

Substrata

Archaeological Geophysical Surveyors

An archaeological gradiometer survey

Land at Plumb Park, Exmouth, East Devon

Ordnance Survey NGR (E/N): 302260,81153 (point)

Report: 150324

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Accompanying CD-ROM

Report.....	Adobe PDF format
Copies of report figures.....	Adobe PDF format
Raw and processed grid & composite files	DW Consulting TerraSurveyor 3 formats
Minimal processing data plots and metadata	DW Consulting TerraSurveyor 3 formats
Final data processing data plots and metadata	DW Consulting TerraSurveyor 3 formats
GIS project, shape files and classification schema	
GIS project	Manifold 8 ‘.map’ file
GIS shape files	ESRI standard
GIS classification schema	Adobe PDF format
AutoCAD version of the survey interpretation	AutoCAD DXF

Website: substrata.co.uk

For an overview of Substrata, our archaeological geophysical surveying techniques and the results we obtain.

1 Survey description and summary

1.1 Survey

Type: twin-sensor fluxgate gradiometer
Date: 11 to 20 March 2015
Area: 10.5ha
Project Manager: Ross Dean BSc MSc MA MifA
Lead Surveyor: Mark Edwards BA

1.2 Client

AC Archaeology Ltd, 4 Halthaies Workshops, Bradninch, Nr Exeter, Devon EX5 4QL

1.3 Location

Site: Land at Plumb Park
Village & Civil Parish: Exmouth,
District: East Devon
County: Devon
Nearest Postcode: EX8 2TB
NGR: SY 022 811
Ordnance Survey E/N: 302260,81153 (point)

1.4 Archive

OASIS number: substrat1-207869
Archive: The archive of this survey will be held by Substrata and will be deposited with the Archaeology Data Service (ADS, undated).

1.5 Introduction

This report was commissioned by AC Archaeology Ltd on behalf of clients in support of a forthcoming planning application. The location of the application area is shown in Figure 1. It comprises approximately 14.5ha of land, 10.5ha of which was subject to the geophysical survey.

1.6 Summary

The magnetic contrast across the area was sufficient to be able to differentiate between anomalies representing possible archaeological features and background magnetic responses.

Twenty-six magnetic anomaly groups were identified as potentially representing archaeological deposits or features, the majority of which are most likely to relate to past agricultural activities and to former field boundaries or other enclosures of unknown date. Five of the groups represent former field boundaries mapped on the Littleham tithe map and on Ordnance Survey maps. One represents a mapped former marl pit recorded in the Devon County Council Historical Environment Record (MDV55223). One group coincides with the location of a former WW2 anti-aircraft gun emplacement (MDV71901) and a further group may be associated with this emplacement.

2 Survey aims and objectives

2.1 Aims

1. Define and characterise and detectable archaeological remains on the site.
2. Inform any future archaeological investigation of the area.

2.2 Objectives

1. Complete a gradiometer survey across agreed parts of the application area.
2. Identify any magnetic anomalies that may be related to archaeological deposits, structures or artefacts.
3. Within the limits of the techniques and dataset, archaeologically characterise any such anomalies or patterns of anomalies.
4. Accurately record the location of the identified anomalies.
5. Produce a report based on the survey that is sufficiently detailed to inform any

subsequent development on the site about the location and possible archaeological character of the recorded anomalies.

3 Standards

The standards used to complete this survey are defined by the Institute for Archaeologists (2011). The codes of approved practice that were followed are those of the Institute for Archaeologists (2008 and 2009) and Archaeology Data Service/Digital Antiquity Guides (undated). The document text was written using the house style of the Institute for Archaeologists (Institute for Archaeologists, undated).

4 Site description

4.1 Landscape and land use

The proposed application area occupies 15.32ha of agricultural land on the southeast outskirts of Exmouth. The land has a predominantly south facing aspect and is bisected by two combes defining two prominent areas of higher ground in the north and southeast sections of the application area. The northern rise, known locally as Donkey Hill (Figure 2), forms a significant local landscape feature. The land within the application area lies between 25m and 60m OD.

4.2 Geology

The application area is located on a solid geology boundary with mudstone of the Triassic Exmouth Mudstone and Sandstone Formation on the southern side of the application area. To the north and northeast the rocks are sandstones of the same Formation. The Formation is described as reddish brown silty mudstones with intercalated reddish brown lenticular sandstone beds, exceptionally to 30m thick, but mostly 5 to 10m thick. The thickest, most persistent, sandstones occur at the top of the Formation. The superficial geology is not recorded in the source used (British Geological Survey, undated).

5 Archaeological background

An assessment of the archaeological background of the site is contained in an Historic Environment Assessment by AC Archaeology Ltd which was completed as part of the programme of works of which this report is a part (James, 2012).

The application area contains fields with names that could be indicative of the presence of ironworking, earthworks and land by a boundary mound, while other field names suggest that vines and plum trees may once have grown within the site. Recorded heritage assets within the application area include the sites of a WWII light anti aircraft battery (Devon County Council Historic Environment Record MDV71901) which appears as a faint, circular sunken earthwork feature on aerial photographs and an old marl pit (MDV55223) which shows on aerial photographs as a large circular depression. Despite the limited number of currently recorded heritage assets, the application area is considered to have potential in topographic terms for the presence of prehistoric and possibly later activity (ibid: 1, 16).

