Substrata
Archaeological Geophysical Surveyors

An archaeological gradiometer survey

Land at Maiden Newton, Dorset

Ordnance Survey (E/N): 359629,98000 (point)

Report: 150213

Ross Dean BSc MSc MA MIfA

16 February 2015

Substrata
Archaeological Geophysical Surveyors
15 Horizon View, Bath Hotel Road
Westward Ho!
Bideford
Devon EX39 1GX
Tel: 07788627822
Email: geophysics@substrata.co.uk
Web: substrata.co.uk

Client:
AC Archaeology Ltd
Manor Farm Stables
Chicklade
Hindon
Nr. Salisbury
Wiltshire SP3 5SU
Web: acarchaeology.co.uk

Contents

Figures

Tables

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 ..... Adobe PDF format
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 (if required) ..... AutoCAD DXF

1 Survey description and summary

1.1 Survey

Type:	twin-sensor fluxgate gradiometer
Date:	22 January 2014
Area:	1ha
Project Manager:	Ross Dean BSc (hon) MSc MA MIfA
Lead surveyor:	Mark Edwards BA (hon)

1.2 Client

AC Archaeology Ltd, Manor Farm Stables, Chicklade, Hindon, Nr. Salisbury, Wiltshire SP3 5SU

1.3 Location

Site:	Land at Maiden Newton
Village & Civil Parish:	Maiden Newton
Administrative District:	West Dorset
County:	Dorset
Nearest Postcode:	DT2 0AG
NGR:	SY596980
Ordnance Survey E/N:	359629,98000 (point)

1.4 Archive

OASIS number:	substrat1-203923
Archive:	At the time of writing, the archive of this survey will be held by Substrata.

1.5 Introduction

This report was commissioned by AC Archaeology Ltd on behalf of Strutt and Parker LLP in support of a proposed planning application to West Dorset District Council. The application area covers approximately 1ha of rough grassland on the north side of Maiden Newton, on the valley floor adjacent to the River Frome. The location of the proposed development area is shown in Figure 1.

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.

Fifteen magnetic anomaly groups were identified as possibly representing archaeological deposits or features. Two groups coincide with the edges of prominent earthworks recorded by AC Archaeology during a site visit completed as part of an Historic Environment Assessment of the application area. A further three groups are likely to be associated with other earthworks recorded during the assessment. These earthworks pre-date the available historical maps (Cottam, 2014). The pattern of these groups and the remaining groups identified as relating to potential archaeological deposits implies either an area of former agricultural activity with the creation of, for example, strip lynchets, tracks and enclosures or an area of former property boundaries and associated enclosures and tracks.

2 Survey aims and objectives

2.1 Aims

1. Define and characterise and detectable archaeological remains on the site.
2. Help establish the cultural heritage and archaeological implications of a proposal for a solar array.

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 2010) 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 application area covers approximately 1ha of rough grassland on the north side of Maiden Newton, on the valley floor adjacent to the River Frome and lies at approximately100m AOD (Figure 1). The area includes the site of a former quarry at its northern end.

4.2 Geology

The application area is located on rocks of the Cretaceous Upper Greensand Formation which typically comprises fine-grained, glauconitic, shelly sandstone and siltstone.

The superficial geology is Quaternary clay, silt, sand and gravel Head deposits (British Geological Survey, undated).

5 Archaeological background

An assessment of the archaeological background of the site is contained in Cottam (2014), an Historic Environment Assessment which was completed as part of the programme of works of to which this report contributes. The following is extracted from the Assessment.

There are no designated heritage assets within the application area which lies within the Maiden Newton Conservation Area. The principal archaeological interest within the application area comprises the presence of prominent linear earthworks which appear to pre-date the available historic maps. These lie adjacent to the twelfth century church and may represent property boundaries, or tofts, of medieval date. The field name Court Close may also be of interest. Additionally, a Romano-British cremation urn was found within the application area in the mid-nineteenth century. No associated cremations, features or deposits were recorded. Although no settlement of this date has yet been recorded within the study area, the Roman road from Dorchester to Exeter passes through the village approximately 300m to the south (*ibid*; 1).

The earthworks discussed above coincide with anomaly groups 1, 2, 6, 7 and 8 (Table 1, Figures 2 and 3) which are discussed below 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 reader is referred to section 7.

6.1 Results

Figures 2 and 3 show the interpretation of the survey data. They 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.

Figures 2 and 3 together with Table 1 comprise the analysis of the survey data. Plots of the processed data are provided in Figures 4 and 5.

6.2 Discussion

General points

Anomalies though to relate to natural features and recently deposited rubble 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.

