Substrata
Archaeological Geophysical Surveyors

An archaeological gradiometer survey

Land adjacent to Hill Barton Business Park, Clyst St Mary, Devon

Ordnance Survey (E/N): 300877,91323 (point)

Report: 141105

Ross Dean BSc MSc MA MIfA

05 November 2014

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
4 Halthaies Workshops
Bradninch
Nr Exeter
Devon EX5 4QL
Tel: 01392 882410
Web: acarchaeology.co.uk

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1 Survey description and summary

1.1 Survey

Type:	twin-sensor fluxgate gradiometer
Date:	7, 8 and 16 August 2014
Area:	7.8ha
Lead surveyor:	Ross Dean BSc MSc MA MIfA

1.2 Client

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

1.3 Location

Site:	Land adjacent to Hill Barton Business Park
Civil parish:	Farringdon
District:	East Devon
County:	Devon
Nearest Postcode:	EX5 2HU
NGR:	SY 008 913
Ordnance Survey E/N:	300877,91323 (point)

1.4 Archive

OASIS number:	substrat1-194267
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 clients. It has been prepared as part of a programme of work in support of a forthcoming planning application at the above site. The location of the survey area is shown in Figure 4.

1.6 Summary

The data collected suggests that the ground may have been subjected to considerable disturbance in the past which could have had an impact on the magnetic contrast required to identify magnetic anomalies that may indicate archaeological deposits or features. Two magnetic anomaly groups were identified as relating to possible archaeological deposits or features. One group lies along the north-eastern edge of a possible rectangular enclosure shown on an aerial photograph of 1999-2000. The other may relate to an archaeological deposit or structure but no further archaeological characterisation could be established.

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 application area comprises two parcels of land approximately 8ha in extent to the northeast of the Hill Barton Business Park as shown in Figure 4.

At the time of the survey the land was under grass.

4.2 Geology

The application area is located on a solid geology of the Early Triassic Exmouth Mudstone And Sandstone Formation which comprise reddish brown silty mudstones with intercalated reddish brown lenticular sandstone beds, exceptionally to 30m thick, but mostly 5 to 10m thick. The superficial geology was not recorded in the source used (British Geological Survey, undated).

5 Archaeological background

The following is a short summary of information obtained from the Devon and Dartmoor Historic Environment Record (HER) within 5000m of the survey area and deemed relevant to the understanding of the gradiometer survey. Except where specifically stated, this information was obtained using the Heritage Gateway (English Heritage, undated). The HER entries cited below are summarised in Appendix 4. Figure 2 shows the survey interpretation superimposed on a map of heritage assets within the application area.

The reader is advised that this summary should not be used outside the context of this report and is referred to the Devon Historical Environment Record (HER) via the Devon County Council Historic Environment Service for informed provision of the information.

5.1 Historical Landscape Characterisation

The application area has two historic landscape characterisation areas. Both fields are characterised as 'Modern enclosures adapting post-medieval fields' in which the current enclosures have been created by adapting earlier fields of probable Post-medieval date. The north-eastern field also has an area of 'Former Orchards' lying within the survey area. The area was once an orchard planted with fruit trees, but these have been lost in the 20 century (Devon County Council, undated).

5.2 Heritage Assets within the Survey Area

There are two undesignated heritage assets within the survey area. One is a set of linear cropmark features that are probably the remains of old field boundaries (HER entry MDV29734). The other is a possible rectangular enclosure shown on an aerial photograph of 1999-2000 (MDV73316). The orchard is not represented in the survey data. A linear magnetic anomaly coincides with the north-eastern edge of the possible enclosure (Figures 1 and 2).

5.3 Heritage Assets close to the Survey Area

A view of the HER across a wider area demonstrates activity in the area from Prehistoric times onwards. Within 500m of the survey area are one and possibly two Medieval farmsteads or settlements (MDV15532 and MDV16379). An extant track that could date from the eleventh century AD onwards lies to the southeast of the survey area (MDV46816) and a Prehistoric rectilinear, single ditched enclosure and rectilinear enclosure lies north of Glebe Copse some 425m northeast of the survey location point (MDV59080).

