LAND AT
RYLAND ROAD
DUNHOLME
LINCOLNSHIRE

GEOPHYSICAL SURVEY

Work undertaken for
Robert Doughty Consultancy Ltd

Report produced by
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October 2013

National Grid Reference: TF 0197 7950
OASIS Reference No.: archaeol1- 61756

APS Report No: 124/13

ARCHAEOLOGICAL
PROJECT
SERVICES

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1. SUMMARY

Detailed magnetic gradiometer survey was undertaken in connection with proposed development on land at Ryland Road, Dunholme, Lincolnshire. The survey area totalled 3.3ha.

No features of potential archaeological origin were recorded. A strong bipolar linear response indicates the route of a relatively modern pipe/service. Other strong bipolar variations reflect the presence of poles supporting overhead electric lines. More widespread disturbed response at the southern and eastern margins of the field probably results from further concentrations of metallic or highly-fired debris either buried or incorporated into the ploughsoil.

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'* (IFA 2008).

2.2 Background

Archaeological Project Services was commissioned by Robert Doughty Consultancy Ltd on behalf of Gin Property Ltd to undertake detailed magnetometer survey totalling some 3.3ha on land at Ryland Road, Dunholme, Lincolnshire in connection with proposed development of the area. The survey was carried out between the 15th and 16th October 2013.

2.3 Topography and Geology

Dunholme is located 8km northeast of Lincoln in the West Lindsey district of the Lincolnshire (Fig. 1).

The site lies c. 500m northwest of the village core, on the west side of Ryland Road, at National Grid Reference TF 0197 7950 (Fig. 1).

The survey area lies on relatively level ground on the dipslope of the limestone escarpment on the western edge of the Lincolnshire clay vale at some 20m AOD. Local soils are calcareous fine loamy soils of the Aswarby Association developed on Cornbrash Formation limestone (Hodge *et al*. 1984, 99; BGS 50000 scale digital geology).

3. GEOPHYSICAL SURVEY

3.1 Methods

Location and layout of the survey areas is shown in Figure 2. The field was under pasture and in good condition for survey.

Survey was undertaken in accordance with English Heritage (2008) and IfA (2011) guidelines and codes of conduct.

The magnetic survey was carried out using a 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.

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.

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.

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 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 and trace plots (Figs 3, 4; clipped for display but otherwise unprocessed), together with greyscale plots of the processed data (Fig. 5). Magnetic anomalies have been identified and plotted onto an interpretative drawing (Fig. 6) and are described below.

Magnetic disturbance
Linear bipolar anomaly **A** probably indicates the route of a relatively modern pipe/service. Other strong area bipolar responses at **B**-**E** reflect the presence of

poles supporting overhead electric lines. More widespread bipolar response at the southern and eastern margins of the field probably results from further concentrations of metallic or highly-fired debris either buried or incorporated into the ploughsoil.

Agricultural response
The pattern of weak negative linear response (paler in the processed plot), parallel to the western boundary, is typical of responses due to relatively recent agricultural activities.

Iron spikes (discrete bipolar anomalies)
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. These are fairly widely scattered though with a distinctly linear pattern in the west of the field perhaps reflecting some former boundary (e.g. fence line) here.

4. DISCUSSION

Detailed magnetic gradiometer survey was undertaken in advance of proposed residential development at the site. No features of potential archaeological origin were identified within the geophysical survey. The survey plot is dominated by strong bipolar responses typical of modern pipes/services and wider spread metallic or highly-fired debris. Other strong area bipolar variations are due to the presence of poles (and, more to the point, their ground anchors) supporting overhead electric lines.

It should, however, be noted that not all archaeological features will be responsive to the technique and absence of magnetic anomalies does not necessarily indicate a total absence of archaeological features.

5. ACKNOWLEDGEMENTS

Archaeological Project Services wishes to acknowledge Julie Robinson of Robert Doughty Consultancy who commissioned the project on behalf of Gin Property Ltd and arranged access. The work was coordinated by Gary Taylor who edited this report along with Tom Lane.