A review of cartographic evidence has established that the proposed application area lies within land which comprises modern enclosures adapting post medieval fields (ibid after Devon County Council, undated).

The WWII light anti aircraft battery corresponds with magnetic anomaly group 20 in Figure 2 and the former marl extraction pit is represented by group 14. These are discussed further in section 6.

6 Results, discussion and conclusions

This survey was designed to record magnetic anomalies. The anomalies themselves cannot be regarded as actual archaeological features and the dimensions of the anomalies shown do not represent the dimensions of any associated archaeological features. The analysis presented below identifies and characterises anomalies and anomaly groups that may relate to archaeological deposits and structures.

The terms ‘archaeological features’ and ‘archaeological deposits’ refer to any artefacts, material deposits or disturbance of natural deposits thought to be the result of human activity and not undertaken as recent land maintenance or farming.

The reader is referred to section 7.

6.1 Results

Figure 2 shows the interpretation of the survey data. It includes the anomaly groups identified as relating to archaeological deposits along with their numbers. Table 1 is an extract of the detailed analysis of the survey data which is provided in the attribute tables of the GIS project on the accompanying CD-ROM and in the project archive.

Figure 2 and Table 1 comprise the analysis of the survey data. Plots of the processed data are provided in Figures 3 and 4.

6.2 Discussion

6.2.1 General points

Not all anomalies or anomaly groups identified in Table 1 are necessarily discussed below. All identified anomaly groups are recorded in the GIS project on the accompanying CD-ROM.

Anomalies thought to relate to natural features were not mapped.

Recent man-made objects such as manholes, water management equipment, drains, cables and other services were only mapped where they comprised significant magnetic responses across the dataset that needed clarification. If mapped, they are listed in Table 1 but are not discussed below.

There are numerous anomaly groups that could be interpreted as relating to large postholes or pits although most will have natural origins. Anomalies of this sort are only mapped as potential archaeology if they are clustered in groups or otherwise form recognisable patterns.

Data collection along the survey area edges was restricted as shown in Figures 3 and 4 due to the presence of magnetic materials in and adjacent to field boundaries. Strong magnetic responses mapped close to the field boundaries are likely to relate to these materials except where otherwise indicated in Figure 2.

6.2.2 Data relating to historical maps and other records

Magnetic anomaly groups **4**, **9** and **10** represent former field boundaries mapped on the Littleham tithe map of 1844 and on Ordnance Survey maps between 1890 and at least 1988 but not on the current map. Groups **101** and **102** represent lengths of iron or steel wires, cables, pipes or drains that follow the line of the field boundaries represented by groups 4 and 10 respectively. Groups **17** and **18** represent former field boundaries mapped between 1844 and 1988 but no later. Group 9 may represent a former Devon bank field boundary which are comprise a stone-lined earthen bank with flanking ditches. The extant field boundaries around the application area are of this type (James 2012: 16). The nature of the other former field boundaries represented by groups 4, 9, 17 and 18 cannot be determined. Their anomaly patterns indicate intermittent spreads of rubble and disturbed ground.

Anomaly group **14** represents debris and other deposits filling a former marl pit recorded on Ordnance Survey maps between 1890 and at least 1988 but not on the current map. The feature was labelled 'Old Marl Pit' on the maps produced between 1890 and 1906. It shows on aerial photographs as a large circular depression and was observed as a slight hollow during a field inspection. The pit is not recorded on the Littleham tithe map of 1844 but a kink in the mapped field boundary reveals its location (James 2012: 10, 16, 17). The pit is recorded in the Devon County Council Historic Environment Record (DCCHER) entry MDV55223.

Group **20**, on the summit of Donkey Hill, coincides with the location of a WW2 light anti-aircraft battery which appears as a feint, circular, sunken earthwork feature on aerial photographs. Evidence on the ground appears to be confined to several fragments of nineteenth century brick (ibid: 11, 16, 17). The site of the battery is recorded in DCCHER MDV71901. Donkey Hill was formerly referred to as 'Slagbury' on the Littleham tithe apportionments and the 'slag' element may refer to iron production or waste tipping. The 'bury' element may refer to earthworks but none are recorded in the field (ibid: 11). The magnetic anomalies are probably related to remains of the anti-aircraft battery and may represent brickwork although this cannot be certain without further archaeological investigation. A short linear feature represented by group **21** lies adjacent to group 20 but the relationship between the two anomalies is unclear.

6.2.3 Data with no previous archaeological provenance

Groups **2 and 8** may represent terraced deposits or natural soil accumulation on the relatively steep slopes.

Groups **5 and 22** may represent archaeological deposits and disturbed ground although they could relate to relatively recent rubble or near-surface bedrock.

Groups **12 and 13** reflect either field drains or linear archaeological deposits such as former field boundaries.