5.4 Previous Historical Environment work

EDV4878: Desk-based Assessment of Land Between Hill Barton Industrial Estate and the A3052 Exeter to Sidmouth Road (Farnell, 2009)

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

Figure 1 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 from a detailed analysis of the survey data provided in the attribute tables of the GIS project on the accompanying CD-ROM.

Figure 1 along with Table 1 comprises the analysis of the survey data. Figure 2 shows the survey interpretation superimposed on a map of heritage assets within the application area. A plot of the processed data is provided in Figure 3.

6.2 Discussion

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.

General points

Anomalies though 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.

Data collection along the field edges was restricted as shown in Figures 1 to 3 due to the presence of magnetic materials in and adjacent to the field boundaries. Strong magnetic responses mapped close to the field boundaries are likely to relate to these materials except where indicated otherwise in Figure 1.

The data collected suggests that the ground may have been subjected to considerable disturbance in the past which could have had an impact on the magnetic contrast required to identify magnetic anomalies that may indicate archaeological deposits or features.

Data relating to historical maps and other records

No recorded magnetic anomaly groups coincide with features recorded on historical Ordnance Survey maps.

Data with previous archaeological provenance

As shown in Figure 2, anomaly group **2** lies along the north-eastern edge of a possible rectangular enclosure shown on an aerial photograph of 1999-2000 (MDV73316). Information concerning the possible enclosure is sparse and so the anomaly is designated ‘possible archaeology’ only.

Data with no previous archaeological provenance

Group **1** may relate to an archaeological deposit or structure and may be associated with group 2 but, given its isolation in the data set, no further archaeological characterisation could be established.

6.3 Conclusions

The data collected suggests that the ground may have been subjected to considerable disturbance in the past which could have had an impact on the magnetic contrast required to identify magnetic anomalies that may indicate archaeological deposits or features. Two magnetic anomaly groups were identified as relating to possible archaeological deposits or features. One group lies along the north-eastern edge of a possible rectangular enclosure shown on an aerial photograph of 1999-2000. The other may relate to an archaeological deposit or structure but no further archaeological characterisation could be established.

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 John Valentin of AC Archaeology Ltd for commissioning us to complete this survey.

9 Bibliography

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

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Farnell, A. J. (2009) *An Archaeological Trench Evaluation on Land Between Hill Barton Industrial Estate and the A3052 Exeter to Sidmouth Road*. Exeter Archaeology Unpublished Report. 09.110.

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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 [October 2014]

Institute for Archaeologists (2009) *Code of conduct*. Reading: Author [Online], Available: http://www.archaeologists.net/sites/default/files/node-files/code_conduct.pdf [October 2014]

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 [October 2014]