Data collection along the survey area edges was restricted as shown in Figures 2 to 5. Figure 2 is annotated to show the location of the quarry, an electricity pole and trees which restricted access. The presence of magnetic materials on the electricity pole and in and adjacent to the field boundaries further reduced the area that could be surveyed. Strong magnetic responses mapped close to these field boundaries are likely to relate to such materials except where indicated otherwise in Figures 2 and 3.

Data relating to historical maps and other records

No magnetic anomaly groups coincided with features recorded on historical maps.

Magnetic anomaly groups **6 and 8** coincide with, and are likely to represent, the northern and southern edges of prominent north-east to south-west trending linear earthworks (Figure 3) which are visible on aerial photographs and appear to pre-date the available historic maps (Cottam, 2014).

Groups **1, 2 and 7** have the same alignment as a north-north-west to south-south-east trending linear earthworks visible on aerial photographs (*ibid*). As such, the anomaly groups may represent an extension of the visible earthworks. They are typical of anomalies representing sub-soil disturbance such as that caused by ploughing along a field boundary or phases of tracks along a former routeway.

Data with no previous archaeological provenance

Magnetic anomaly groups **10 and 11** are partially masked by strong magnetic interference from a recent service (group 101) and by magnetic responses representing recent rubble deposits, disturbed ground and magnetic materials in nearby field boundaries. Nevertheless there is sufficient data to suggest that groups 10 and 11 may represent similar features to the earthworks reflected by groups 1, 2, 6, 7 and 8 (discussed above).

Groups **3, 4 and 5** are linear groups that are most likely to represent former field boundaries, enclosures or agricultural features such as strip lynchets or past ploughing of unknown date.

Groups **12 to 15** are also affected by surrounding magnetic interference but are most likely to also represent former field boundaries, enclosures or agricultural features such as strip lynchets or past ploughing 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.

Fifteen magnetic anomaly groups were identified as possibly representing archaeological deposits or features. Two groups coincide with the edges of prominent earthworks recorded by AC Archaeology during a site visit completed as part of an Historic Environment Assessment of the application area. A further three groups are likely to be associated with other earthworks recorded during this assessment. These earthworks pre-date the available historical maps (Cottam, 2014). The pattern of these groups and the remaining groups identified as relating to potential archaeological deposits implies either an area of former agricultural activity with the creation of, for example, strip lynchets, tracks and enclosures or an area of former property boundaries and associated enclosures and tracks.

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.

8 Acknowledgements

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

9 Bibliography

Archaeology Data Service/Digital Antiquity Guides to Good Practice (undated): *Geophysical Data in Archaeology* [Online], Available: http://guides.archaeologydataservice.ac.uk/g2gp/Geophysics_Toc [January 2015]

British Geological Survey (undated) *Geology of Britain viewer [Online], Available: http://www.bgs.ac.uk/discovering Geology/geologyOfBritain/viewer.html* [February 2015]

Clark, A. (2000) *Seeing Beneath the Soil, Prospecting methods in archaeology*, London: Routledge

Dean, R. (2015) *A gradiometer survey method statement, Land at Maiden Newton, Dorset,* Substrata unpublished document

Institute for Archaeologists (undated) *IfA house style*, [Online], Available: http://www.archaeologists.net/sites/default/files/node-files/ifa_house_style.pdf [February 2015]

Institute for Archaeologists (2011) *Standard and guidance archaeological geophysical survey*. Reading: Author [Online], Available: http://www.archaeologists.net/sites/default/files/node-files/Geophysics2010.pdf [February 2015]

Institute for Archaeologists (2010) *Code of conduct*. Reading: Author [Online], Available: http://www.archaeologists.net/sites/default/files/node-files/code_conduct.pdf [February 2015]

Institute for Archaeologists (2008) *Code of approved practice for the regulation of contractual arrangements in archaeology*. Reading: Author [Online], Available: http://www.archaeologists.net/sites/default/files/node-files/ifa_code_practice.pdf [February 2015]

Cottam, S. (2014) *Land at Maiden Newton, Dorset, Centred on NGR Historic Environment Assessment*, AC Archaeology Ltd unpublished document ACD112/11

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.