6. PERSONNEL

Project coordinator: Gary Taylor
Geophysical Survey: Neil Jefferson
Survey processing and reporting: Steve Malone

7. BIBLIOGRAPHY

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

Hodge, CAH., Burton, RGO., Corbett, WM., Evans, R., and Seale, RS, 1984 *Soils and their use in Eastern England*, Soil Survey of England and Wales 13

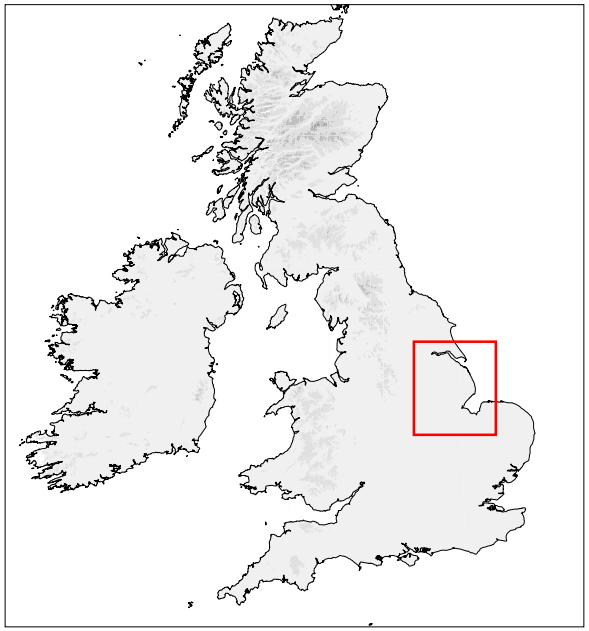
IfA, 2008 *Standard and Guidance for Field Evaluation.*

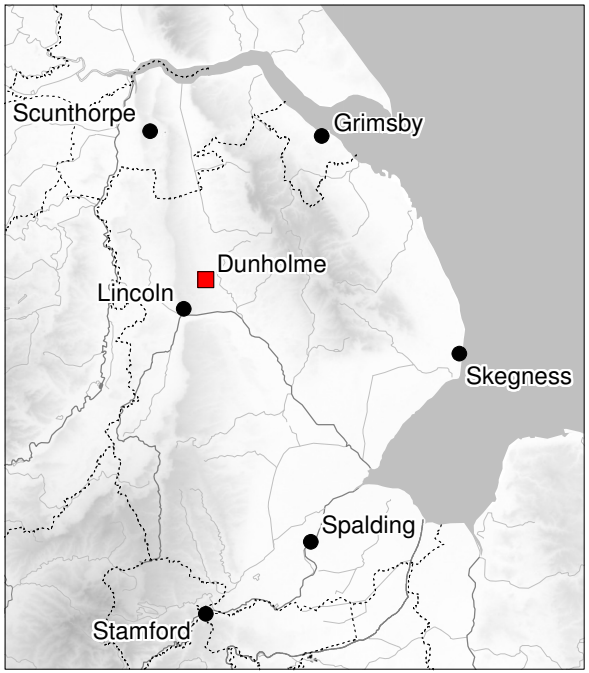
IfA, 2011 *Standard and Guidance for Geophysical Survey.*

8. ABBREVIATIONS

BGS British Geological Survey

IfA Institute for Archaeologists





Archaeological Project Services		
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Scale: varies	Drawn by: SM	Report No: 124/13