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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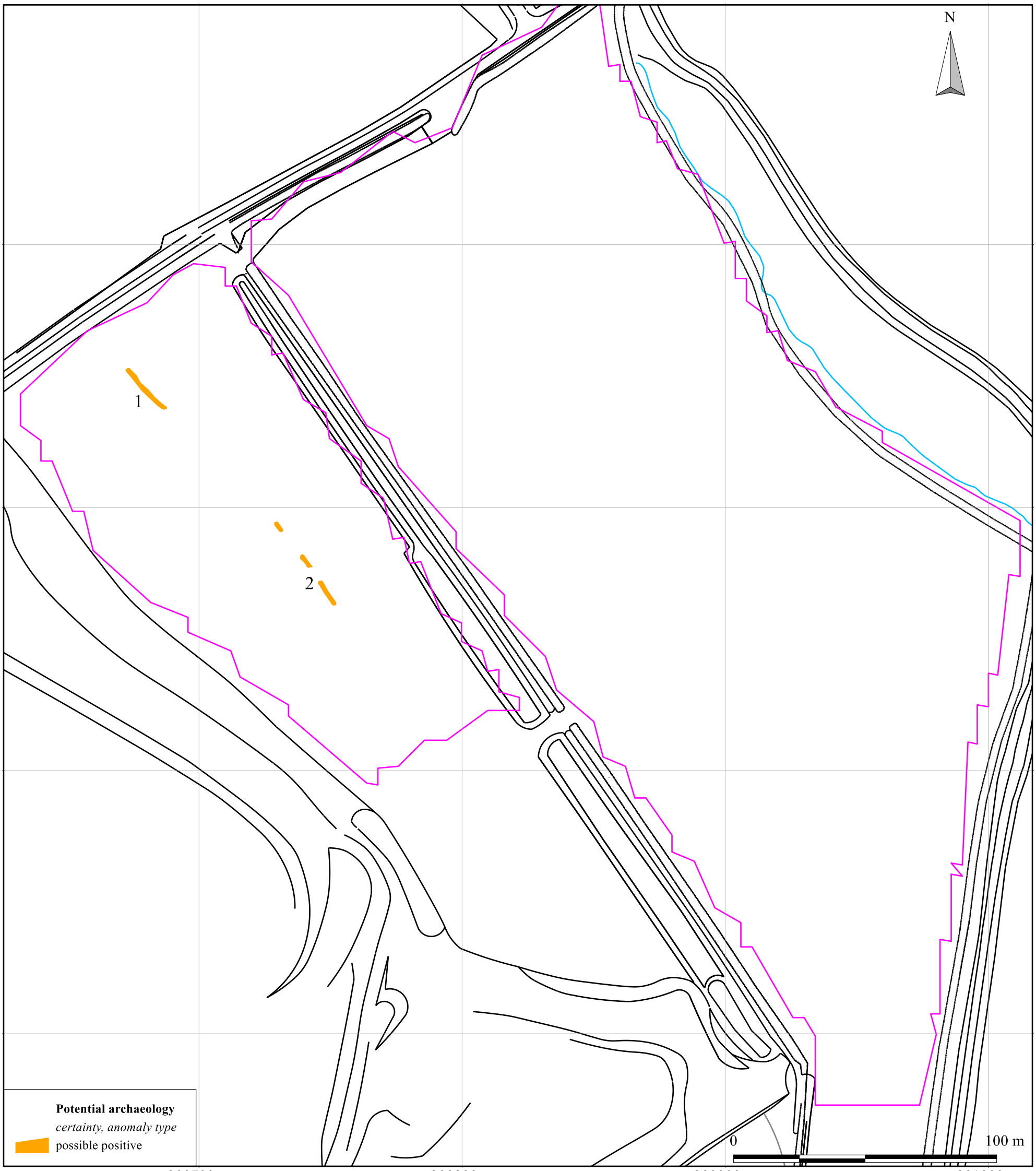
anomaly group	associated anomalies	anomaly characterisation certainty & class	anomaly form	additional archaeological characterisation	comments	supporting evidence
1		possible, positive	linear			
2		possible, positive	linear	enclosure boundary	anomaly group coincides with a possibly rectangular enclosure of unknown date mapped from an aerial photograph; details of enclosure are vague and so anomaly remains classified as 'possible archaeology'	HER MDV73316

Table 1: data analysis



British Grid
centre X: 300821.25 m, centre Y: 91270.34 m

Scale: 1:1500 @ 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. Anomalies likely to represent geological or other natural deposits are not mapped unless relevant to potential archaeological events or deposit