Site: An archaeological gradiometer survey
Land at Maiden Newton, Dorset
Centred on NGR 359629,98000
Report 150213

anomaly group	associated anomalies	anomaly characterisation certainty & class	anomaly form	additional archaeological characterisation	comments	supporting evidence
1		possible, positive	linear			
2	7	possible, positive	multiple parallel-linears		a group of linear parallel anomalies typical of those representing a group of tracks forming a routeway or soil disturbance around a former boundary; the groups are aligned with an linear feature visible on aerial photographs	
3		possible, positive	linear			
4		possible, positive	disrupted linear			
5		possible, positive	disrupted linear			
6	8	likely, positive	disrupted linear		anomaly groups coincide with the northern edge of substantial earthworks recorded by AC Archaeology Ltd which in turn coincide with features visible on aerial photographs	AC Archaeology report ACW711/1/0
7	2	possible, negative	linear		such anomaly groups are typical of those representing a group of tracks forming a routeway; the groups are aligned with a linear feature visible on aerial photographs	AC Archaeology report ACW711/1/0
8	6	likely, positive	disrupted linear		anomaly groups coincide with the southern edge of substantial earthworks recorded by AC Archaeology Ltd which in turn coincide with features visible on aerial photographs	AC Archaeology report ACW711/1/0
9		possible, positive	linear			
10		possible, positive	disrupted linear			
11		possible, positive	multiple parallel-linears		these anomaly groups lie on the edge of an area of high magnetic signals but are relatively clear and may represent one or more linear features	
12		possible, positive	linear			
13		possible, positive	linear		anomaly group aligns with a modern property boundary but also with other anomalies and, on balance, is probably not associated with the boundary	
14		possible, positive	linear			
15		possible, positive	linear			
101		possible, high contrast linear		service	anomaly group represents a ferrous pipe, cable or drain	

Table 1: data analysis

359000 m

360000 m

99000 m

98000 m

97000 m

N

Chilfrome

River Frome

Nordor Hill

The Quarry

Higher Frome Vauchurch

Tollerford

Maiden Newton

Frome Vauchurch

Lower Frome Vauchurch

0

500 m

application area

359000 m

360000 m

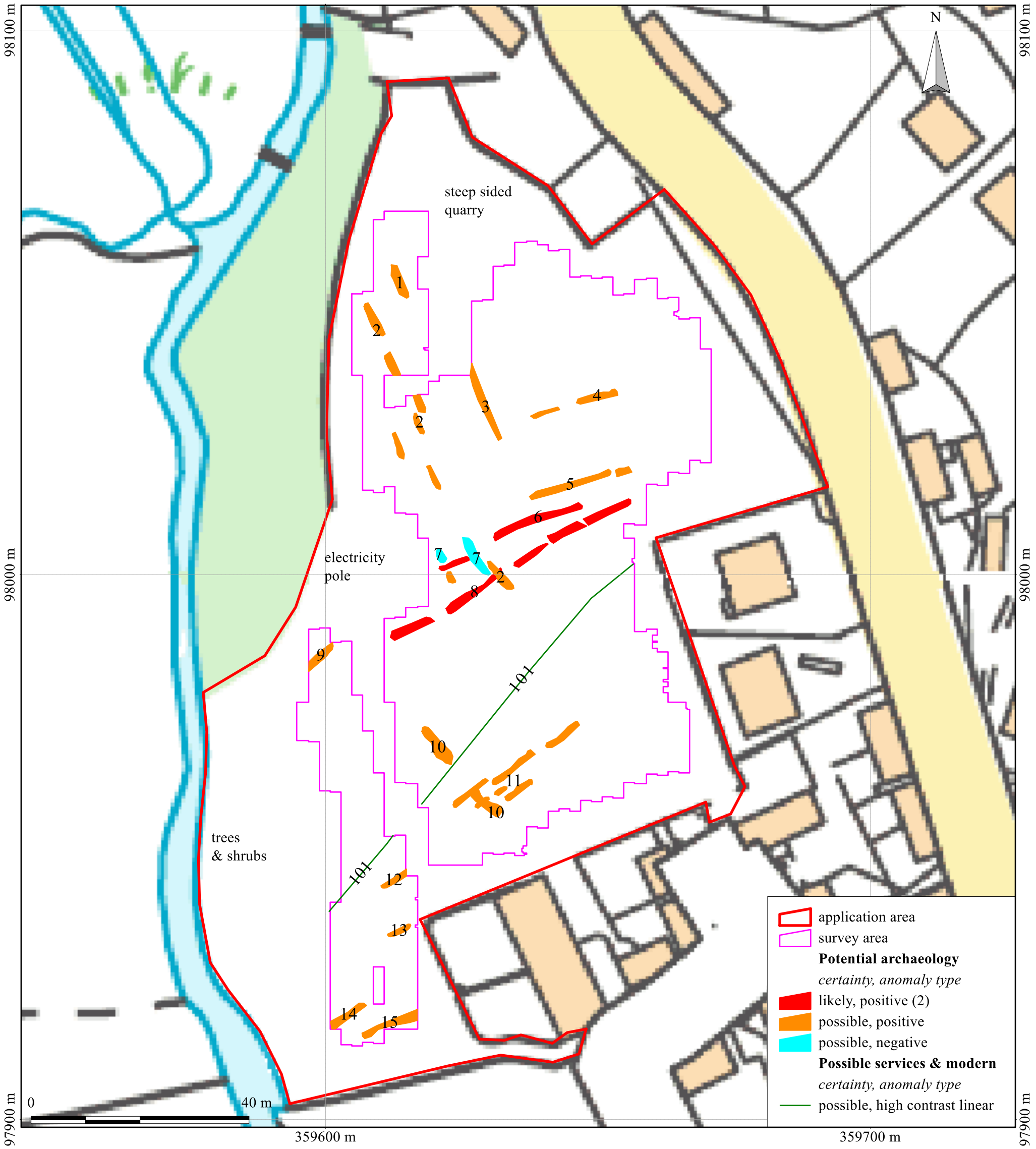
British Grid
centre X: 359583.25 m, centre Y: 98008.94 m