Figure 1 Site location map

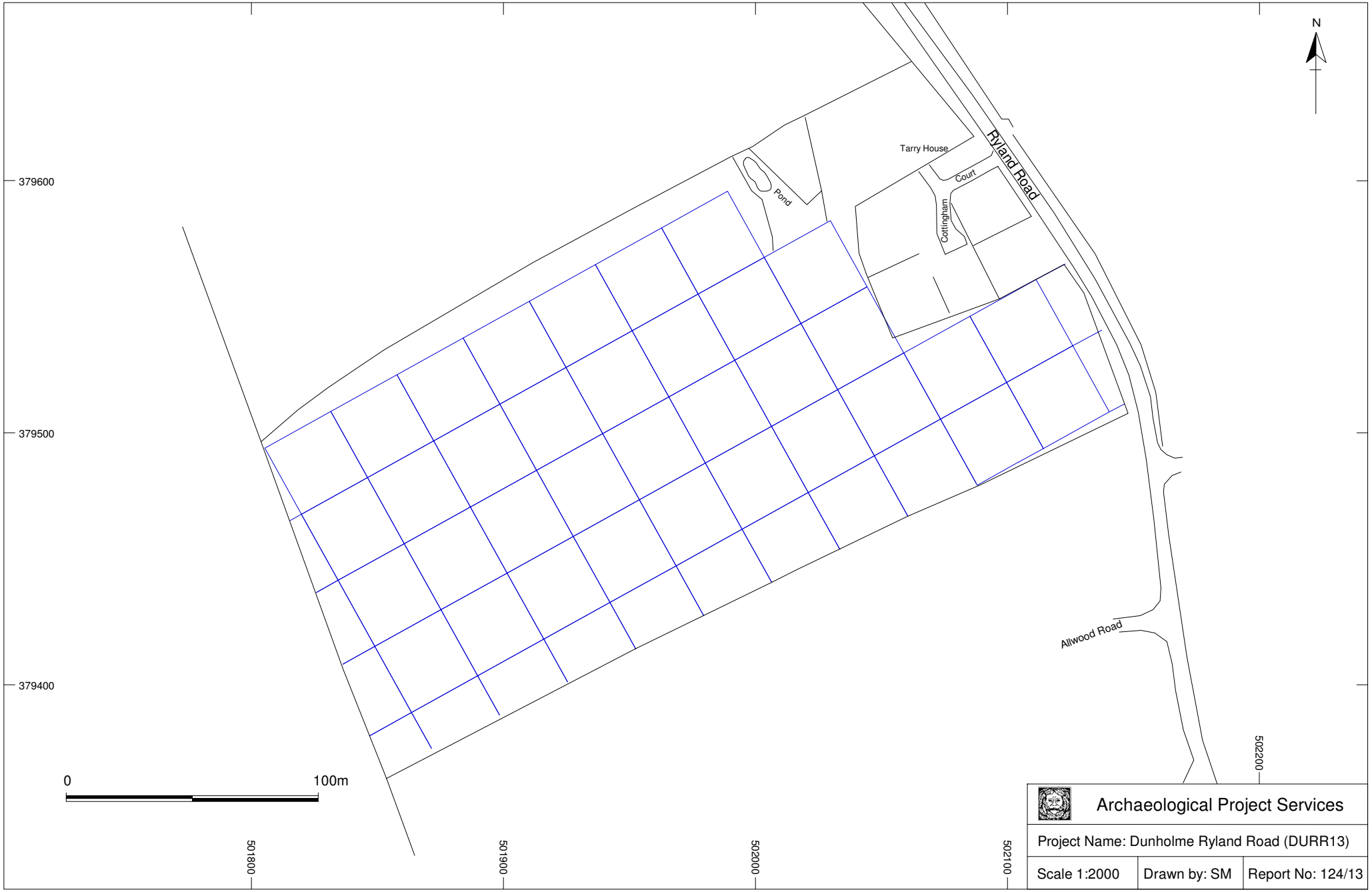


