

Substrata

Archaeological Geophysical Surveyors

An archaeological gradiometer survey

Land at Newton St Cyres, Devon

Ordnance Survey (E/N): 288093,98234 (point)

Report: 140731

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31 July 2014

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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	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	AutoCAD DXF

1 Survey description and summary

Type of survey: twin-sensor fluxgate gradiometer
Date of survey: 23 July 2014
Area surveyed: 3ha
Lead surveyor: Ross Dean BSc MSc MA MifA

Client

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

Location

Site: Land at Newton St Cyres
Parish: Newton St Cyres
District: Mid Devon
County: Devon
Nearest Postcode: EX5 5BJ
NGR: SX 880 982
Ordnance Survey E/N: 288093,98234 (point)
OASIS number: substrat1-186255
Archive: At the time of writing, the archive of this survey will be held by Substrata.

Summary

This report was commissioned by AC Archaeology Ltd on behalf of clients and 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 proposed development area is shown in Figure 4.

The magnetic contrast across the area was sufficient to be able to differentiate between anomalies representing possible archaeological features and background magnetic responses. Twenty-three magnetic anomaly groups were identified as pertaining to archaeological deposits or structures. Two groups corresponded to field boundaries mapped by the Ordnance Survey between 1890-91 and 1992. There is the possibility of an enclosure in the northern field. Six groups indicate the presence of deposits of rubble and/or fired material such as brick and one of these, in the southern field, may represent a brick lined culvert or former track. Three groups represent either archaeological pits or tree boles. The remaining anomaly groups highlighted as representing possible archaeological deposits or features have patterns typical of anomalies representing former field and enclosure boundaries of unknown date and archaeological provenance. Given the presence of a former water meadow in the survey area, some of these anomalies may relate to water management features but it is not possible to distinguish such features in the dataset.

2 Survey aims and objectives

Survey aims

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

Survey Objectives

1. Complete a gradiometer survey across agreed parts of the survey 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

Landscape and land use

A location plan is provided in Figure 4, appendix 1. The northern field was under grass pasture at the time of the survey. The southern field was an orchard.

Geology

The site is located on a solid geology of the Shute Sandstone Formation. These rocks are predominantly reddish-brown, silty, very fine-grained sandstone and sandy siltstone, weathering to silty sand and sandy silt. Breccia lenses occur at a few localities. Beds of intraformational breccia are locally present. The superficial geology is not recorded in the source used (British Geological Survey, undated).

5 Archaeological background

A comprehensive description of the heritage assets relevant to the application area can be found in Pink (2014).

The following is a short interpretation of information obtained from the Devon and Dartmoor Historic Environment Record (HER) relevant to the immediate survey area (Figure 1). Except where specifically cited, this information was obtained using the Heritage Gateway (English Heritage, undated 1). A summary of the records consulted can be found in Appendix 4.

The reader is advised that this summary should not be used outside the context of this report and is referred to the Devon HER for informed provision of the record.

Within and immediately adjacent to the survey area the HER is concerned primarily with a Modern (between 1751 AD and 2009 AD) former water meadow system. The remains of a sluice gate (HER record MDV79434) a small waterwheel (MDV79437) were recorded in the northern field (see Figure 1). To the south and southeast of the survey area there are records of a sluice gate (MDV79432), a leat (MDV79435) and an leat aqueduct over the Shuttern Brook (MDV79438).

Of these, the sluice gate MDV79432 was the only artefact within the area that could be surveyed and nothing was recorded indicating its presence in the dataset. This does not mean that the gate is not present but does indicate that no associated magnetic materials remain.

Historical Landscape Characterisation

Northern field

Modern enclosures adapting post-medieval fields: modern enclosures that have been created by adapting earlier fields of probable post-medieval date (Devon County Council, undated)

Southern field

Former orchards: this area was once an orchard planted with fruit trees, but these have been lost in the 20th century (Devon County Council, undated). Trees are still extant in this area.

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 attempts to identify and characterise anomalies and anomaly groups that may pertain to archaeological deposits and structures.

The reader is referred to section 7.

6.1 Results

Figure 1 shows the interpretation of the survey across the northern and southern field. It includes the anomaly groups identified as pertaining 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.