Scale: 1:8000 @ A3. Spatial Units: Meter. Do not scale off this drawing

An archaeological gradiometer survey
Land at Maiden Newton, Dorset
Centred on NGR 359629,98000
Report 150213

Figure 1: location map

Substrata
Orchard Lodge, Cornborough Road
Westward Ho!, Bideford, Devon EX39 1GX
Tel: 07788627822
Email: geophysics@substrata.co.uk
Web: substrata.co.uk



British Grid
centre X: 359635.37 m, centre Y: 98001

Scale: 1:700 @ A3. Spatial Units: Meter. Do not scale off this drawing

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 archaeolo

An archaeological gradiometer survey
Land at Maiden Newton, Dorset
Centred on NGR 359629,98000
Report 150213

Figure 2: survey interpretation

Substrata
Orchard Lodge, Cornborough Road
Westward Ho!, Bideford, Devon EX39 1GX
Tel: 07788627822
Email: geophysics@substrata.co.uk
Web: substrata.co.uk

British Grid
centre X: 359635.37 m, centre Y: 98001

Scale: 1:700 @ A3. Spatial Units: Meter. Do not scale off this drawing

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 archaeolo

An archaeological gradiometer survey
Land at Maiden Newton, Dorset
Centred on NGR 359629,98000
Report 150213

Figure 3: survey interpretation over 1.2cm aerial photography

Substrata
Orchard Lodge, Cornborough Road
Westward Ho!, Bideford, Devon EX39 1GX
Tel: 07788627822
Email: geophysics@substrata.co.uk
Web: substrata.co.uk

359600 m
359700 m
98100 m
98000 m
97900 m
N
0
40 m
application area
Gradiometer processed data shade plot
nT
2
-2

British Grid
centre X: 359635.37 m, centre Y: 98001

Scale: 1:700 @ A3. Spatial Units: Meter. Do not scale off this drawing

An archaeological gradiometer survey
Land at Maiden Newton, Dorset
Centred on NGR 359629,98000
Report 150213

Figure 4: shade plot of processed data

Substrata
Orchard Lodge, Cornborough Road
Westward Ho!, Bideford, Devon EX39 1GX
Tel: 07788627822
Email: geophysics@substrata.co.uk
Web: substrata.co.uk

359600 m
359700 m
98100 m
98000 m
97900 m
N
0
40 m
application area
Gradiometer processed data
contour plot
> 4.00
2.00 - 4.00
1.00 - 2.00
0.50 - 1.00
-0.50 - 0.50
-1.00 - -0.50
-2.00 - -1.00
-4.00 - -2.00
< -4.00

British Grid
centre X: 359635.37 m, centre Y: 98001

Scale: 1:700 @ A3. Spatial Units: Meter. Do not scale off this drawing

An archaeological gradiometer survey
Land at Maiden Newton, Dorset
Centred on NGR 359629,98000
Report 150213

Figure 5: contour plot of processed data

Substrata
Orchard Lodge, Cornborough Road
Westward Ho!, Bideford, Devon EX39 1GX
Tel: 07788627822
Email: geophysics@substrata.co.uk
Web: substrata.co.uk