Figure 2 Location and layout of survey area

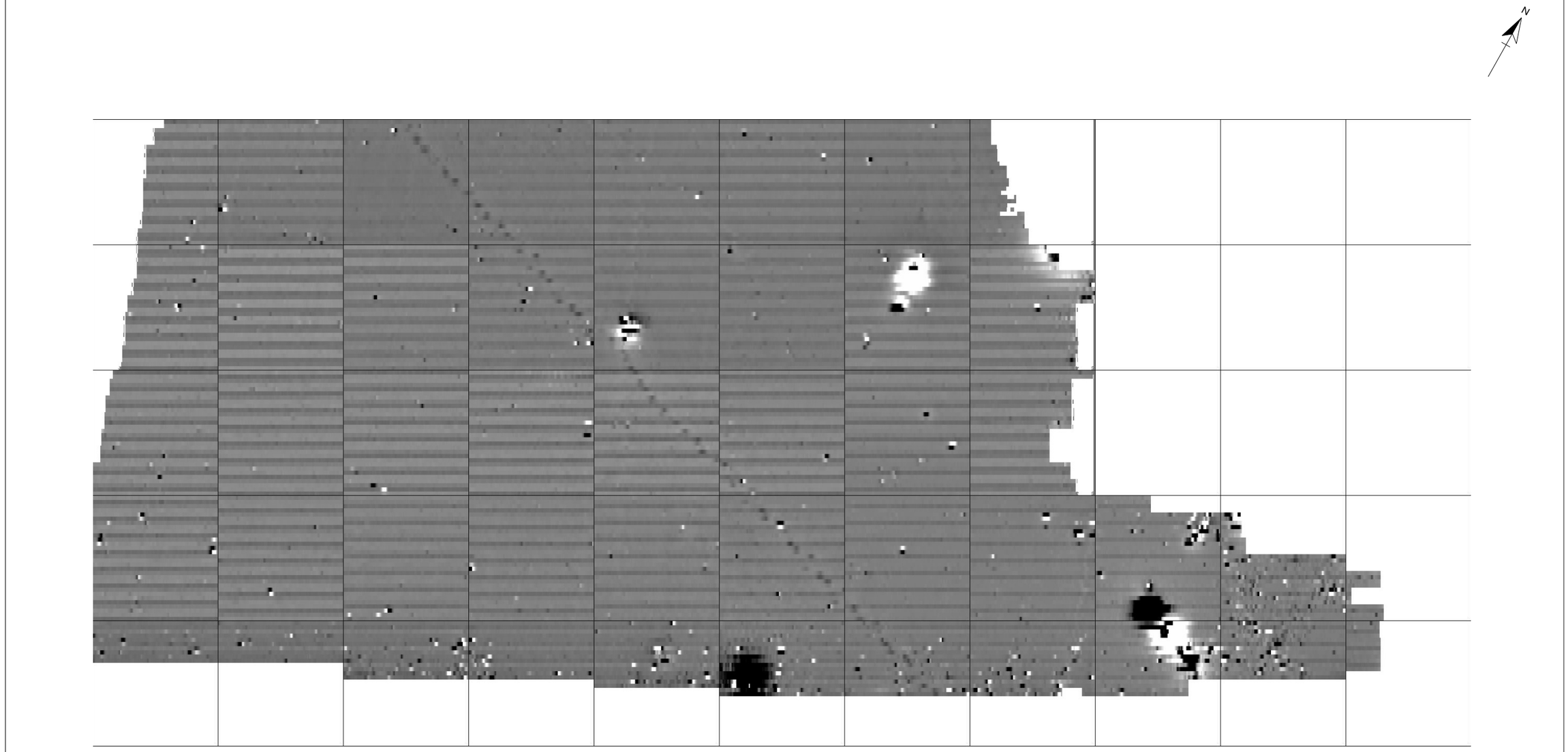


