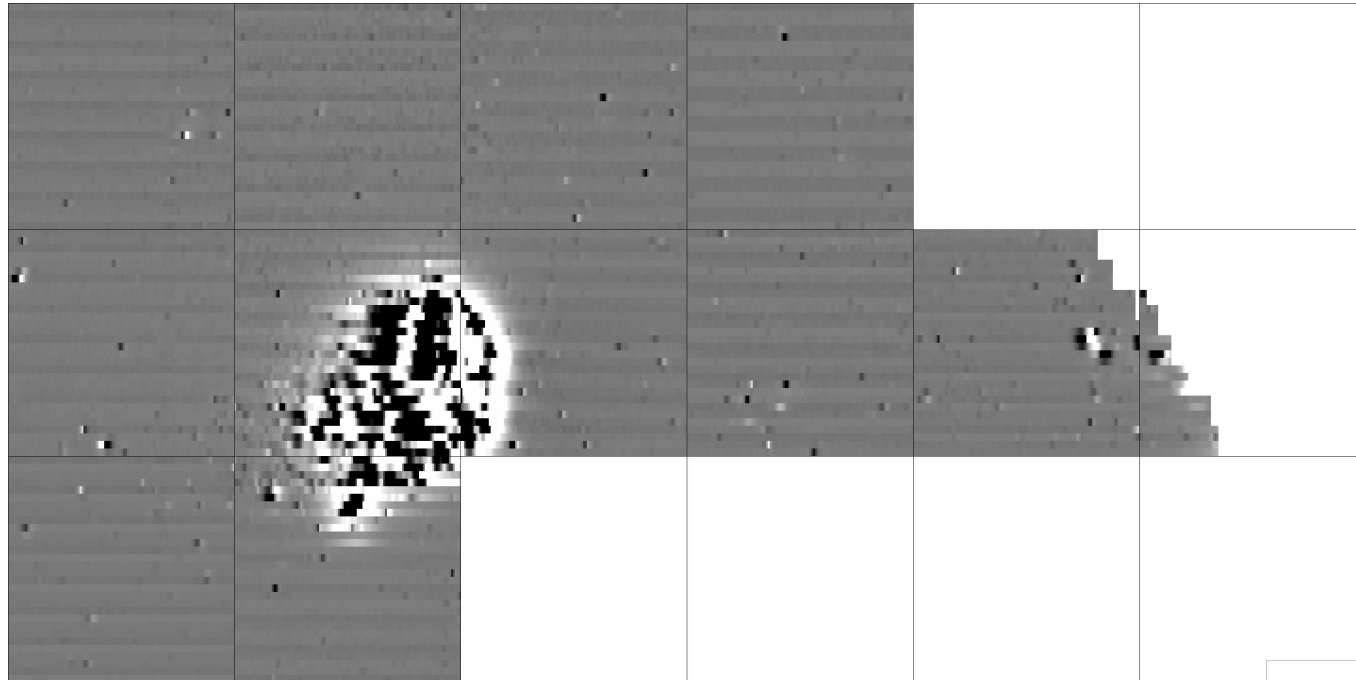
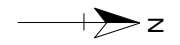
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Figure 8 Area 2: processed data greyscale plot





0 50m


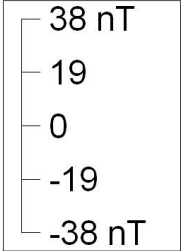
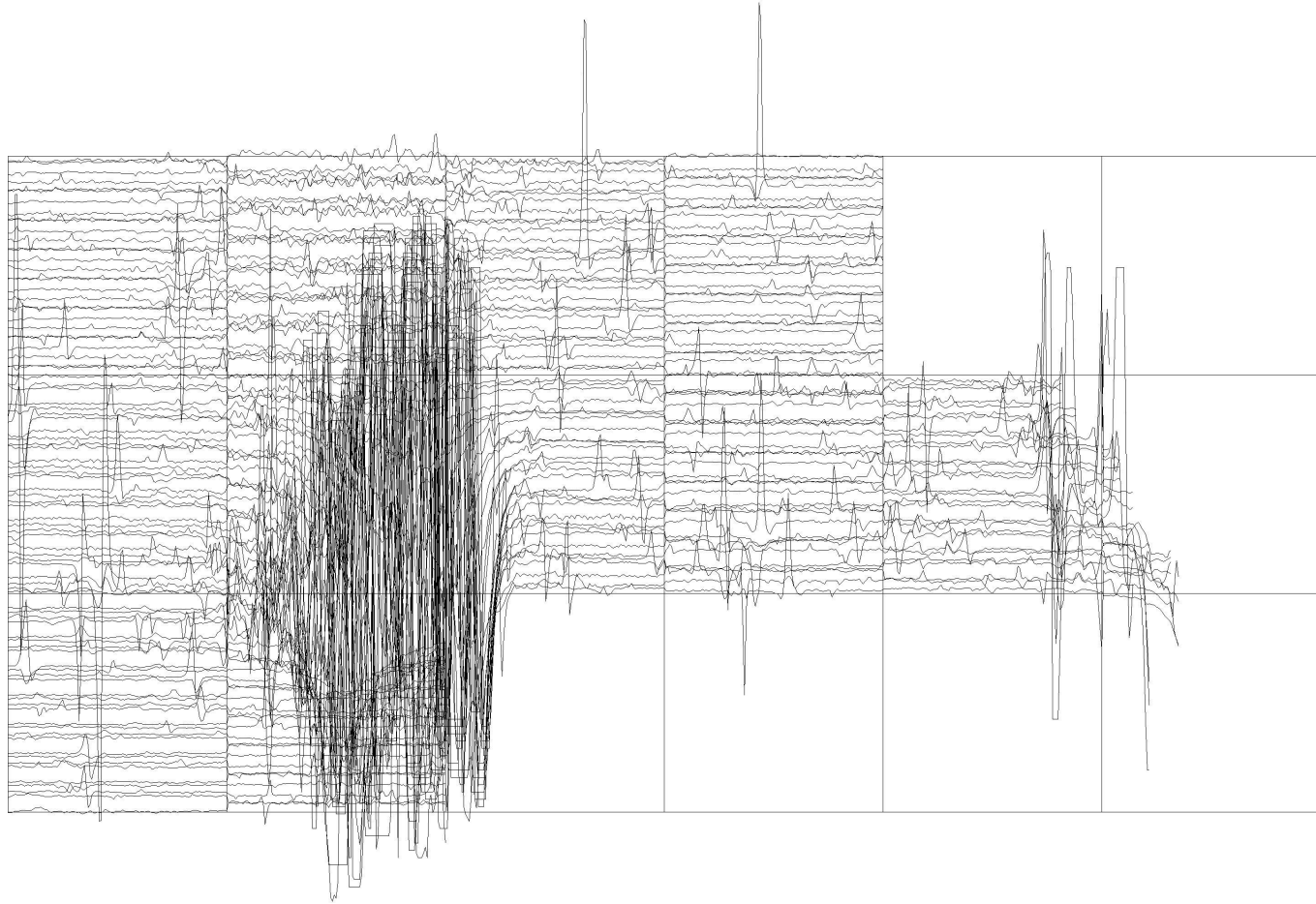
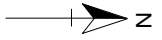
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Figure 9 Area 3: unprocessed data greyscale plot - clip +/-50nT