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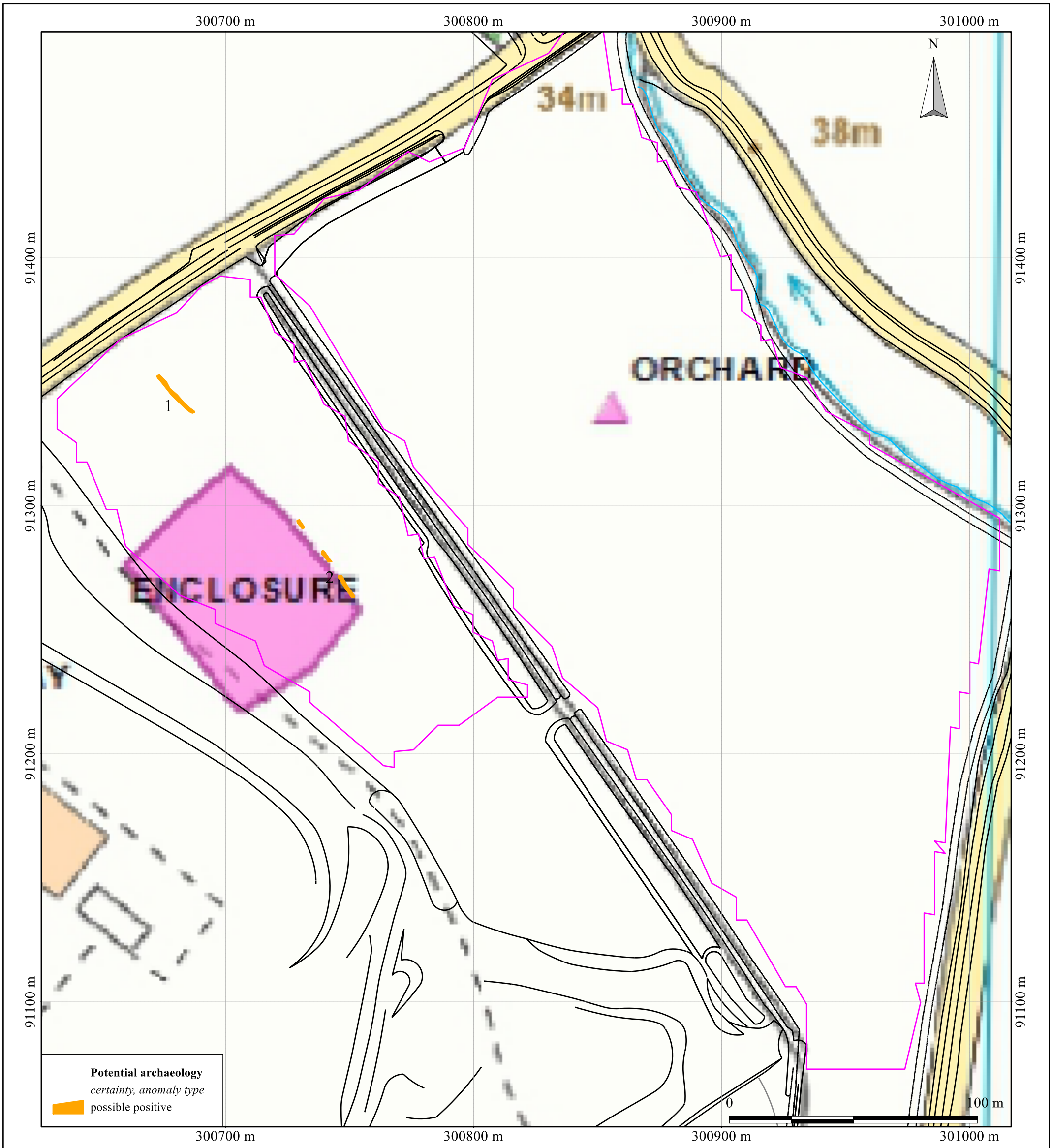
Figure 1: survey interpretation

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



British Grid
centre X: 300821.25 m, centre Y: 91270.34 m

Scale: 1:1500 @ A3. Spatial Units: Meter. Do not scale off this drawing

Notes:
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Figure 2: survey interpretation with map of possible enclosure