Figure 3 - minimally processed data greyscale plot

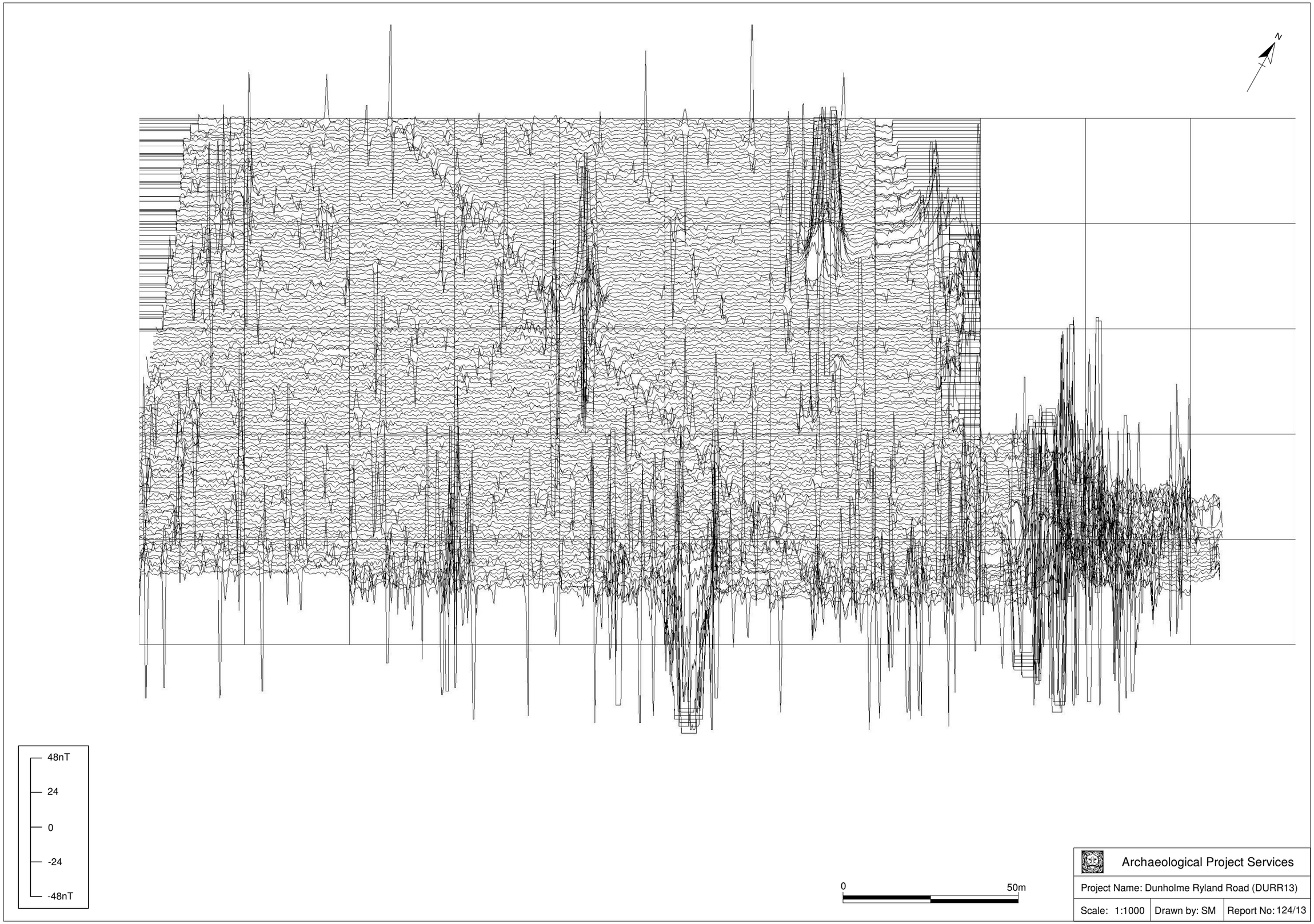
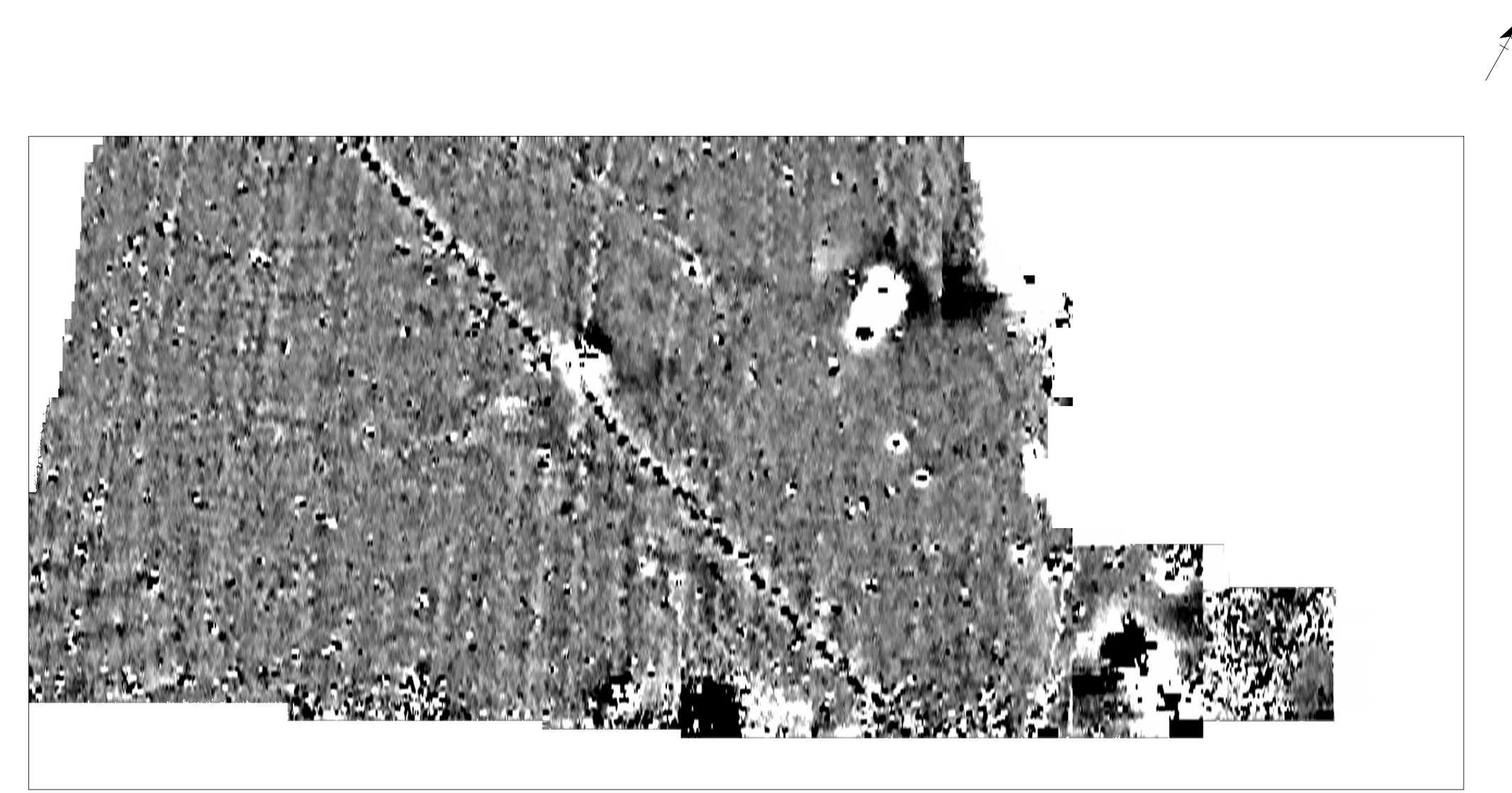