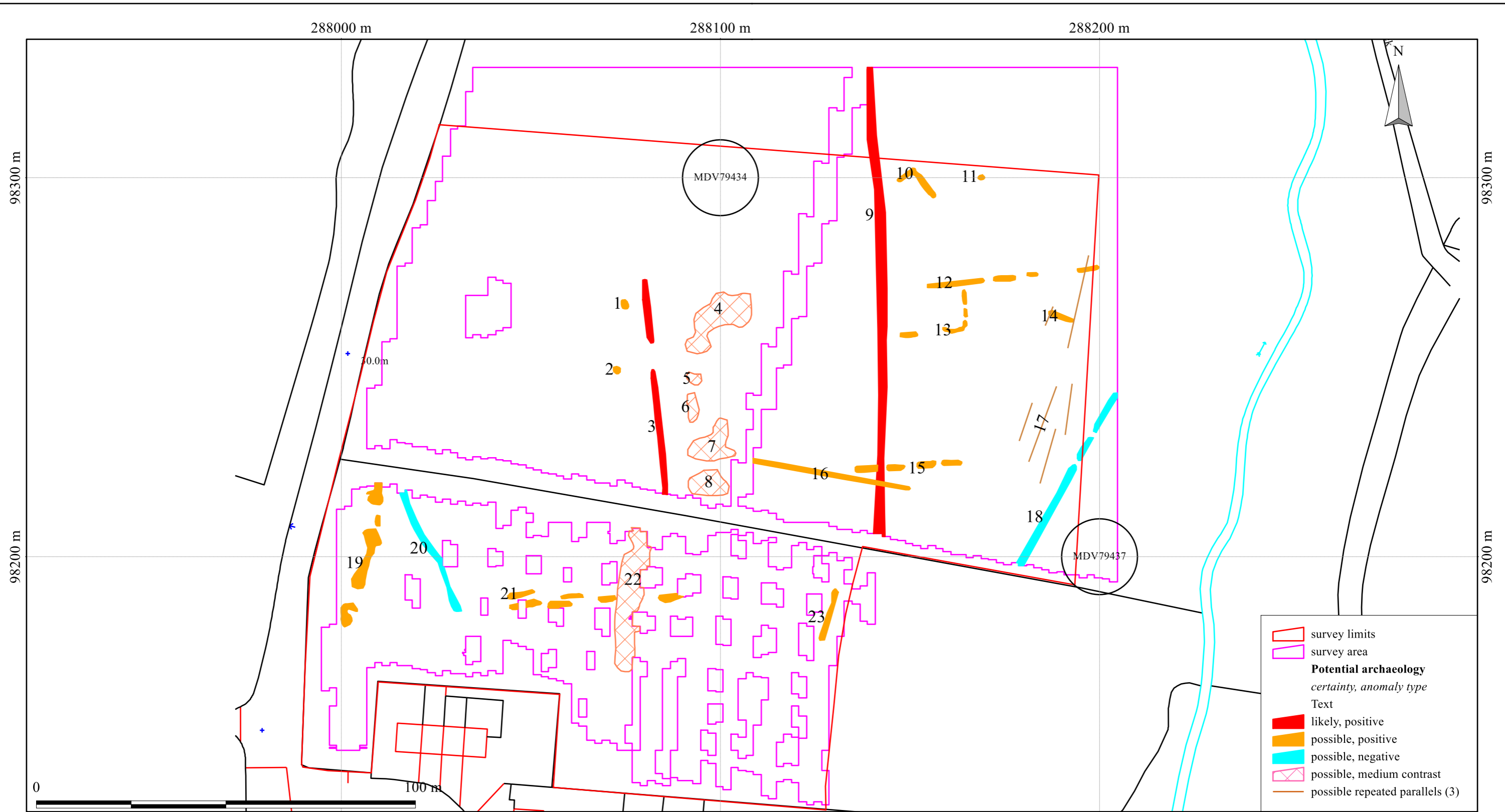
Figure 1 along with table 1 comprises the analysis of the survey data.

A plot of the processed data is provided in Figures 2 and 3 (Appendix 1).