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Tel: 07788627822
Email: geophysics@substrata.co.uk
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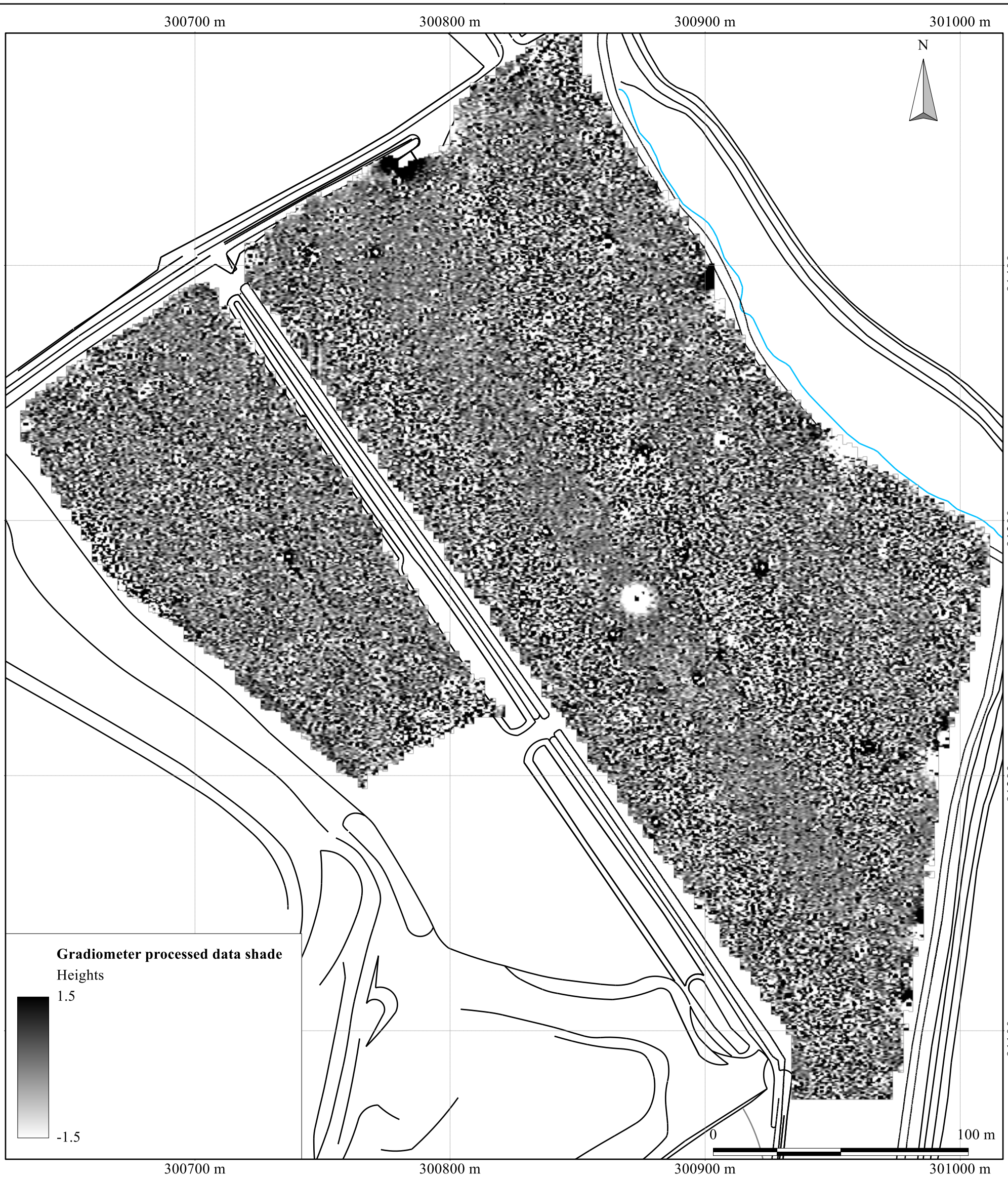

British Grid
centre X: 300821.25 m, centre Y: 91270.34 m

Scale: 1:1500 @ A3. Spatial Units: Meter. Do not scale off this drawing

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Figure 3: shade plot of processed data

