

An archaeological gradiometer survey

Land to the Northwest of Forches Cross, Newton Abbot, Devon

Ordnance Survey NGR (E/N): 284040,73330

Report: 150323

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23 March 2015

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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:	Area 6: 9 March 2015				
		Area 2.7: 10 to 11 November 2014				
	Area:	Area 6: 7.7ha				
		Area 2.7: 0.7ha				
	Lead surveyor:	Ross Dean BSc MSc MA MIfA				

1.2 Client

SLR Consulting Ltd, 69 Polsloe Road, Exeter, Devon EX1 2NF

1.3 Location

Site:	Land to the Northwest of Forches Cross
Town & Civil Parish:	Newton Abbot
District:	Teignbridge
County:	Devon
Nearest Postcode:	TQ12 6PZ
NGR:	SX840733 (point)
Ordnance Survey E/N:	284040,73330 (point)

 1.4 Archive OASIS number: Archive:
 Archive:
 Substrat1-207080 At the time of writing, the archive of this survey will be held by Substrata and will be deposited with a suitable archive organisation in the near future.

1.5 Introduction

This report was commissioned by SLR Consulting Ltd on behalf of Devon County Council Engineering Design Group as part of a forthcoming application. The location of the application area is shown in Figure 1.

The eastern edge of the survey (area 2.7 in Figure 5) was subject to a separate survey (Dean, 2014) completed on behalf of Devon County Council Engineering Design Group and reproduced here with permission. The survey interpretation designations used in this report follow on from those in the earlier report for ease of data integration.

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.

Sixty-seven magnetic anomaly groups were identified as relating to possible archaeological deposits or features. The majority are most likely to relate to more than one phase of former field boundaries and other enclosures. Three anomaly groups represent a Prehistoric double-ditched enclosure recorded in the Devon Historic Environment Record MDV9121. A further three groups within the enclosure may represent sub-circular features. There are a number of areas with enhanced magnetic responses that may reflect disrupted archaeological deposits although one of these may reflect natural spring deposits. Two potential ditched tracks or roads were also recorded.

2 Survey aims and objectives

2.1 Aims

1. Contribute to the informing of the design of the scheme and the location and scope of the archaeological mitigation required by the impact of the development.

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 Land use and topography

The application area comprised agricultural land laid to arable use at the time of the survey.

The land is bordered by a stream to the north, the A382 to the east, Staplehill Road to the south and agricultural land to the west. The majority of the land lies between 45m and 40m O.D. and ground descends to approximately to 30m O.D. in the west-east trending stream valley to the north.

4.2 Geology

The application area is located on an unconformable solid geology boundary. To the south and west of the area the rocks are slate, lava and tuff from the Carboniferous and Devonian Gurrington Slate Formation. To the north and east the rocks are sand, silt and clay of the Palaeogene Bovey Formation. The superficial deposits were not recorded in the source used (British Geological Society, undated).

5 Archaeological background

A comprehensive report of the historic environment of a wider area including the relevant information for the application area is provided in Smart (2014). A Prehistoric double-ditched rectangular enclosure within the application area has been recorded on aerial photographs (Devon Historic Environment Record MDV9121). Slight traces of a bank were noted in 1983.

The Modern Historic Landscape Characterisation for the application area is *Modern enclosures adapting Medieval fields*: these modern fields have been created out of probable Medieval enclosures with the sinuous Medieval boundaries surviving in places (Devon County Council, undated).

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

The survey area was designated area 6 to facilitate data integration with the part of the application area surveyed during 2014 (see Section 1 and Figure 5).

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

Figure 2 along with Table 1 comprises 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 and roadside boundaries. Strong magnetic responses mapped close to the field and roadside boundaries are likely to relate to these materials except where otherwise indicated in Figure 2.

The parallel linear patterns in the direction of survey are likely to reflect former ploughing with some enhancement of instrument calibration limitations across the western side of the area corresponding to the change in geology (Section 5).