Archaeological Project Services

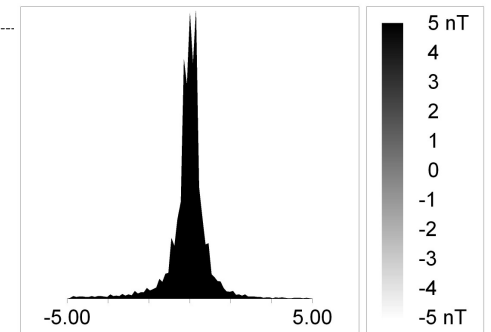
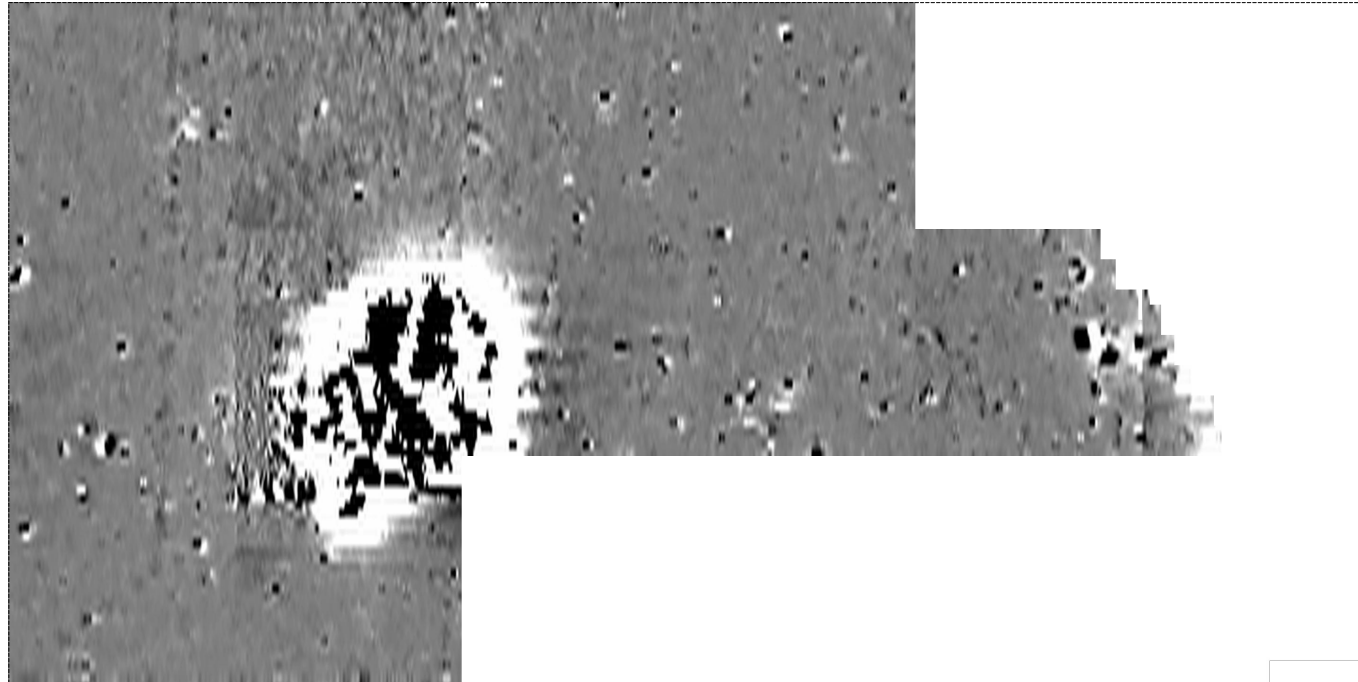
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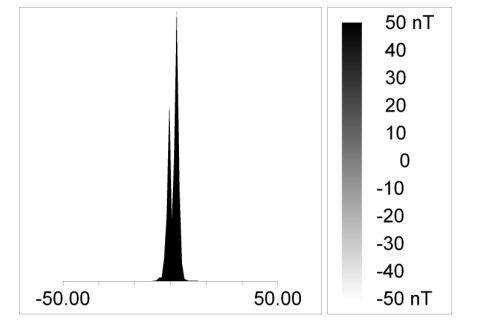
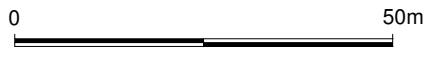
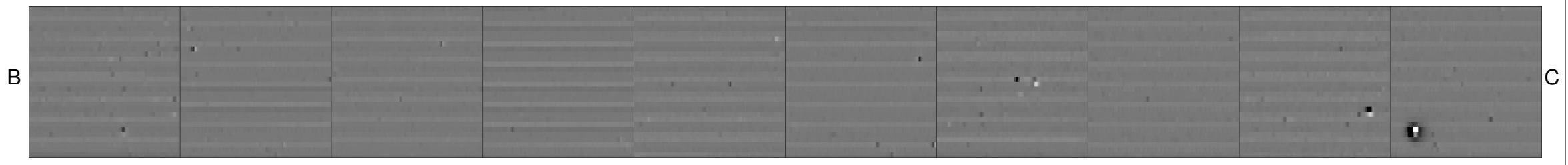
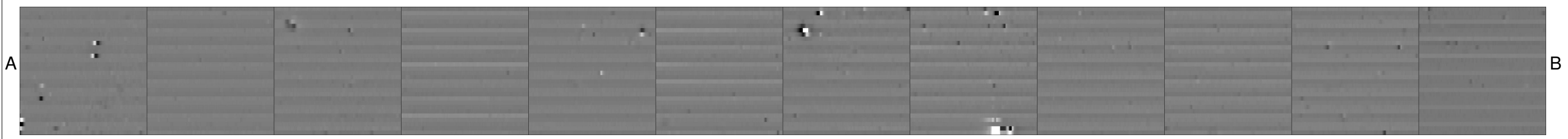
Figure 10 Area 3: unprocessed data trace plot