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Tel: 07788627822
Email: geophysics@substrata.co.uk
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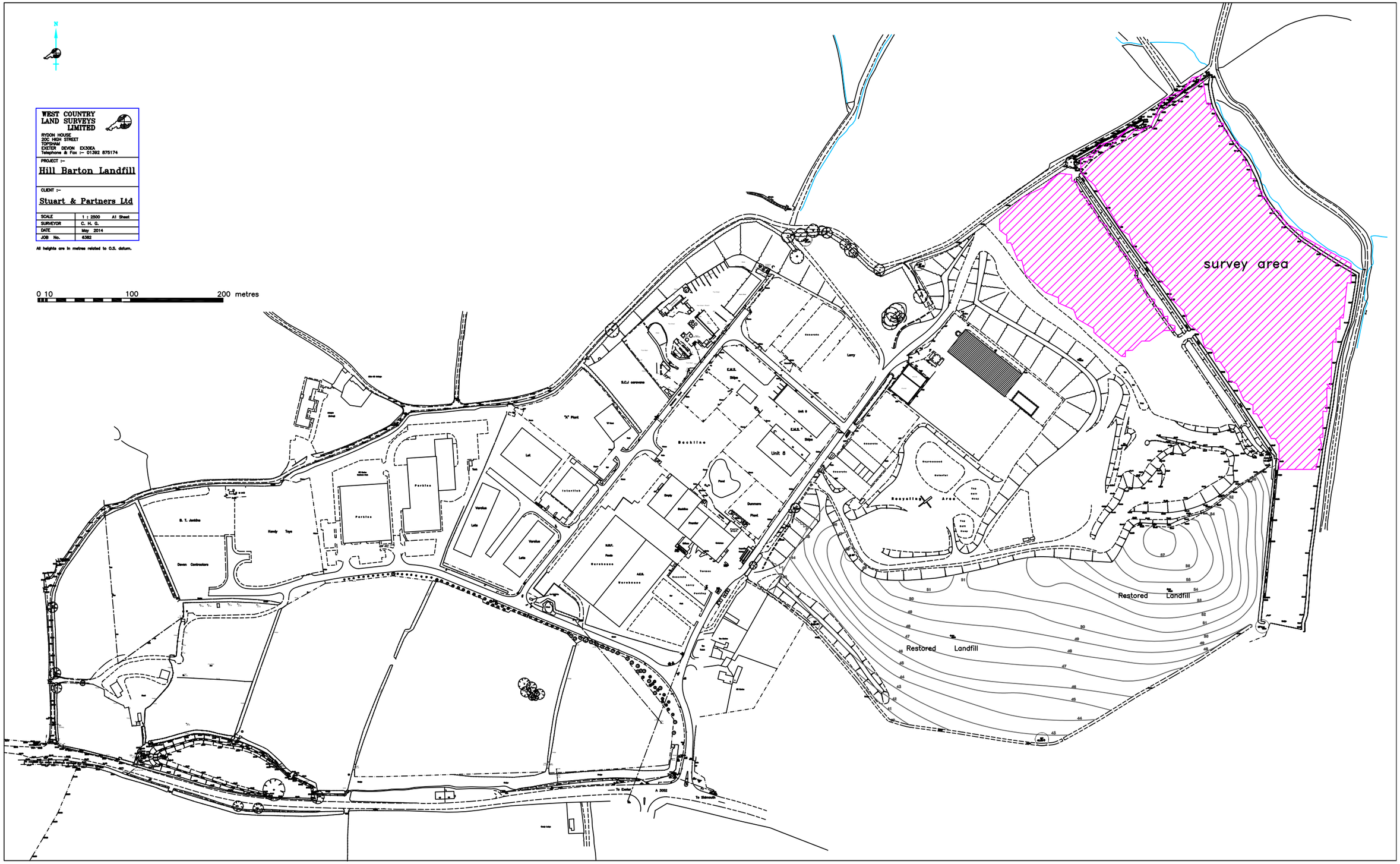

Figure 4: location map

Appendix 2 Methodology Summary

<table>
<tr><th colspan="2">Table 2: methodology summary</th></tr>
<tr><td colspan="2">Documents
Survey methodology statement: Dean (2014)</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 3: 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: 3.0.25.1
Stats Max: 97.92 Min: -153.49 Std Dev: 5.27 Mean: 0.06 Median: 0.00 Processes: 4 1 Base Layer 2 Clip at 1.00 SD 3 De Stagger: Grids: All Mode: Both By: -2 intervals 4 DeStripe Median Sensors: All Note: converting the gradiometer data into ESRI GIS files imposed an x=y interpolation on the entire dataset

Appendix 4 Summaries of cited Devon and Dartmoor Historical Environment Record Entries as recorded in the Heritage Gateway (English Heritage, undated)

HER Number: MDV29734
Summary:
South of Denbow Farm. Linear cropmark features, probably old field boundaries. Recorded on July 1984 AP (dap).
Location Grid Reference: SY 008 913; approximately 80m GN253 from survey location point
Monument Type(s) and Dates: ORCHARD (Modern - 1751 AD to 2009 AD (Between))