6.2.2 Data relating to historical maps and other records

The magnetic anomalies recorded did not coincide with features recorded on historical or modern Ordnance Survey maps of the area.

Magnetic anomaly groups **62**, **63** and **64** coincide with, and are very likely to represent, a double-ditched rectangular enclosure, thought to be Prehistoric (before 43AD) (Devon Historic Environment Record MDV9121).

6.2.3 Data with no previous archaeological provenance

Most of the anomaly groups mapped as representing potential archaeological deposits exhibit patterns typical of anomalies representing multiple phases of former enclosures and field boundaries. The dates of these features cannot be interpreted using geophysical mapping but the proximity of the double-ditched enclosure implies that Prehistoric fields and enclosures may be represented. Of these, group 42 is most likely to represent a relatively recent service ditch although it does run parallel with group 48 and so an archaeological origin cannot be rejected without further archaeological investigation.

Within the likely double-ditched enclosure, there are three partial sub-circular anomaly groups that may represent a ring-ditch or large round-house (group **69**) and two smaller sub-circular features such as round-houses (groups **74** and **77**).

Anomaly groups **81** and **97** are most likely to represent two ditched tracks or roads with possible metalling in places or, less likely, former two Devon bank field boundaries.

The relatively enhanced, mixed magnetic response of anomaly group 46 may represent areas of former archaeological activities and soil disturbance such as quarrying although such patterns can also result from rising springs.

Group **68** also represents an area of enhanced magnetic response. The tighter anomaly patterns recorded here imply ground disturbance and possibly heated materials such as those left by industrial or craft work.

Groups 52, 56, 58, 65, 85 and 94 represent spreads of relatively enhanced magnetic material which often represents disrupted archaeological deposits.

Group **95** is most likely to represent a relatively recent iron or steel object but its form is a little unusual and it may represent a deposit of heated material.

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.

Sixty-seven magnetic anomaly groups were identified as relating to possible archaeological deposits or features. The majority are most likely to relate to more than one phase of former field boundaries and other enclosures. Three anomaly groups represent a Prehistoric double-ditched enclosure recorded in the Devon Historic Environment Record MDV9121. A further three groups within the enclosure may represent sub-circular features. There are a number of areas with enhanced magnetic responses that may reflect disrupted archaeological deposits although one of these may reflect natural spring deposits. Two potential ditched tracks or roads were also recorded.

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 Helen Smart of SLR Consulting Ltd for commissioning us to complete this survey.

9 Bibliography

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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.