0 50m

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Figure 11 Area 3: processed data greyscale plot




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Figure 12 Area 4: unprocessed data greyscale plot - clip +/-50nT

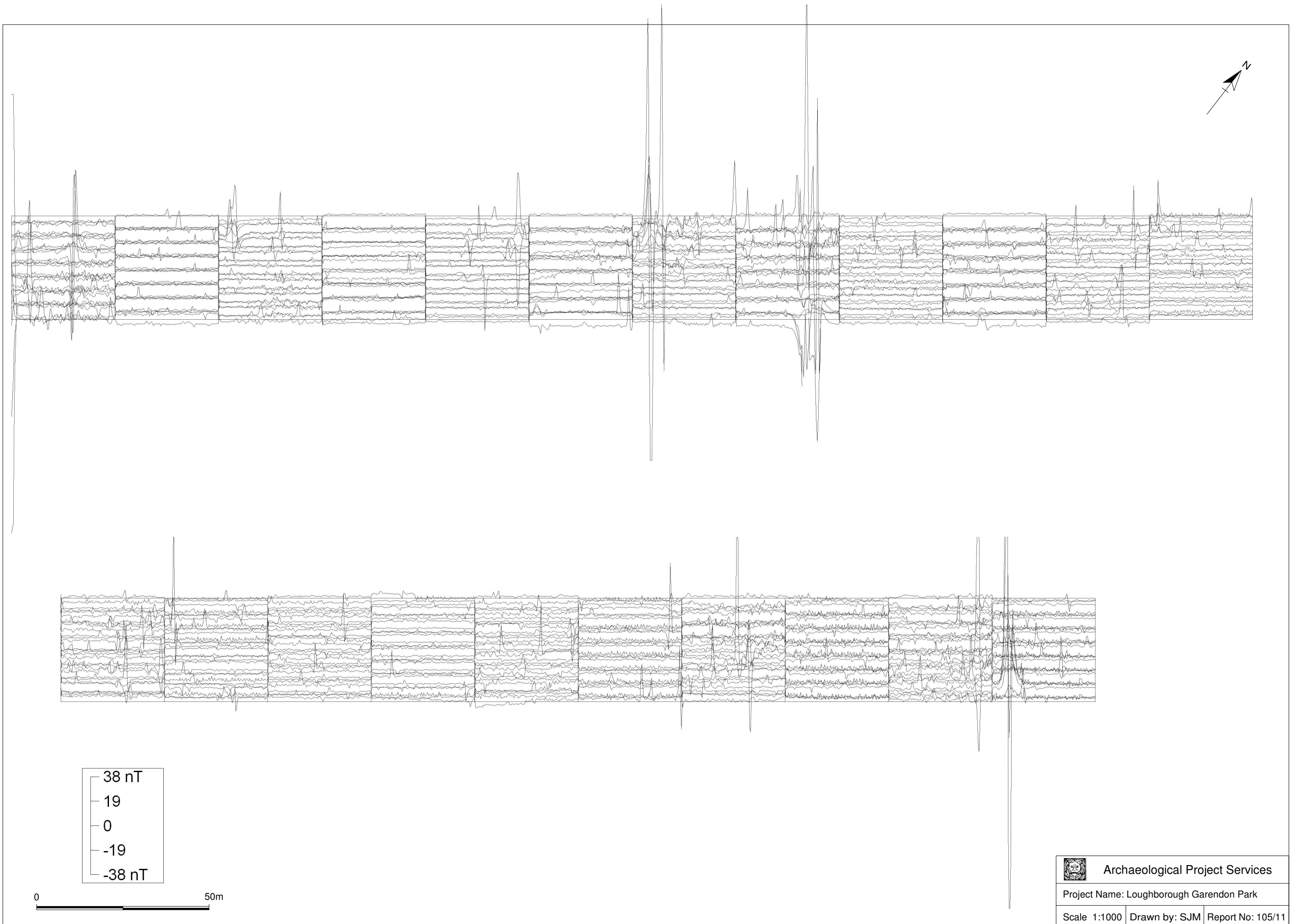
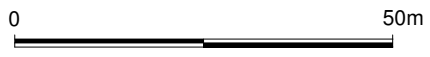
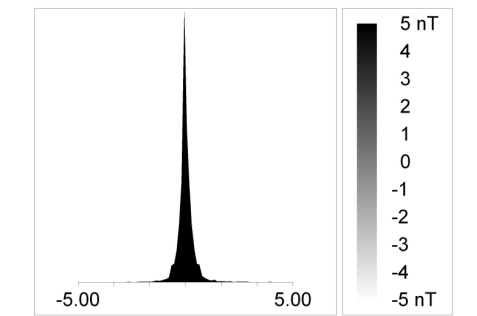
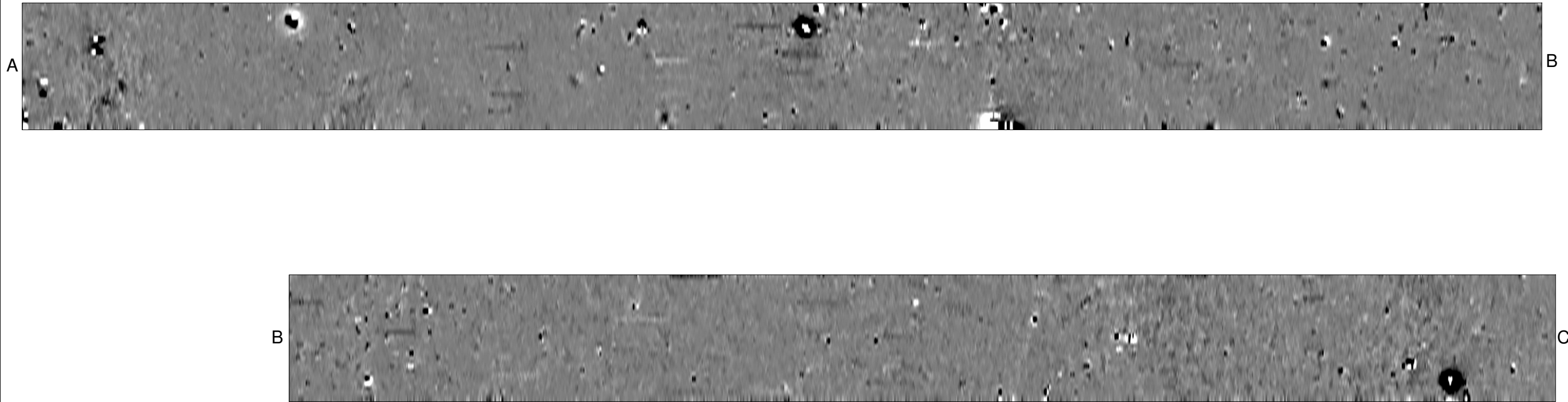