Appendix 2 Methodology Summary

<table>
<tr><th colspan="2">Table 1: methodology summary</th></tr>
<tr><td colspan="2">Documents
Survey methodology statement: Dean (2015)</td></tr>
<tr><td colspan="2">Methodology
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.</td></tr>
<tr><td colspan="2">Grid
Method of Fixing: DGPS set-out using pre-planned survey grids and Ordnance Survey coordinates.
Composition: 30m by 30m grids
Recording: Geo-referenced and recorded using digital map tiles.
DGPS used: Spectra Precision PM5V2 GPS with external antenna and survey pole and DigiTerra Explorer 7 as the survey control program.</td></tr>
<tr><td>Equipment
Instrument: Bartington Instruments grad601-2
Firmware: version 6.1</td><td>Data Capture
Sample Interval: 0.25-metres
Traverse Interval: 1 metre
Traverse Method: zigzag
Traverse Orientation: GN</td></tr>
<tr><td colspan="2">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</td></tr>
</table>

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: 187.77 Min: -92.55 Std Dev: 13.77 Mean: -0.17 Median: 0.01 Processes: 5 1 Base Layer 2 Clip at 2.00 SD 3 De Stagger: Grids: All Mode: Both By: -1 intervals 4 DeStripe Median Traverse: Grids: All 5 Interpolate: Match X & Y Doubled.

Appendix 4 Geophysical surveying techniques

1 Introduction

Substrata offers magnetometer and earth resistance surveying. We also provide other archaeology-specific geophysical surveys such as ground penetrating radar and resistivity. The particular method or combination of methods used depends on local soil conditions and the survey requirements. These methods are capable of delivering fast and accurate assessments of the archaeology of both large and small sites.

Further details can be found on our website at www.substrata.co.uk.

2 Magnetometer surveying

Standard magnetometer surveys are the workhorse of archaeological surveying when speed and cost-effectiveness are important. Identifiable archaeological features include areas of occupation, hearths, kilns, furnaces, ditches, pits, post-holes, ridge-and-furrow, timber structures, wall footings, roads, tracks and similar buried features.

Magnetometer surveying is used to detect and map small changes in the earth's magnetic field caused by concentrations of ferrous-based minerals within the soil and subsoil, and by materials buried beneath the surface. While most of these changes are too small to affect a compass needle, they can be detected and mapped by sensitive field equipment. During surveys the different magnetic properties of top-soils, sub-soils, rock formations and archaeological features are recorded as variations against a background value. Subsequently magnetic anomalies resulting from potential archaeology can be identified and interpreted.

Bartington grad601-2 gradiometers

A gradiometer is a type of magnetometer and is sensitive to relatively small changes in the earth's magnetic field. Our primary surveying instruments are Bartington Grad601-2 (dual sensor) fluxgate gradiometers with automatic data loggers. They are specifically designed for field use by archaeologists. The Bartington gradiometers provide proven technology in archaeological magnetic surveying and offer fast, accurate set-up and survey rates. They are sensitive to depths of between 0 and 1.5m below ground level, with optimum sensitivity at depths of 1m or less.

Multiple sensor arrays

A technique relatively new to commercial archaeological surveying but well understood in academic circles involves the use of multiple magnetometer sensors towed behind a quad bike or similar vehicle. With multiple sensors and the use of on-board GPS units, it is possible to achieve faster survey rates at competitive commercial rates when compared to the use of multiple instruments and the techniques discussed above provided the ground is suitable for the vehicle and array. Substrata is pleased to announce that we now offer this service on suitable larger sites

3 Earth resistance surveying

Earth resistance surveying is an excellent tool for detecting buried archaeology. Its relatively slow rate of survey compared to magnetometer surveys means that it usually employed in commercial surveys when a detailed understanding of buried building remains is required. This technique measures changes in the electrical resistance of the ground being surveyed. In practice, the recording of differences in the electrical resistance of near-surface deposits and structures allows the detection and interpretation of masonry and brick foundations, paving and floors, drains and other cavities, large pits, building platforms, robber trenches, ditches, graves and similar buried features.

Resistance to electrical current flow in the ground depends on the moisture content and structure of the soil and other materials buried beneath the surface. For example, the higher the moisture content of a soil, the less resistant it is to electrical current flow. A ditch completely buried beneath the present ground surface is likely to have an infill soil different to that surrounding the ditch in terms of compactness and composition. As a result, the soil filling the buried ditch will retain moisture in a different way to the surrounding soil which means it will

have an electrical resistance at variance with the surrounding environment. By passing a small current through the ground it is possible to detect, record, plot and interpret such changes in electrical resistance.

For earth resistance surveying Substrata uses the Geoscan Research RM15 series multi-probe resistance meters and purpose-built automatic data-loggers. The Geoscan MPX15 multiplexer is an integral part to the instrument configuration and facilitates multi-probe arrays which speed up survey area coverage rates and, if required, facilitate simultaneous multiple-depth data collection.