Group **24** may relate to archaeological deposits although its nature and location in a valley may mean that it represents deposits left by occasional water flow close to the extant field boundary or possibly an former stream bed.

The remaining magnetic anomaly groups mapped as relating to possible archaeological deposits are linear and curvilinear groups that are most likely to relate to past field boundaries or other enclosures of unknown date.

6.3 Conclusions

The magnetic contrast across the area was sufficient to be able to differentiate between anomalies representing possible archaeological features and background magnetic responses.

Twenty-six magnetic anomaly groups were identified as potentially representing archaeological deposits or features, the majority of which are most likely to relate to past agricultural activities and to former field boundaries or other enclosures of unknown date. Five of the groups represent former field boundaries mapped on the Littleham tithe map and on Ordnance Survey maps. One represents a mapped former marl pit recorded in the Devon County Council Historical Environment Record (MDV55223). One group coincides with the location of a former WW2 anti-aircraft gun emplacement (MDV71901) and a further group may be associated with this emplacement.

7 Disclaimer and copyright

The description and discussion of the results presented in this report are the authors, based on his interpretation of the survey data. Every effort has been made to provide accurate descriptions and interpretations of the geophysical data set. The nature of archaeological geophysical surveying is such that interpretations based on geophysical data, while informative, can only be provisional. Geophysical surveys are a cost-effective early step in the multi-phase process that is archaeology. The evaluation programme of which this survey is part may also be informed by other archaeological assessment work and analysis. It must be presumed that more archaeological features will be evaluated than those specified in this report.

Ross Dean, trading as Substrata, will assign copyright to the client upon written request but retains the right to be identified as the author of all project documentation and reports as defined in the Copyright, Designs and Patents Act 1988 (Chapter IV, s.79).

8 Acknowledgements

Substrata would like to thank John Valentin of AC Archaeology Ltd for commissioning us to complete this survey.

9 Bibliography

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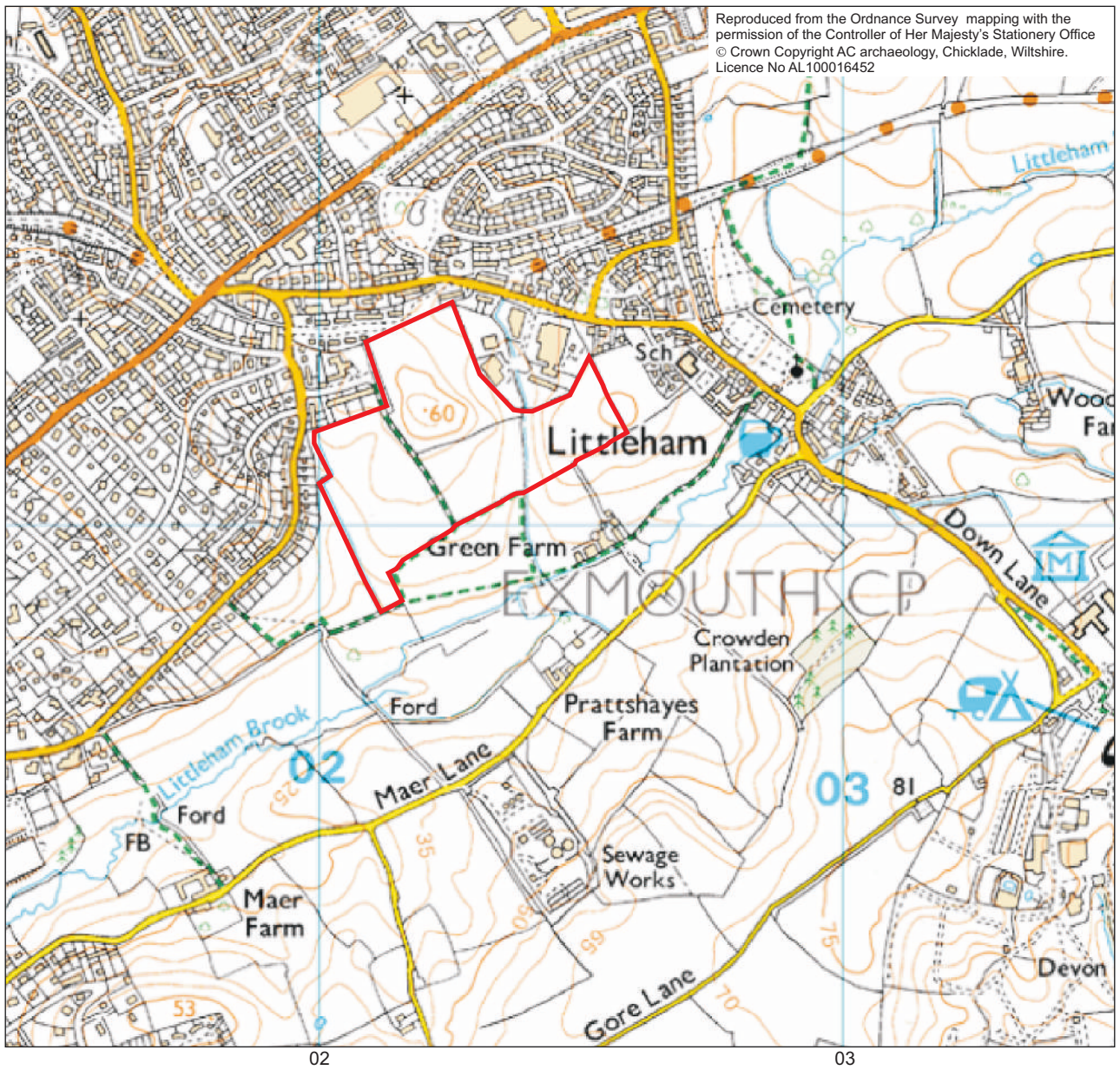
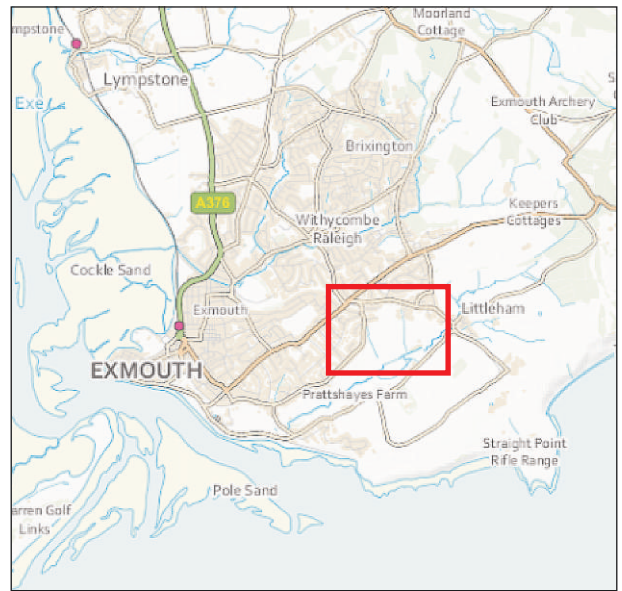
James, T. (2012) *Land at Plumb Park, Exmouth, East Devon (centred on SY 02260 81153) Historic Environment Assessment*, AC Archaeology Ltd unpublished document ACD513/1/2