Figure 1: location map



Figure 2: survey interpretation

field	anomaly	associated	anomaly characterisation	anomaly form	additional archaeological	comments	supporting evidence
number	group	anomalies	certainty & class		characterisation		
2	14		possible, positive	linear			
	15		possible, positive	linear			
	16		possible, positive	curvilinear			
	1/		possible, positive	finear			
6	104		possible, high contrast linear	linear	service steel or iron pipe, cable or drain	service not recorded as a recent utility and may relate to local farming or land management	
0	39 40		possible, positive	norallal double disrupted linears			
	40		possible, positive	linear		anomaly group may consecut an archaeological linear denosit or relatively report ploughing over magnetically enhanced denosits which may have	
	41		possible, positive	linear		anomaly group may represent an archaeological linear deposit of relatively recent proughing over magneticany emanced deposits which may have	
	42	48	possible positive	disrupted linear	archaeological linear or local service trench	architectorgical again realized	
	72	40	possible, positive	disrupted intear	archaeological inical of local service trenen	anomaly group may represent areacongy and rans paranter with to out is more meet to represent a recent service denen not	
	43		possible positive	disrupted linear			
	44		possible positive	disrupted curvilinear			
	45		possible positive	linear			
	46		possible, mixed spread	irregular	archaeological activity or natural deposits	anomaly group may represent an area of archaeological activity or possibly natural disturbance, e.g. springs	
	47		possible, positive	disrupted linear			
	48	42	possible, positive	disrupted linear			
	49		possible, positive	disrupted linear			
	50		possible, positive	disrupted linear			
	51		possible, positive	disrupted linear			
	52		possible, positive spread	broad linear		anomaly group may represent a spread of archaeological deposits	
	53		possible, positive	linear			
	54		possible, positive	disrupted linear			
	55		possible, positive	linear			
	56		possible, positive spread	sub-circular		anomaly group may represent a spread of archaeological deposits, an archaeological fill or an earthen surface	
	57		possible, positive	disrupted linear			
	58		possible, positive spread	irregular		anomaly group may represent a spread of archaeological deposits	
	59		possible, positive	disrupted linear			
	60		possible, positive	disrupted linear			
	61		possible, positive	disrupted curvilinear			
	62		likely, positive		enclosure	anomaly group coincides with and is likely to represent a Prehistoric, double-ditched, rectangular enclosure	DCCHER MDV9121
	63		likely, positive		enclosure	anomaly group coincides with and is likely to represent a Prehistoric, double-ditched, rectangular enclosure	DCCHER MDV9121
	64		likely, positive		enclosure	anomaly group coincides with and is likely to represent a Prehistoric, double-ditched, rectangular enclosure	DCCHER MDV9121
	65		possible, positive spread	oval		anomaly group may represent a spread of archaeological deposits, an archaeological fill or an earthen surface	
	66		possible, positive	disrupted linear			
	6/		possible, positive	linear			
	08 60		possible, mixed spread	nortial sub aircular	ring ditah ar round house	anomaly group may represent a spread of archaeological material	
	70		possible, positive	disrupted linear			
	70		possible, positive	linear			
	72		possible dipole	linear	iron or steel objects	anomaly groups, while possibly representing archaeological deposits, are more likely to represent relatively recent items	
	72		possible positive	linear		anomaly groups, while possibly representing a chaeological deposits, are more nicely to represent relatively recent relatively recent relatively	
	74		possible positive	nartial sub-circular	round house or similar structure		
	75		possible positive	oval	pit		
	76		possible positive	linear	F		
	77		possible positive	partial sub-circular	round house or similar structure		
	78		possible, dipole		iron or steel object	anomaly group, while possibly representing archaeological deposits, is more likely to represent relatively recent items	
	79		possible, positive	linear			
-	80		possible, positive	linear		anomaly group may represent an archaeological linear deposit or relatively recent ploughing over magnetically enhanced deposits which may have	
			* **			archaeological significance	
•	81		possible, pos/neg/pos	parallel disrupted linears	edged track or road	anomaly groups may represent a track or road edged with ditches	
	82		possible, positive	oval	pit		
	83		possible, positive	disrupted linear			
	84		possible, positive	disrupted linear			
	85		possible, positive spread			anomaly group may represent a spread of archaeological deposits	
	86		possible, positive	disrupted linear			
	87		possible, positive	linear			
	88		possible, positive	linear			
	89		possible, positive	disrupted linear			
	90		possible, positive	linear			
	91		possible, positive	linear			
	92		possible, positive	disrupted linear			
	93		possible, positive	linear			
	94		possible, positive spread	broad linear		anomaly group may represent a linear spread of archaeological deposits	
	95		possible, high positive	1		anomaly group may represent a relatively recent iron or steel deposit but could represent a deposit of heated material	
	96		possible, positive	linear	· · · · · · · · · · · · · · · · · · ·		
	97		possible, pos/neg/pos	parallel disrupted linears	euged track or road	anomaly groups may represent a track or road edged with ditches	
	98		possible, positive	diammtad linear			
	99		possible, positive	disrupted linear			
	500		possible positive	linear			
	121		nossible low contrast linear	service trench or field drain	service trench or field drain	service not recorded as a recent utility and may relate to local farming or land management	
	121		possible high contrast linear	ferrous nine, cable or drain	gas nine	service not manned as a recent utility on available alas but is likely to represent a case nine	gas marker pole in field
L	122		possione, ingn contrast inical	remous pipe, cubic of utalli	Bus Pipe	por rice not mapped as a recent aunity on available plans but is nikely to represent a gas pipe	Sus marker pole in nelu

Table 1: data analysis



Figure 3: shade plot of processed data



Figure 4: contour plot of processed data



Figure 5: survey areas

Appendix 2 Methodology Summary

Table 2: methodology summary

Documents

Survey methodology statement: Dean (2014b)

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.