Figure 13 Area 4: unprocessed data trace plot




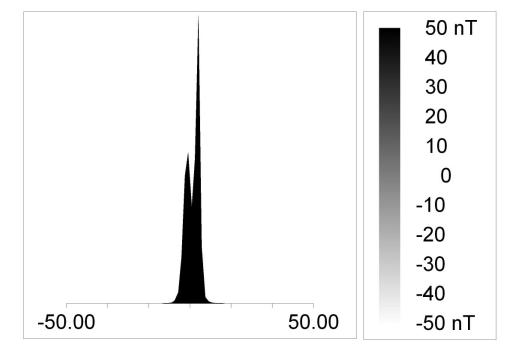
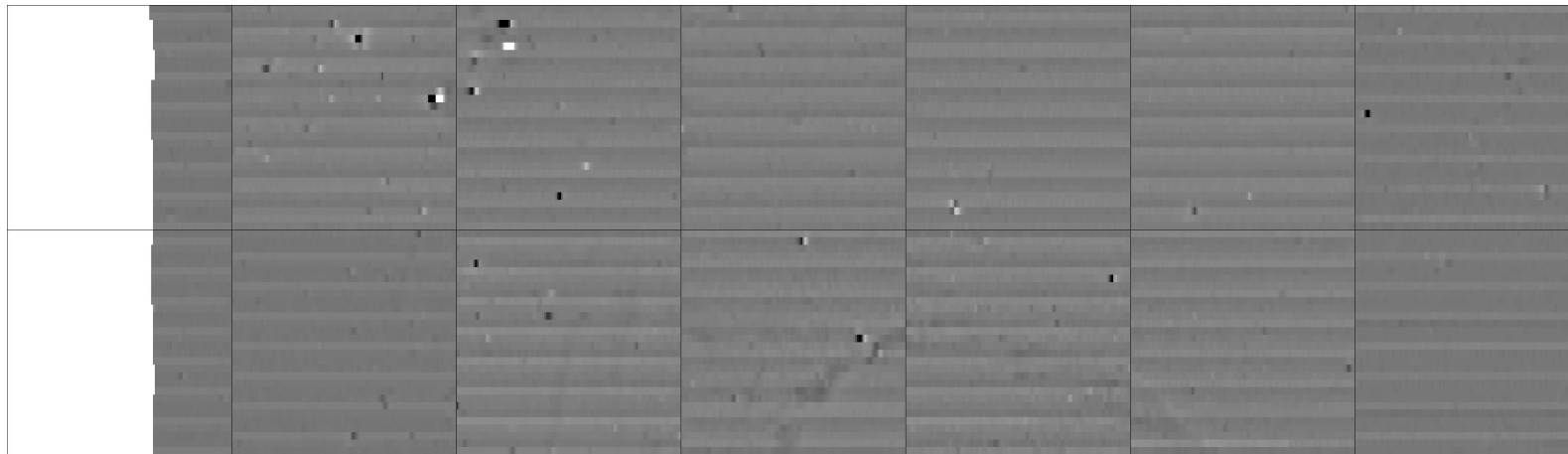
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Figure 14 Area 4: processed data greyscale plot