Appendix 1 Analysis table and supporting plots

General Guidance

The anomalies represented in the survey plots provided in this appendix are magnetic anomalies. The apparent size of such anomalies and anomaly patterns are unlikely to correspond exactly with the dimensions of any associated archaeological features.

A rough rule for interpreting magnetic anomalies is that the width of an anomaly at half its maximum reading is equal to the width of the buried feature, or its depth if this is greater (Clark, 2000: 83). Caution must be applied when using this rule as it depends on the anomalies being clearly identifiable and distinct from adjacent anomalies. In northern latitudes the position of the maximum of a magnetic anomaly will be displaced slightly to the south of any associated physical feature.



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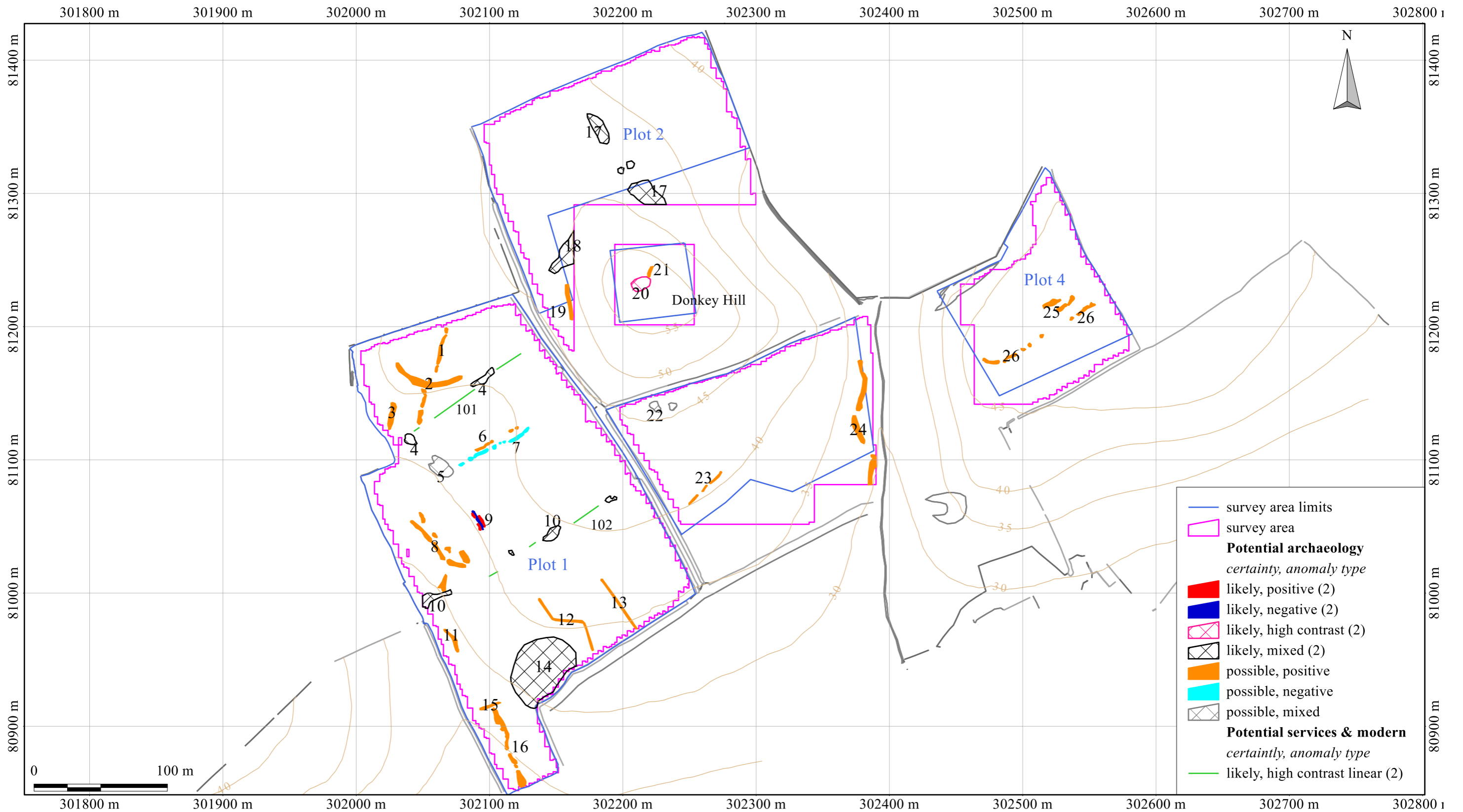