Site: An archaeological gradiometer survey
Land at Newton St Cyres, Devon
Ordnance Survey (E/N): 288093,98234 (point)
Report: 140731

anomaly group	anomaly characterisation certainty & class	anomaly form	additional archaeological characterisation	comments	supporting evidence
1	possible, positive	oval	pit		
2	possible, positive	oval	pit		
3	likely, positive	disrupted linear	field boundary	anomalies coincide with a field boundary mapped by the Ordnance Survey between 1890-91 and 1992	Ordnance Survey maps 1890-91 to 1992
4	possible, medium contrast	irregular	rubble and/or brick	anomalies show contrasts typical of a deposit of rubble and/or brick or similar fired material	
5	possible, medium contrast	irregular	rubble and/or brick	anomalies show contrasts typical of a deposit of rubble and/or brick or similar fired material	
6	possible, medium contrast	irregular	rubble and/or brick	anomalies show contrasts typical of a deposit of rubble and/or brick or similar fired material	
7	possible, medium contrast	irregular	rubble and/or brick	anomalies show contrasts typical of a deposit of rubble and/or brick or similar fired material	
8	possible, medium contrast	irregular	rubble and/or brick	anomalies show contrasts typical of a deposit of rubble and/or brick or similar fired material	
9	likely, positive	linear	field boundary	anomaly group coincides with a field boundary mapped by the Ordnance Survey between 1890-91 and 1992 - anomalies indicate a modern service pipe or cable running along the northern section	Ordnance Survey maps 1890-91 to 1992
10	possible, positive	rectilinear		anomaly groups are low contrast but may indicate a partial rectilinear deposit or return	
11	possible, positive	oval	pit		
12	possible, positive	disrupted linear			
13	possible, positive	disrupted return or rectilinear	enclosure		
14	possible, positive	linear			
15	possible, positive	disrupted linear			
16	possible, positive	linear			
17	possible, parallel linears		ploughing disturbance	anomaly groups represent possible ploughing disturbance enhanced in the data by the presence of relatively magnetic deposits in the subsoil	
18	possible, negative	disrupted linear			
19	possible, positive	disrupted linear			
20	possible, negative	linear			
21	possible, positive	parallel disrupted linears	former track		
22	possible, medium contrast	linear	brick-lined drain or culvert or track metalling		
23	possible, positive	linear			

Table 1: data analysis



British Grid
centre X: 288108.32 m, centre Y: 98234.62 m

Scale: 1:1000 @ A3. Spatial Units: Meter. Do not scale off this drawing

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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.

Figure 1: survey interpretation with location of relevant HER entries (Appendix 4)

6.2 Discussion

Refer to Figure 1 (this section) and Figure 2 (appendix 1). Not all anomalies or anomaly groups identified in the survey dataset are necessarily discussed below. All identified anomaly groups are recorded in the GIS project on the accompanying CD-ROM. Those anomaly groups possibly representing archaeological deposits are included in the data analysis (Table 1).

General points

There are distinct, parallel, closely spaced, northeast to southwest trending linear patterns in the magnetic response in the northern field. These patterns reflect recent ploughing and crop sowing, emphasised by the likely presence of a concentration of magnetic materials in the subsoil (magnetic anomaly group 17, Figure 1).

Anomalies thought to relate to natural features were not mapped. Recent man-made objects such as manholes, water management equipment or drains have not been mapped except where they comprise significant magnetic responses across the dataset.

Data collection along the field edges was restricted as shown in Figures 1 to 3 due to the presence of magnetic materials and objects in and adjacent to the field boundaries. Strong magnetic responses mapped close to the field boundaries are likely to relate to these items except where indicated otherwise in Figure 1. Further restrictions were imposed by the presence of trees with protective fencing in the southern field.

Data relating to historical maps and other records

Magnetic anomaly groups **3 and 6** correspond to field boundaries recorded by the Ordnance Survey between 1890-91 and 1992.

Data with no previous provenance

Magnetic anomaly groups **1, 2 and 11** may relate to archaeologically significant pits or to tree boles. Only further archaeological investigations will resolve their nature.

Group **13** has a relatively low contrast but the anomalies may indicate the presence of a deposit with a return which may indicate the boundary of an enclosure.

Groups **4 to 8** have a relatively strong magnetic response and they may relate to deposits of rubble and/or bricks or similar fired material.