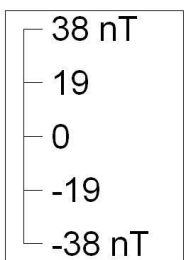
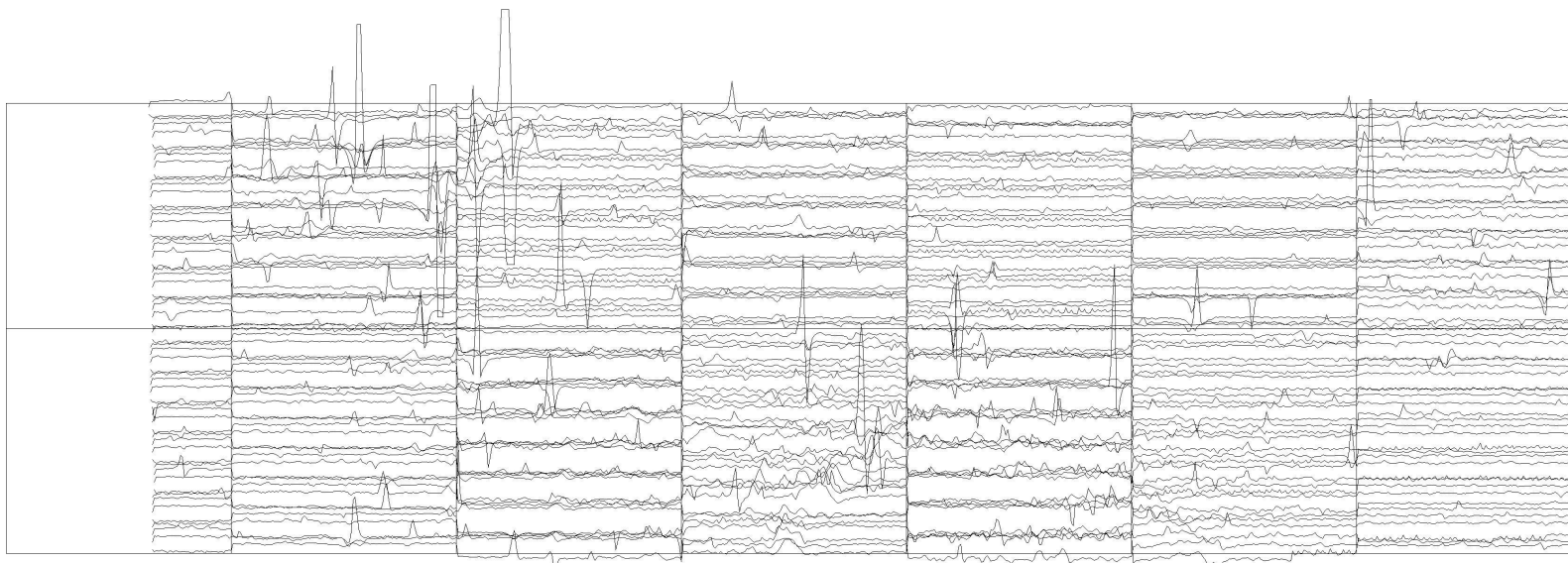
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Figure 15 Area 5: unprocessed data greyscale plot - clip +/-50nT




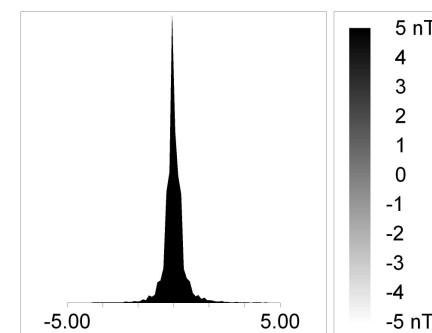
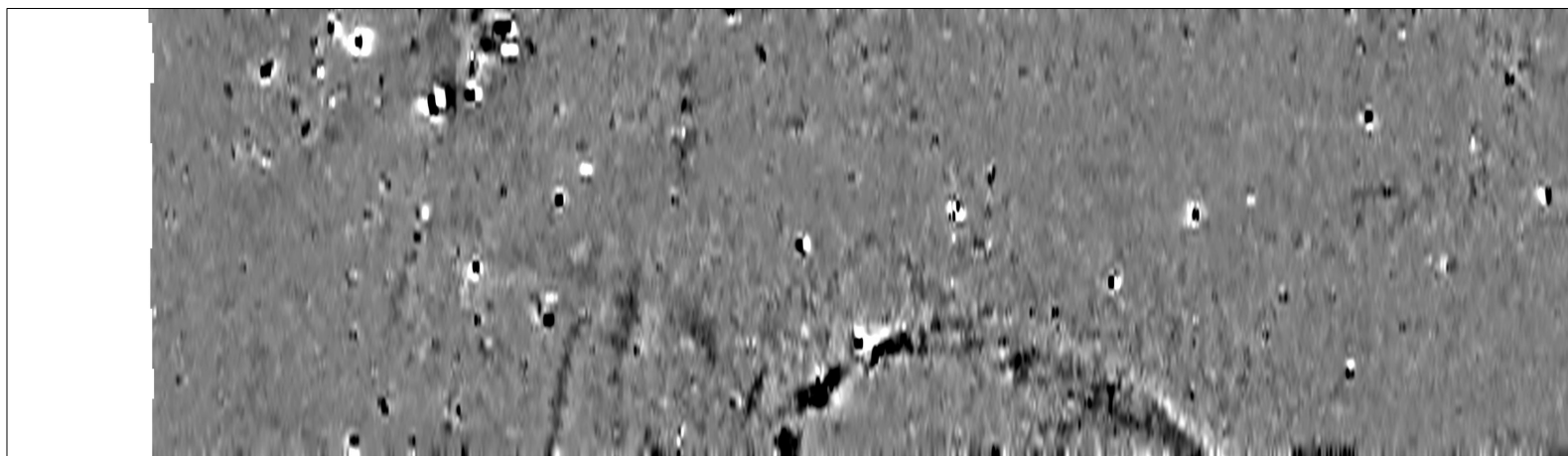
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Figure 16 Area 5: unprocessed data trace plot