Application area

PROJECT
 Plumb Park, Littleham, Exmouth, Devon

TITLE
 Fig. 1: Location of site





British Grid
centre X: 302276.35 m, centre Y: 81138.04 m

Scale: 1:2800 @ A3. Spatial Units: Meter. Do not scale off this drawing

Copyright Substrata 2015.

Base map: Sumo Survey Services on behalf of Ward Williams Associates
Contours: to O.D. based on Sumo contour survey

Notes:

1. All interpretations are provisional and represent potential archaeological deposits.
2. Anomalies designated "likely archaeology" have supporting evidence e.g. historical maps and or visible earthworks.
3. Representative; not all instances are mapped.
4. Anomalies likely to represent geological or other natural deposits are not mapped unless relevant to potential archaeological events or deposits.

Site: An archaeological gradiometer survey
Land at Plumb Park, Exmouth, East Devon
Ordnance Survey (E/N): 302260,81153 (point)
Report: 150324

field number	anomaly group	associated anomalies	anomaly characterisation certainty & class	anomaly form	additional archaeological characterisation	comments	supporting evidence
1	1		possible, positive	disrupted linear			
	2		possible, positive	broad curvilinear		terraced deposits or natural sediment build-up	
	3		possible, positive	linear			
	4		likely, mixed	disrupted linear	field boundary	anomaly groups coincide with a field boundary mapped between 1844 and at least 1988	1844 Littleham tithe map, OS 1:10000 1988
	5		possible, mixed	irregular	archaeological deposit or recent rubble		
	6	7	possible, positive	disrupted linear		anomaly group may relate to a former linear structure also likely to be represented by group 7	
	7	6	possible, negative	disrupted linear		anomaly group may relate to a former linear structure also likely to be represented by group 6	
	8		possible, positive	disrupted curvilinear		terraced deposits or natural sediment build-up	
	9		likely, pos/neg/pos	disrupted linear	field boundary	anomaly groups coincide with a field boundary mapped between 1844 and at least 1988; anomalies suggest a Devon bank field wall	1844 Littleham tithe map, OS 1:10000 1988
	10		likely, mixed	disrupted linear	field boundary	anomaly groups coincide with a field boundary mapped between 1844 and at least 1988	1844 Littleham tithe map, OS 1:10000 1988
	11		possible, positive	linear			
	12		possible, positive	multilinear	ditch or field drain		
	13		possible, positive	linear	ditch or field drain		
	14		likely, mixed	sub-circular	marl pit	anomaly group coincides with the location of a feature mapped as an 'Old Marl Pit'	DCCHER MDV55223, OS 6 inch map 1906
	15		possible, positive	linear			
	16		possible, positive	disrupted linear			
101		likely, high contrast linear			ferrous wire, cable, pipe or drain	anomaly groups are associated with a field boundary mapped between 1844 least 1988	1844 Littleham tithe map, OS 1:10000 1988
	102		likely, high contrast linear		ferrous wire, cable, pipe or drain	anomaly groups are associated with a field boundary mapped between 1844 least 1988	1844 Littleham tithe map, OS 1:10000 1988
2	17		likely, mixed	disrupted linear	field boundary	anomaly groups coincide with a field boundary mapped between 1844 and 1969 but not in 1970	1844 Littleham tithe map, OS 1:10560 1969, OS 1:2500 1970
	18		likely, mixed	disrupted linear	field boundary	anomaly groups coincide with a field boundary mapped between 1844 and 1969 but not in 1970	1844 Littleham tithe map, OS 1:10560 1969, OS 1:2500 1970
	19		possible, positive	linear			
	20		likely, high contrast	irregular	rubble and other archaeological deposits	anomaly group coincides with the location of a WW2 anti-aircraft battery; several 19th century bricks and brick fragments were noted on the summit of Donkey Hill during a site visit made by AC Archaeology in 2012. The locale was named 'Slagbury' in the '1842 Littleham tithe apportionment.	DCCHER MDV71901 AC Archaeology document ACD513/1/1
3	21		possible, positive	linear			
	22		possible, mixed	irregular	archaeological deposits, rubble or near-surface bedrock		
	23		possible, positive	disrupted linear			
	24		possible, positive	disrupted sinuous linear	archaeological or natural deposits	anomaly group may represent archaeological deposits but are suggestive of a palaeochannel	
4	25		possible, positive	linear			
	26		possible, positive	disrupted curvilinear			