Figure 4 - minimally processed data trace plot



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Scale: 1:1000	Drawn by: SM	Report No: 124/13

Figure 5 - processed data greyscale plot

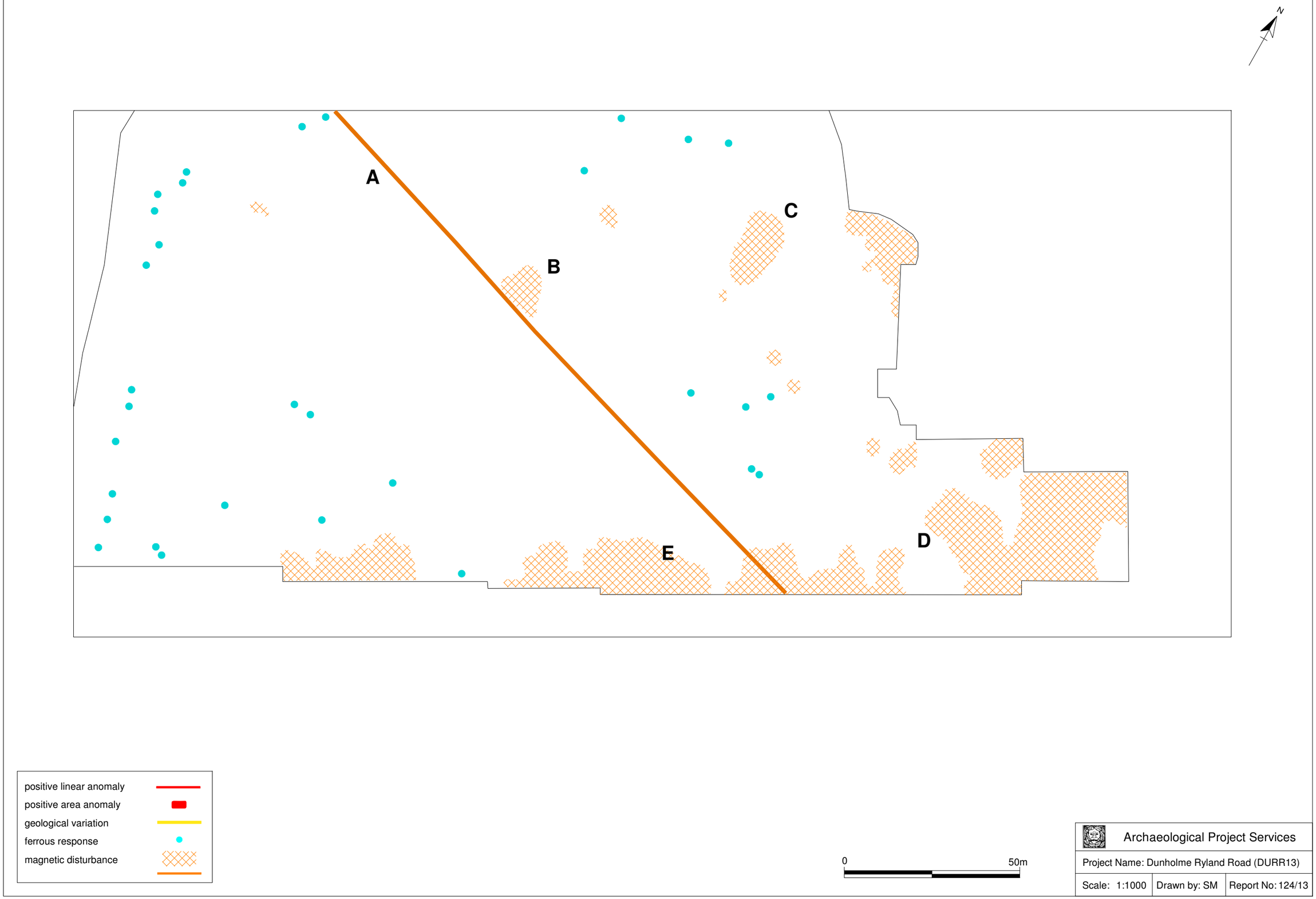

Figure 6 - interpretative plot

Appendix 1
THE ARCHIVE

The archive consists of:

2 Daily record sheets
1 Report text and illustrations
Digital data

File names	Grid files sequentially numbered: DURR13-1.xgd to DURR13-46.xgd		Composite files DURR13-c1.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	ArcheoSurveyor 2.5.19 running under Windows 7		
Date of last modification	17/10/13		
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:

The Collection
Art and Archaeology in Lincolnshire
Danes Terrace
Lincoln
LN2 1LP

Accession Number: LCNCC:2013.

APS Site Code: DURR13