Group **22** is of a similar nature to groups 4 to 8 and may indicate the presence of a brick-lined culvert, a metalled track or, less likely, the footings of a former wall.

The remaining anomaly groups highlighted as representing possible archaeological deposits or features have patterns typical of anomalies representing former field and enclosure boundaries of unknown date and archaeological provenance. Given the presence of a former water meadow in the survey area (see Section 4), some of these anomalies may relate to water management features but it is not possible to distinguish such features in the dataset.

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-three magnetic anomaly groups were identified as pertaining to archaeological deposits or structures. Two groups corresponded to field boundaries mapped by the Ordnance Survey between 1890-91 and 1992. There is the possibility of an enclosure in the northern field. Six groups indicate the presence of deposits of rubble and/or fired material such as brick and one of these in the southern field may represent a brick lined culvert or former track. Three groups represent either

archaeological pits or tree boles. The remaining anomaly groups highlighted as representing possible archaeological deposits or features have patterns typical of anomalies representing former field and enclosure boundaries of unknown date and archaeological provenance. Given the presence of a former water meadow in the survey area, some of these anomalies may relate to water management features but it is not possible to distinguish such features in the dataset.

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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Appendix 1 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.

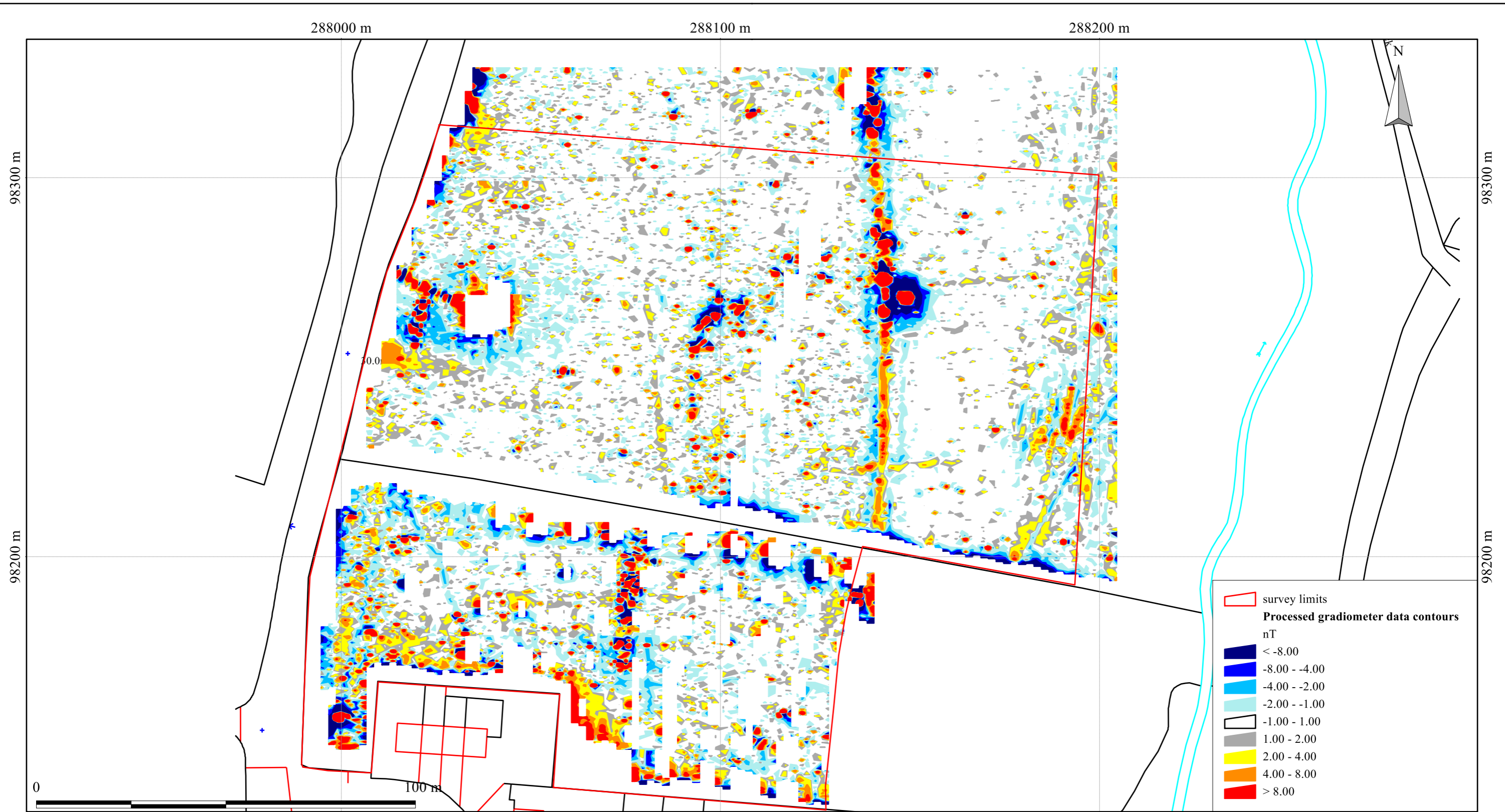


British Grid
 centre X: 288108.32 m, centre Y: 98234.62 m

Scale: 1:1000 @ A3. Spatial Units: Meter. Do not scale off this drawing

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Figure 2: shade plot of processed data