Table 1: data analysis

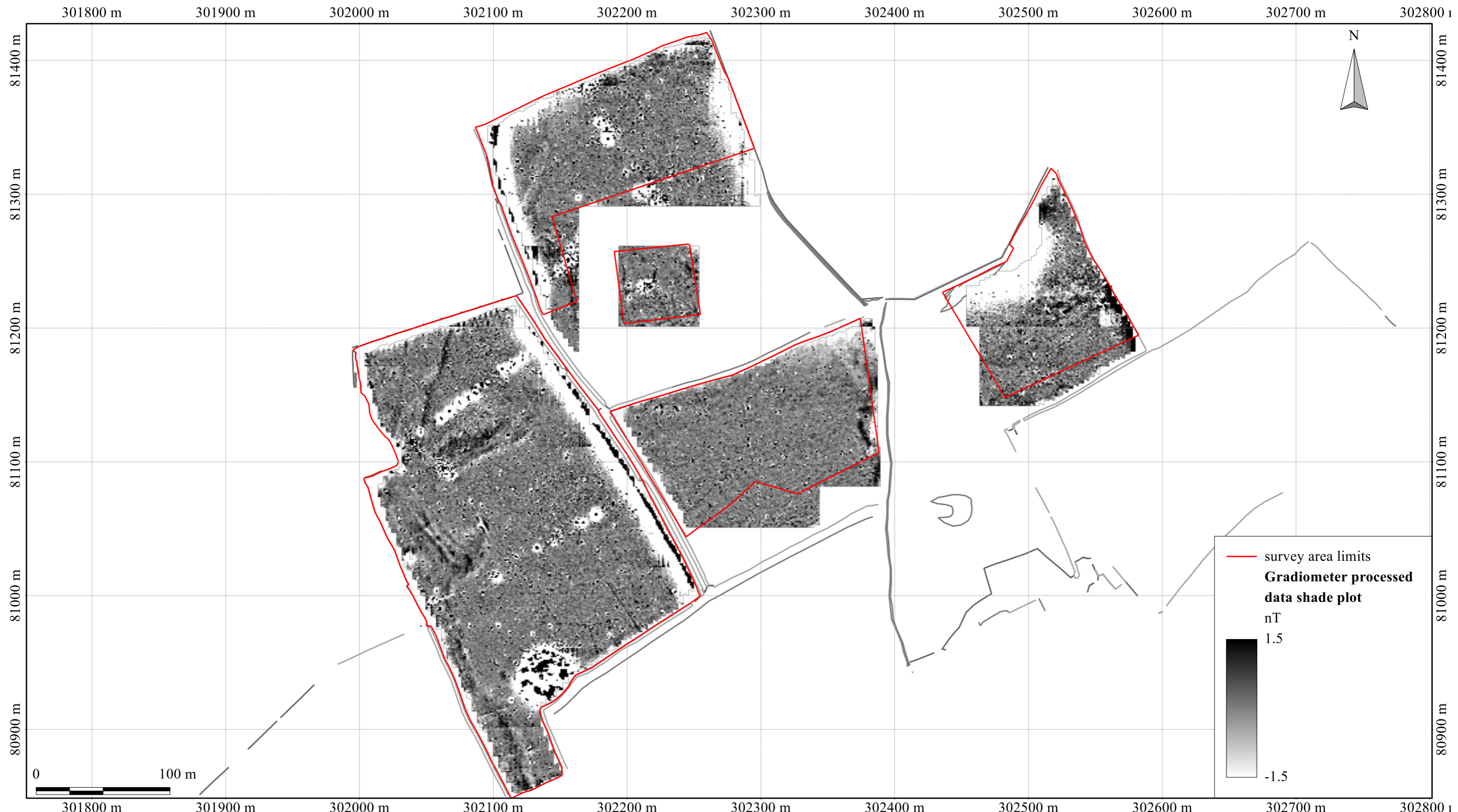
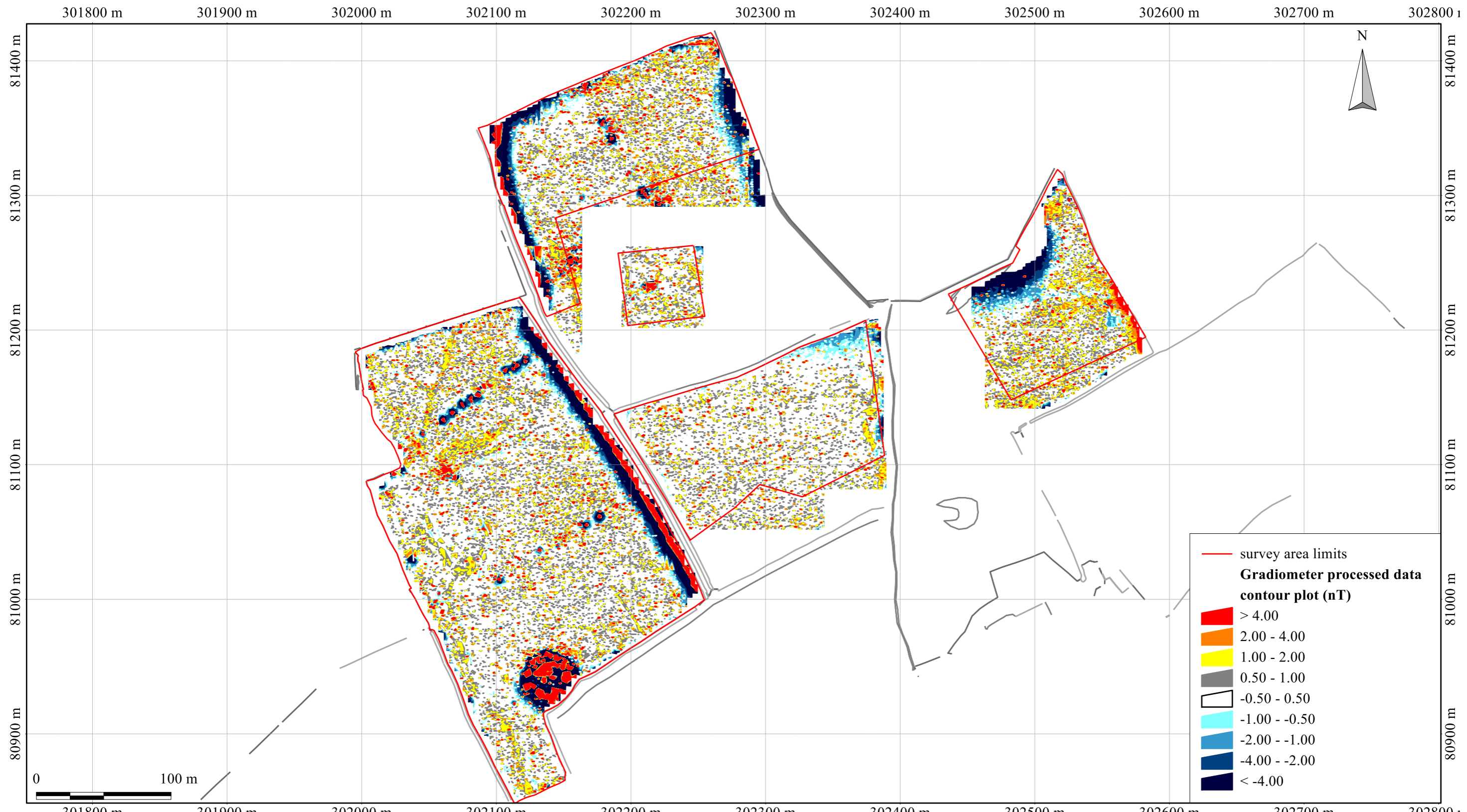