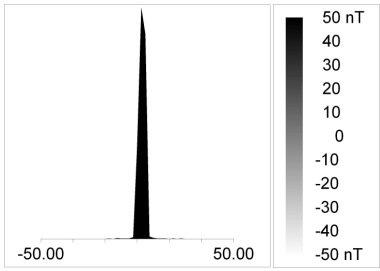
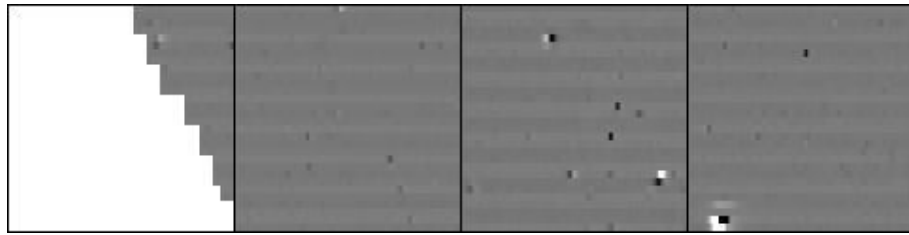
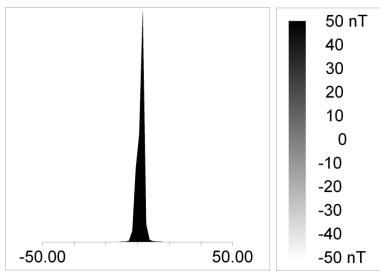
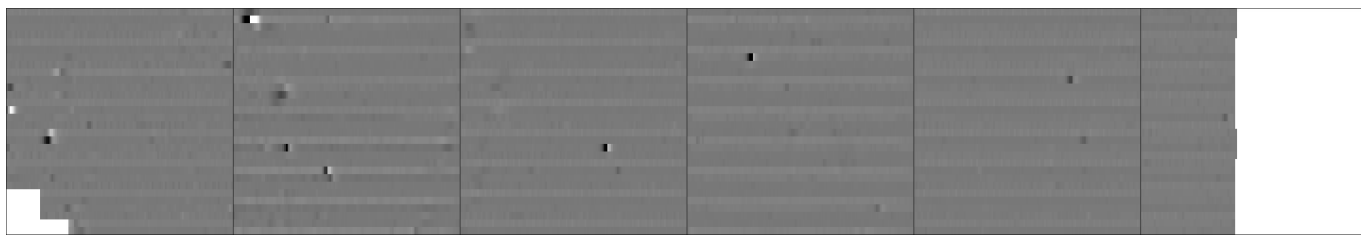
	<b>Archaeological Project Services</b>	
Project Name: Loughborough Garendon Park		
Scale 1:1000	Drawn by: SJM	Report No: 105/11

Figure 17 Area 5: processed data greyscale plot

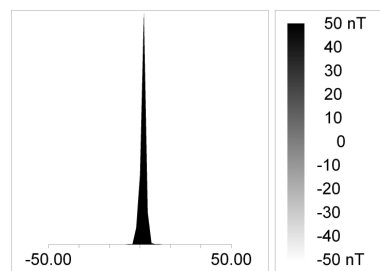
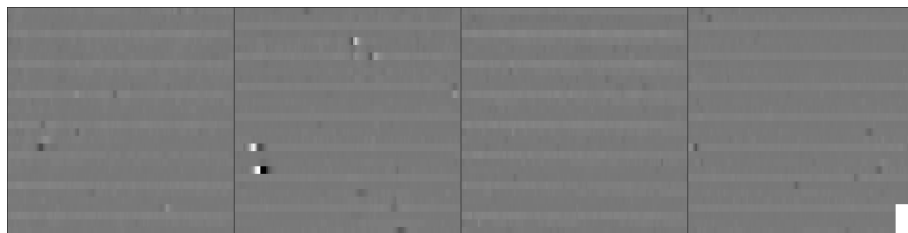
Area 6




Area 7



Area 8



0 50m

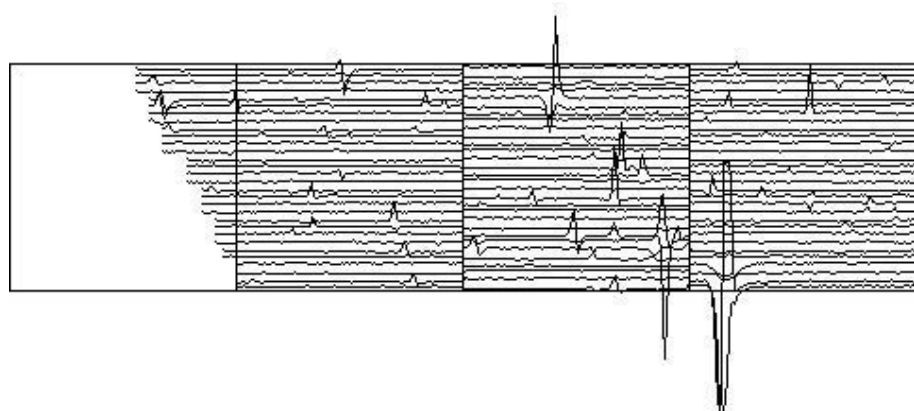
 Archaeological Project Services

Project Name: Loughborough Garendon Park

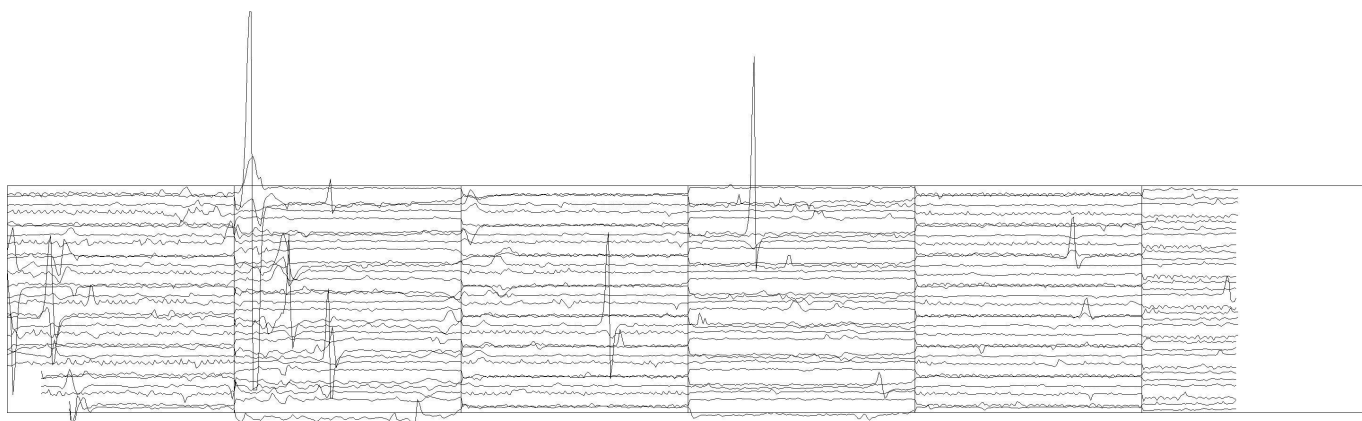
Scale 1:1000 | Drawn by: SJM | Report No: 105/11