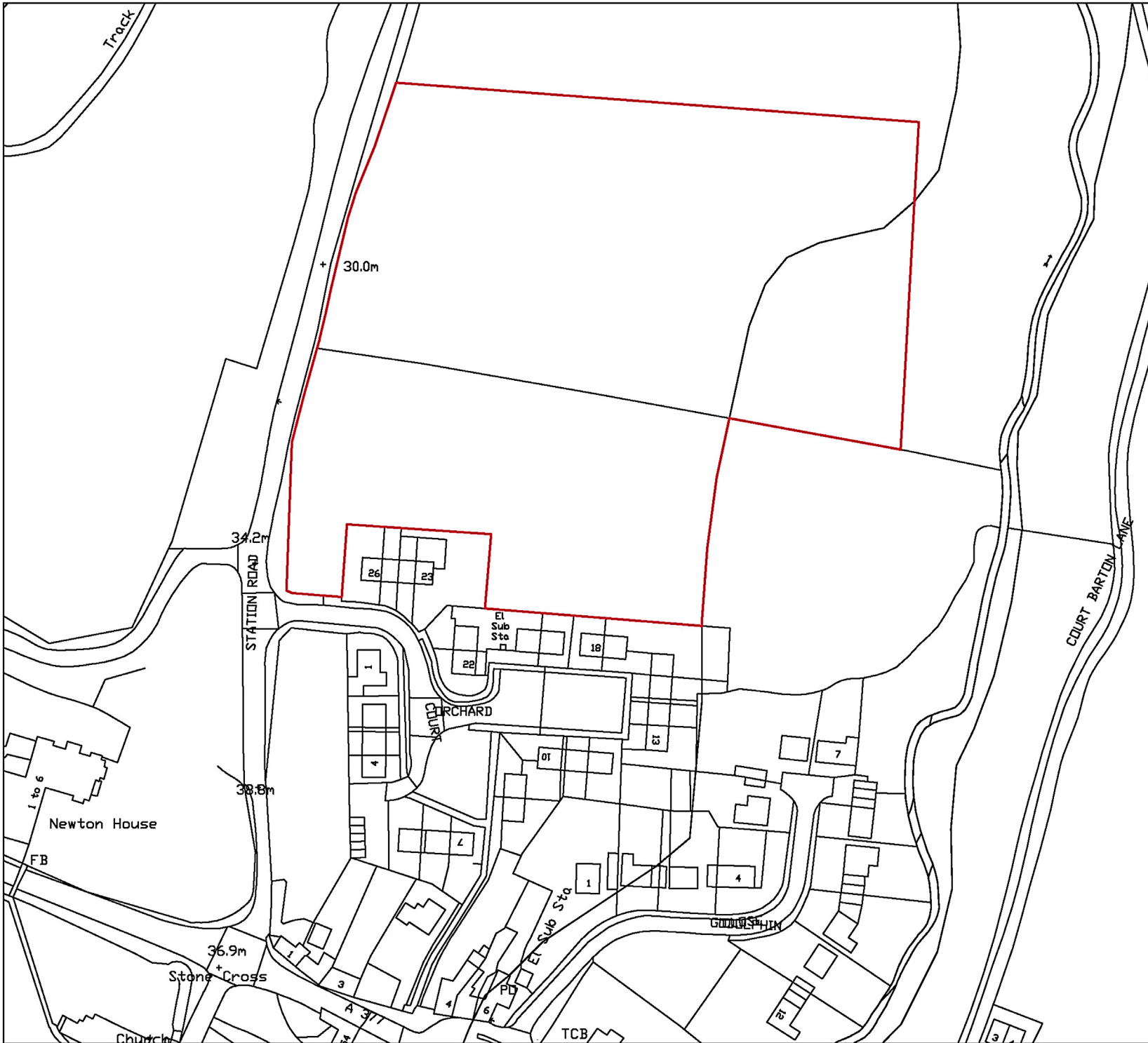


British Grid
 centre X: 288108.32 m, centre Y: 98234.62 m

Scale: 1:1000 @ A3. Spatial Units: Meter. Do not scale off this drawing

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Figure 3: contour plot of processed data



NOTES

Figure 4: site location

REV	NOTES	DATE
	Newton St Cyres Location plan	SB/DC
140208 L 01 01		JUNE 2014

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DRAWING STATUS PRELIMINARY

CONTRACTORS MUST CHECK ALL DIMENSIONS ON SITE. ONLY PRELIM DIMENSIONS ARE TO BE WORKED FROM THIS DRAWING IS COPYRIGHT.

Appendix 2 Methodology Summary

Table 2: 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> GN36</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 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:	244.14
Min:	-235.53
Std Dev:	11.64
Mean:	-0.02
Median:	0.00
Processes: 5	
1 Base Layer	
2 Clip at 2.00 SD	
3 De Stagger: Grids: All Mode: Both By: -3 intervals	
4 DeStripe Median Sensors: All	
5 De Stagger: Grids: nc26.xgd Mode: Both By: -1 intervals	
Note: converting the gradiometer data into ESRI GIS files imposed an x=y interpolation on the entire dataset	

Appendix 4 Summary of relevant entries from the Devon and Dartmoor Historic Environment Record (HER)

Source: Heritage Gateway (English Heritage, undated 1).

The reader is advised that this summary should not be used outside the context of this report and is referred to the Devon HER for informed provision of the record.

HER Number: MDV79432

Name: Sluice to East of Station Road, Newton St. Cyres

Summary: Buried remains of sluice gates forming part of former leat and water meadow system.