Figure 3: shade plot of processed data



British Grid
centre X: 302276.35 m, centre Y: 81138.04 m

Scale: 1:2800 @ A3. Spatial Units: Meter. Do not scale off this drawing

Copyright Substrata 2015.
Base map: Sumo Survey Services on behalf of Ward Williams Associates

Figure 4: contour plot of processed data

Appendix 2 Methodology Summary

Table 1: methodology summary	
<p>Documents Survey methodology statement: Dean (2014)</p>	
<p>Methodology</p> <ol style="list-style-type: none"> 1. The work was undertaken in accordance with the survey methodology statement. The geophysical (gradiometer) survey was undertaken with reference to standard guidance provided by the Institute for Archaeologists (2011) and Archaeology Data Service/Digital Antiquity Guides (undated). 2. The survey grid location information and grid plan was recorded as part of the project in a suitable GIS system. 3. Data processing was undertaken using appropriate software, with all anomalies being digitised and geo-referenced. The final report included a graphical and textual account of the techniques undertaken, the data obtained and an archaeological interpretation of that data and conclusions about any likely archaeology. 	
<p>Grid <i>Method of Fixing:</i> DGPS set-out using pre-planned survey grids and Ordnance Survey coordinates. <i>Composition:</i> 30m by 30m grids <i>Recording:</i> Geo-referenced and recorded using digital map tiles. <i>DGPS used:</i> Spectra Precision PM5V2 GPS with external antenna and survey pole and DigiTerra Explorer 7 as the survey control program.</p>	
<p>Equipment <i>Instrument:</i> Bartington Instruments grad601-2 <i>Firmware:</i> version 6.1</p>	<p>Data Capture <i>Sample Interval:</i> 0.25-metres <i>Traverse Interval:</i> 1 metre <i>Traverse Method:</i> zigzag <i>Traverse Orientation:</i> GN</p>
<p>Data Processing, Analysis and Presentation Software IntelliCAD Technology Consortium IntelliCAD 7.2 DW Consulting TerraSurveyor3 Manifold System 8 GIS Microsoft Corp. Office Excel 2013 Microsoft Corp. Office Publisher 2013 Adobe Systems Inc Adobe Acrobat 9 Pro Extended</p>	