Figure 18 Areas 6, 7, 8: unprocessed data greyscale plot - clip +/-50nT

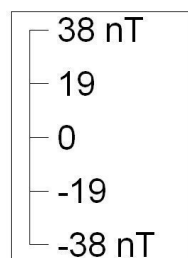
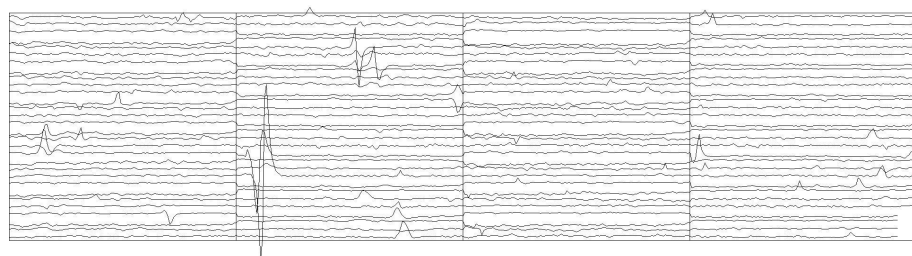
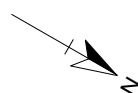
Area 6



Area 7



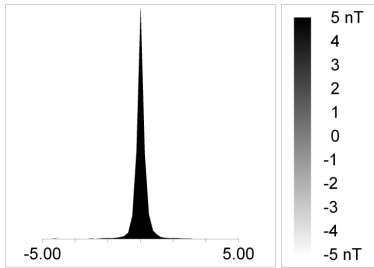
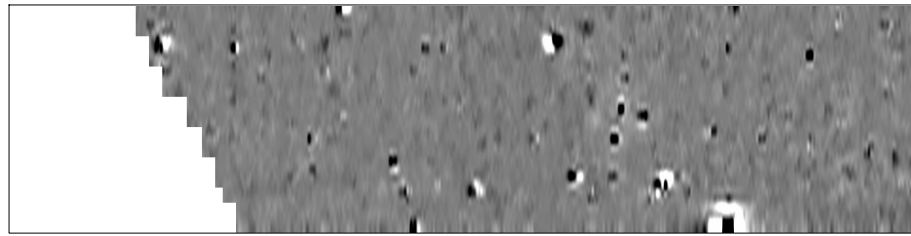
Area 8



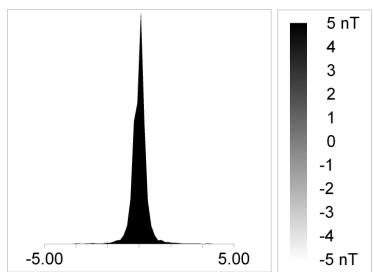
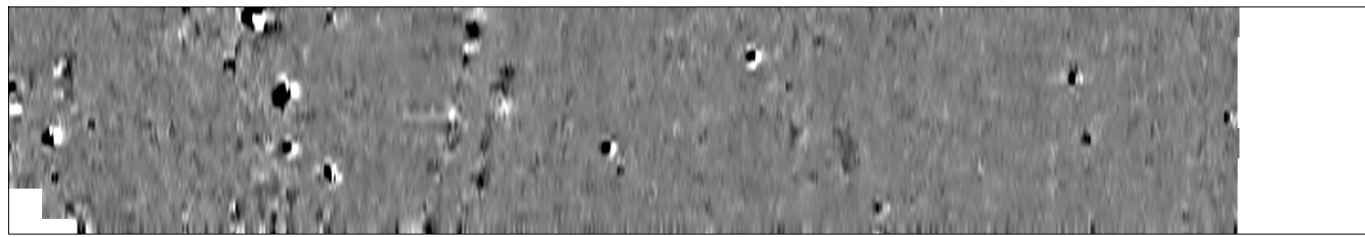
0		50m	
	Archaeological Project Services		
Project Name: Loughborough Garendon Park			
Scale 1:1000	Drawn by: SJM	Report No: 105/11	