Location Grid Reference: SX 881 981 (134m at GN177 from site location point)

Monument Type(s) and Dates: SLUICE (Modern - 1751 AD to 2009 AD (Between))

Full description:

Ordnance Survey, 1904 - 1906, Second Edition Ordnance Survey 25 inch map (Cartographic)

Sluice marked on 1904-1906 25 inch Ordnance Survey map, on stream/lead off the Shuttern Brook between Station Road and Court Barton Lane. Map object based on this Source.

Watts, S., 2011, Watermeadow and Leat System at Newton St Cyres (Personal Comment)

Site visit 9th February 2011. Buried remains of sluiceways forming part of a former leat and watermeadow system situated at southern end of field to east of Station Road. A leat runs eastwards from the sluiceways to a small waterwheel adjacent to Court Barton Lane. Other details: Digital photos.

Associated Monuments:

MDV79435 Related to: Leat to West of Court Barton Lane, Newton St. Cyres (Monument)

MDV79434 Related to: Sluiceway to East of Station Road, Newton St. Cyres (Monument)

MDV79437 Related to: Waterwheel to South of Court Barton, Newton St. Cyres (Monument)

HER Number: MDV79434

Name: Sluiceway to East of Station Road, Newton St. Cyres

Summary: Sluiceway marked on 1904-1906 Ordnance Survey map. Part of former leat and watermeadow system.

Location Grid Reference: SX 881 983 (66.4m at GN6.1 from site location point)

Monument Type(s) and Dates: SLUICE (Modern - 1751 AD to 2009 AD (Between))

Full description:

Ordnance Survey, 1904 - 1906, Second Edition Ordnance Survey 25 inch map (Cartographic)

Sluice marked on 1904-1906 25 inch Ordnance Survey map, on stream/lead off Shuttern Brook to east of Station Road. Probably part of a former watermeadow system.