HER Number: MDV73316
Name: Possible enclosure, near Denbow Cross, Farringdon
Summary:
Possible rectangular enclosure shown on aerial photograph of 1999-2000.
Location Grid Reference: SY 007 912; approximately 215m GN235 from survey location point
Monument Type(s) and Dates: ENCLOSURE (Unknown date)
Sources / Further Reading:
Aerial Photograph: GetMapping. 1999 - 2000. Millennium Map. Photograph (Digital).
Report - Evaluation: Farnell, A. J.. 2009. An Archaeological Trench Evaluation on Land Between Hill Barton Industrial Estate and the A3052 Exeter to Sidmouth Road. Exeter Archaeology Report. 09.110.
Associated Events:
EDV4878 - Desk-based Assessment of Land Between Hill Barton Industrial Estate and the A3052 Exeter to Sidmouth Road

HER Number: MDV15528
Summary - not yet available
Location Grid Reference: SY 006 917; approximately 468m GN324 from survey location point
Monument Type(s) and Dates: FARMSTEAD (Medieval - 1066 AD to 1539 AD (Between))
Untitled Source (Migrated Record):
Reichel, O. J. /tda/35(1903)291/The Hundred of Budleigh in the time of "Testa de Nevil", A.D.1244. Denbow, alias Benbow, Ferndon, and Little Farringdon. This settlement appeared in the 1244 "Testa de Nevil"

HER Number: MDV15532
Summary - not yet available
Location Grid Reference: SY 01 91; approximately 346m GN159 from survey location point
Monument Type(s) and Dates: FARMSTEAD (Medieval - 1066 AD to 1539 AD (Between))
Untitled Source (Migrated Record):
Reichel, O. J. /tda/35(1903)291/The Hundred of Budleigh in the time of "Testa de Nevil", A.D.1244

HER Number: MDV16379
Summary:
Eveleigh. A lost settlement is possibly sited here. It is recorded as Iueleia in 1086, Yevelegh in 1378 and Eveleigh in 1733. The name comes from the Old English Ifa's Leah (e. P. N. S.). Domesday records the Eveleigh and Whiteheathfield On The Culm were both Fulcher's in 1086. In 1428, the inquisition of John Dynham shows they were both held by one and the same owner (Reichel, 1910). Possibly the Eveleigh referred to by Reichel, belonging to the Honour of Plympton and held by Fulcher of the Ordnance Officers in 1086 (Reichel, 1928-1938). (See also MDV15532).
Location Grid Reference: SY 01 91; approximately 346m GN159 from survey location point
Monument Type(s) and Dates: FARMSTEAD (VIII to XVIII - 701 AD to 1800 AD (Between))

HER Number: MDV46816
Summary:
Vis=28/01/1993 (Dick). NW-SE trackway defined by 2 banks. The E bank is less substantial and seems more disturbed, although several mature oaks are present. The W bank also supports large trees and survives up to 2m high in places. A narrow stream now runs along the track. Appears to continue the line of the Farringdon/Clyst Honiton parish boundary, which turns W to follow the Denbow Cross Road at SY00509130. This alignment, and presence of ancient woodland indicator species' indicates some antiquity. Shown as a road/track on 1838 tm (Dick).

Location Grid Reference: SY 005 912; approximately 397m GN252 from survey location point
Monument Type(s) and Dates: TRACKWAY (XI to Modern - 1066 AD to 2009 AD (Between))

HER Number: MDV59080
Name: Cropmark
Summary:
Part of large single ditched enclosure (N and E sides) with corner of another rectilinear enclosure to N. Recorded from the air as a cropmark by F. Griffith in 1996 (aph).
Location Grid Reference: SY 012 916; approximately 425m GN49 from survey location point
Protected Status:
SHINE: Prehistoric rectilinear, single ditched enclosure and rectilinear enclosure north of Glebe Copse
Monument Type(s) and Dates: ENCLOSURE (Prehistoric - 698000 BC to 42 AD (Between))

Appendix 5 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.