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.

Equipment Instrument: Bartington Instruments grad601-2 Firmware: version 6.1	Data Capture Sample Interval: 0.25-metres Traverse Interval: 1 metre Traverse Method: zigzag Traverse Orientation: GN305 (area 6)
Data Processing, Analysis and Presentation Sof IntelliCAD Technology Consortium IntelliCAD 7. DW Consulting TerraSurveyor3 Manifold System 8 GIS Microsoft Corp. Office Excel 2013 Microsoft Corp. Office Publisher 2013 Adobe Systems Inc Adobe Acrobat 9 Pro Extende	tware 2 d

Appendix 3 Data processing

Table 3: gradiometer survey - processed data metadata
SITEInstrument Type:Bartington Grad 610Units:nTDirection of 1st Traverse:0 degCollection Method:ZigZagSensors:2 @ 1.00 m spacing.Dummy Value:32702PROGRAMName:TerraSurveyorVersion:3.0.25.0
Area 6 (Figure 5): Stats Max: 216.89 Min: -243.85 Std Dev: 20.10 Mean: -0.31 Median: 0.00
 Processes: 10 1 Base Layer 2 Clip from -100.00 to 100.00 nT 3 De Stagger: Grids: All Mode: Both By: -2 intervals 4 DeStripe Median Sensors: sb4.xgd sb20.xgd sa2.xgd sa17.xgd sb24.xgd sd10+sa23.xgd sc5.xgd sc13.xgd sd17.xgd sd25.xgd sb5.xgd sb19.xgd sa3.xgd sa16.xgd sb25.xgd sd9+sa24.xgd sc4.xgd sc14.xgd sd18.xgd sd24.xgd sb6.xgd sb18.xgd sa4.xgd sa15.xgd sb26.xgd sd8+sa25.xgd sc3.xgd sc15.xgd sc15.xgd sd19.xgd sd23.xgd sb7.xgd sb17.xgd sa5.xgd sa14.xgd sb27.xgd sd7+sa26.xgd sc2.xgd sc16.xgd sd20.xgd sd22.xgd sb8.xgd sb16.xgd sa6.xgd sb12.xgd sd1+sa26.xgd sd6+sa27.xgd sc1.xgd sc17.xgd sd21.xgd sb15.xgd sa7.xgd sa12.xgd sd5+sa28.xgd sa29.xgd sc18.xgd sb10.xgd sb14.xgd sa8.xgd sa11.xgd sd3.xgd sd4.xgd sb11.xgd sb13.xgd sa9.xgd sa10.xgd 5 DeStripe Median Sensors: sa18.xgd sc7.xgd sc11.xgd sd15.xgd sc21.xgd sc12.xgd sd16.xgd sc22.xgd sc24.xgd 6 DeStripe Median Sensors: sc10.xgd sd14.xgd sc20.xgd 8 Edge Match (Area: Top 210, Left 120, Bottom 239, Right 239) to Right edge 9 Edge Match (Area: Top 150, Left 360, Bottom 179, Right 479) to Bottom edge
Area 2.7 (Figure 5): Stats Max: 45.92 Min: -31.37 Std Dev: 6.50 Mean: -1.04 Median: 0.04
 Processes: 9 1 Base Layer 2 Clip at 1.00 SD 3 Clip at 1.00 SD 4 Clip at 1.00 SD 5 Clip at 2.00 SD 6 De Stagger: Grids: All Mode: Both By: -1 intervals 7 De Stagger: Grids: All Mode: Both By: -1 intervals 8 DeStripe Median Sensors: All 9 Interpolate: Match X & Y Doubled.