Associated Monuments: MDV79432

HER Number: MDV79435

Name: Leat to West of Court Barton Lane, Newton St. Cyres

Summary: Leat serving small waterwheel adjacent to Court Barton Lane.

Location Grid Reference: SX 882 981 (171.5m at GN141.4 from site location point)

Monument Type(s) and Dates: LEAT (Modern - 1751 AD to 2009 AD (Between))

Full description:

Ordnance Survey, 1880 - 1899, Untitled Source (Cartographic)

Course of leat shown on 1880s-1890s 25 inch Ordnance Survey map.

Ordnance Survey, 1904 - 1906, Second Edition Ordnance Survey 25 inch map (Cartographic)

Course of leat shown on 1904-1906 25 inch Ordnance Survey map. Map object based on this Source.

Watts, S., 2011, Watermeadow and Leat System at Newton St Cyres (Personal Comment)

Site visit 9th February 2011. The course of a leat that served a small waterwheel adjacent to Court Barton Lane is still visible across fields to the west of Court Barton Lane. The leat was originally carried in an aqueduct across the Shuttern Brook and was conduited underground from the east bank of the brook to the waterwheel. The underground section has collapsed in places revealing brick lining. Part of the aqueduct survives on the west bank of the Shuttern Brook. Other details: Digital photos.

Associated Monuments

MDV79438 Related to: Aqueduct over Shuttern Brook, Newton St. Cyres (Monument)

MDV79432 Related to: Sluice to East of Station Road, Newton St. Cyres (Monument)

MDV79437 Related to: Waterwheel to South of Court Barton, Newton St. Cyres (Monument)

HER Number: MDV79437

Name: Waterwheel to South of Court Barton, Newton St .Cyres

Summary: The remains of a small waterwheel survive in the hedgebank below Court Barton Lane.

Location Grid Reference: SX 882 982 (112.3m at GN107.6 from site location point)

Monument Type(s) and Dates: WATER WHEEL (Modern - 1751 AD to 2009 AD (Between))

Full description:

Watts, S., 2011, Watermeadow and Leat System at Newton St Cyres (Personal Comment)

Site visit 9th February 2011. The remains of a small waterwheel survive in the hedgebank below Court Barton Lane. The wheel, mostly of iron, is just 46 inches diameter and bears the name 'STENNER & GUNN TIVERTON' on the naves. There is a small pulley on one end of its wheelshaft but it is not clear what it was used to drive. The wheel has been displaced from its ?concrete block 'wheelpit', the latter still retains an iron sluice gate. Both wheel and pit are considerably overgrown.

Other details: Digital photos.

Associated Monuments

MDV79438 Related to: Aqueduct over Shuttern Brook, Newton St. Cyres (Monument)

MDV79435 Related to: Leat to West of Court Barton Lane, Newton St. Cyres (Monument)

MDV79432 Related to: Sluice to East of Station Road, Newton St. Cyres (Monument)

HER Number: MDV79438

Name: Aqueduct over Shuttern Brook, Newton St. Cyres

Summary: Remains of an aqueduct that formerly carried the course of a leat over the Shuttern Brook survive on the west bank of the brook.

Location Grid Reference: SX 882 981 (112.3m at GN107.6 from site location point)

Monument Type(s) and Dates: AQUEDUCT (Modern - 1751 AD to 2009 AD (Between))

Full description:

Ordnance Survey, 1904 - 1906, Second Edition Ordnance Survey 25 inch map (Cartographic)

Site of aqueduct shown on 1904-1906 25 inch Ordnance Survey map.

Watts, S., 2011, Watermeadow and Leat System at Newton St Cyres (Personal Comment)

Remains of an aqueduct that formerly carried the course of a leat over the Shuttern Brook survive on the west bank of the brook. Other details: Digital photo.

Associated Monuments

MDV79435 Related to: Leat to West of Court Barton Lane, Newton St. Cyres (Monument)

MDV79437 Related to: Waterwheel to South of Court Barton, Newton St .Cyres (Monument)

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 is 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.