Appendix 3 Data processing

Table 2: gradiometer survey - processed data metadata	
SITE	
Instrument Type:	Bartington Grad 610
Units:	nT
Direction of 1st Traverse:	0 deg
Collection Method:	ZigZag
Sensors:	2 @ 1.00 m spacing.
Dummy Value:	32702
PROGRAM	
Name:	TerraSurveyor
Version:	3.0.25.0
Stats	
Max:	12.56
Min:	-14.19
Std Dev:	3.01
Mean:	-0.50
Median:	0.00
Surveyed Area:	10.439 ha
Processes: 39	
1 Base Layer	
2 Clip at 1.00 SD	
3 Clip at 3.00 SD	
4 De Stagger: Grids: All Mode: Both By: -2 intervals	
5 DeStripe Median Sensors: All	
6 Edge Match (Area: Top 240, Left 600, Bottom 269, Right 719) to Top edge	
7 Edge Match (Area: Top 240, Left 720, Bottom 269, Right 839) to Top edge	
8 Edge Match (Area: Top 210, Left 840, Bottom 239, Right 959) to Left edge	
9 Edge Match (Area: Top 180, Left 960, Bottom 209, Right 1079) to Top edge	
10 Edge Match (Area: Top 180, Left 1080, Bottom 209, Right 1199) to Left edge	
11 Edge Match (Area: Top 150, Left 1200, Bottom 179, Right 1319) to Left edge	
12 Edge Match (Area: Top 120, Left 1320, Bottom 149, Right 1439) to Top edge	
13 Edge Match (Area: Top 120, Left 1440, Bottom 149, Right 1559) to Top edge	
14 Edge Match (Area: Top 120, Left 360, Bottom 149, Right 479) to Right edge	
15 Edge Match (Area: Top 150, Left 360, Bottom 179, Right 479) to Right edge	
16 Edge Match (Area: Top 120, Left 240, Bottom 149, Right 359) to Top edge	
17 Edge Match (Area: Top 120, Left 1920, Bottom 149, Right 2039) to Bottom edge	
18 Edge Match (Area: Top 120, Left 2040, Bottom 149, Right 2159) to Left edge	
19 Edge Match (Area: Top 120, Left 1800, Bottom 149, Right 1919) to Bottom edge	
20 Edge Match (Area: Top 120, Left 1680, Bottom 149, Right 1799) to Bottom edge	
21 Edge Match (Area: Top 270, Left 2160, Bottom 299, Right 2279) to Top edge	
22 Edge Match (Area: Top 270, Left 2040, Bottom 299, Right 2159) to Top edge	
23 Edge Match (Area: Top 270, Left 1920, Bottom 299, Right 2039) to Top edge	
24 Edge Match (Area: Top 270, Left 1800, Bottom 299, Right 1919) to Top edge	
25 Edge Match (Area: Top 300, Left 1800, Bottom 329, Right 1919) to Top edge	
26 Edge Match (Area: Top 300, Left 1920, Bottom 329, Right 2039) to Top edge	
27 Edge Match (Area: Top 450, Left 1440, Bottom 479, Right 1559) to Left edge	
28 Edge Match (Area: Top 420, Left 1440, Bottom 449, Right 1559) to Bottom edge	
29 Edge Match (Area: Top 450, Left 1560, Bottom 479, Right 1679) to Left edge	
30 Edge Match (Area: Top 480, Left 1440, Bottom 509, Right 1559) to Left edge	
31 Edge Match (Area: Top 480, Left 1560, Bottom 509, Right 1679) to Left edge	
32 Edge Match (Area: Top 510, Left 1560, Bottom 539, Right 1679) to Bottom edge	
33 Clip at 2.00 SD	
34 DeStripe Median Traverse: Grids: All Threshold: 0.25 SDs	
35 Edge Match (Area: Top 150, Left 2040, Bottom 179, Right 2159) to Left edge	
36 Edge Match (Area: Top 150, Left 1200, Bottom 179, Right 1319) to Left edge	
37 Edge Match (Area: Top 330, Left 1320, Bottom 359, Right 1439) to Left edge	
38 Edge Match (Area: Top 360, Left 1320, Bottom 389, Right 1439) to Left edge	
39 Edge Match (Area: Top 390, Left 1320, Bottom 419, Right 1439) to Top edge	
Note: converting the gradiometer data into ESRI GIS files imposed an x=y interpolation on the entire dataset	