Figure 19 Areas 6, 7, 8: unprocessed data trace plot

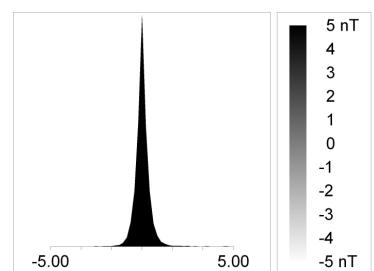
Area 6



Area 7



Area 8



Archaeological Project Services

Project Name: Loughborough Garendon Park

Scale 1:1000 | Drawn by: SJM | Report No: 105/11

Figure 20 Areas 6, 7, 8: processed data greyscale plot

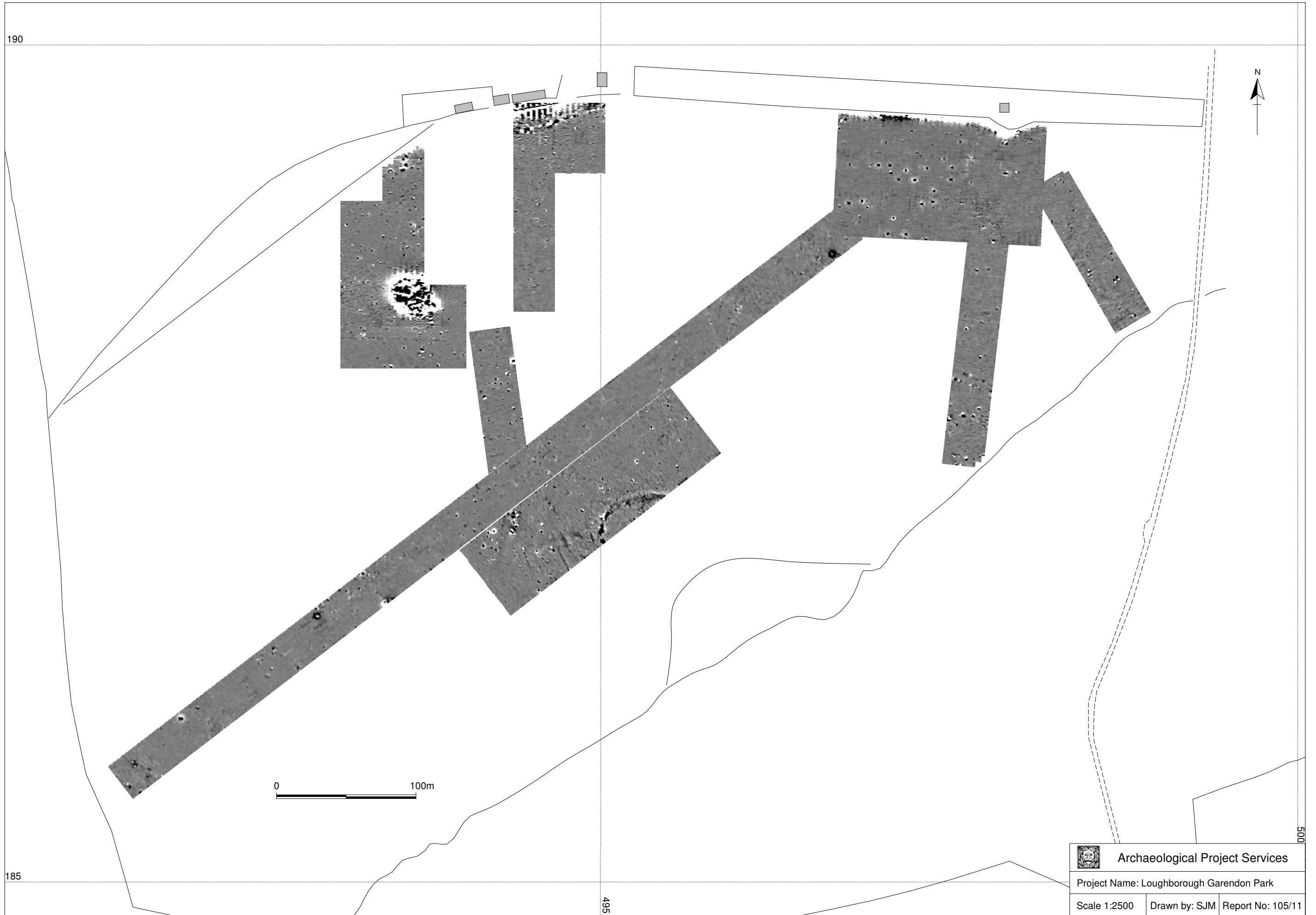








Figure 21 Overall plan of geophysical surveys

positive linear anomaly	
positive area anomaly	
localised positive anomaly	
drainage feature	
ferrous response	
magnetic disturbance	




	<b>Archaeological Project Services</b>
Project Name: Loughborough Garendon Park	
Scale 1:2500	Drawn by: SJM Report No: 105/11

Figure 22 Interpretative plan

## Appendix 1 THE ARCHIVE

The archive consists of:

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

File names	lbgp11-01.xgd lbgp11-02.xgd lbgp11-03.xgd lbgp11-04.xgd lbgp11-05.xgd lbgp11-06.xgd lbgp11-07.xgd lbgp11-08.xgd lbgp11-09.xgd lbgp11-10.xgd lbgp11-11.xgd lbgp11-12.xgd lbgp11-13.xgd lbgp11-14.xgd lbgp11-15.xgd lbgp11-16.xgd lbgp11-17.xgd lbgp11-18.xgd lbgp11-19.xgd lbgp11-20.xgd lbgp11-21.xgd lbgp11-22.xgd lbgp11-23.xgd lbgp11-24.xgd lbgp11-25.xgd lbgp11-26.xgd lbgp11-27.xgd lbgp11-28.xgd lbgp11-29.xgd lbgp11-30.xgd lbgp11-31.xgd lbgp11-32.xgd lbgp11-33.xgd	lbgp11-34.xgd lbgp11-35.xgd lbgp11-36.xgd lbgp11-37.xgd lbgp11-38.xgd lbgp11-39.xgd lbgp11-40.xgd lbgp11-41.xgd lbgp11-42.xgd lbgp11-43.xgd lbgp11-44.xgd lbgp11-45.xgd lbgp11-46.xgd lbgp11-47.xgd lbgp11-48.xgd lbgp11-49.xgd lbgp11-50.xgd lbgp11-51.xgd lbgp11-52.xgd lbgp11-53.xgd lbgp11-54.xgd lbgp11-55.xgd lbgp11-56.xgd lbgp11-57.xgd lbgp11-58.xgd lbgp11-59.xgd lbgp11-60.xgd lbgp11-61.xgd lbgp11-62.xgd lbgp11-63.xgd lbgp11-64.xgd lbgp11-65.xgd lbgp11-66.xgd	lbgp11-67.xgd lbgp11-68.xgd lbgp11-69.xgd lbgp11-70.xgd lbgp11-71.xgd lbgp11-72.xgd lbgp11-73.xgd lbgp11-74.xgd lbgp11-75.xgd lbgp11-76.xgd lbgp11-77.xgd lbgp11-78.xgd lbgp11-79.xgd lbgp11-80.xgd lbgp11-81.xgd lbgp11-82.xgd lbgp11-83.xgd lbgp11-84.xgd lbgp11-85.xgd lbgp11-86.xgd lbgp118.xgd  lbgp11-c1.xcp lbgp11-c2.xcp lbgp11-c3.xcp lbgp11-c4.xcp lbgp11-c5.xcp lbgp11-c6.xcp lbgp11-c7.xcp lbgp11-c8.xcp
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	ArchaeSurveyor 2.54 running under Windows XP Service Pack 3		
Date of last modification	20/09/11		
Indications of known areas of weakness in data	None		

All primary records are currently kept at:

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

The ultimate destination of the project archive is:  
Leicestershire County Council Heritage Services

Leicestershire Museums Accession No:  
Archaeological Project Services Site Code:

X.A115.2011  
CLGM11

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