

**Substrata**

Archaeological Geophysical Surveyors

An archaeological magnetometer survey

**Land at Butcher Park Hill  
Tavistock, Devon**

Centred on NGR 247730,075310

Report: 1805TAV-R-1

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## 1 Introduction

This report presents the results of an archaeological geophysical survey at the site listed in Section 2, hereafter referred to as the 'Survey Area' (Figure 1). It was commissioned by Cotswold Archaeology Ltd on behalf of clients. The main aims of the survey were to locate a buried well recorded on historic maps and a water pipe. Any potential buried archaeology was to be reported according to standard CIfA practice.

The survey and report were completed in compliance with a Survey Method Statement (Dean, 2018).

## 2 Survey description

### 2.1 Survey

Method: shallow depth magnetometer survey  
Instrument: twin-sensor fluxgate gradiometer  
Date: 4 and 9 June 2018  
Area: 2.01ha

### 2.2 Location

Survey Area name: Land at Butcher Park Hill  
Town and civil parish: Tavistock  
District: West Devon  
County: Devon  
Nearest Postcode: PL19 0ER  
NGR: SX 47730 75310 (point)  
NGR (E/N): 247730,075310 (point)  
Historic environment designation: none

### 2.3 Client

Cotswold Archaeology Ltd, Unit 53 Basepoint Business Centre, Yeoford Way, March Barton Trading Estate, Exeter, Devon EX2 8LB

## 3 Summary

A magnetometer survey was selected to provide a relatively fast and cost-effective evaluation of a well recorded on historic maps in Plot 3, a water pipe thought to cross Plot 1 and any buried archaeology across the Survey Area (see Section 12). The plot locations are provided in Figure 2. The magnetic anomaly groups pertaining to the primary targets and to potential buried archaeology were georeferenced to the Ordnance Survey National Grid, mapped, characterised and assigned with an appropriate degree of certainty in conformance with the survey aims and objectives set out in Section 4.

The differences in magnetic responses across the Survey Area were sufficient to be able to differentiate between anomalies representing possible buried archaeology and background magnetic responses.

One anomaly group, representing buried iron or steel and situated on the eastern side of a lane leading to now demolished buildings, may represent objects associated with the site of the former well in Plot 3. A small section of extant water pipe located by a gate leading from Plot 3 to the Butcher Park Hill road was mapped and photographed. It is thought to pass through rock towards the location of the anomaly group.

One anomaly group may represent a service trench and is a candidate for the location of the targeted water pipe in Plot 1.

Six magnetic anomaly groups have been characterised as representing potential buried archaeology. Of these, five groups may represent buried linear archaeological deposits such as fragments of former field and enclosure boundaries removed before the first edition Ordnance Survey map of the area was published in 1884-5. One anomaly group is likely to represent

disturbed ground with some stony deposits and ferrous material, possibly a former small quarry or similar excavated pit.

## 4 Aims and objectives

### 4.1 Aims

Within the framework set out in Chartered Institute for Archaeologists (2014a), complete an archaeological geophysical survey and report which will, as far as possible:

1. Locate and map the position of a well and water pipe.
2. Inform on the presence or absence, character, extent and apparent relative phasing of buried archaeology in order to make an assessment of its merit.

### 4.2 Survey objectives

1. Complete a magnetometer survey across the Survey Area.
2. Identify any magnetic anomalies that may be related to the well and pipe, and to buried archaeology.
3. Within the limits of the technique 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 survey area about the location and possible character of the recorded anomalies.

## 5 Standards

The standards used to complete this survey are defined by the Chartered Institute for Archaeologists (2014a) and Historic England (2008). The codes of approved practice that were followed are those of the Chartered Institute for Archaeologists (2014b) and Archaeology Data Service (undated).

## 6 Methodology

The magnetometer survey was undertaken in accordance with a Survey Method Statement (Dean, 2018) to achieve the aims and objectives set out in Section 4 using the standards and guidance specified in Section 5. The survey method was selected to provide a relatively fast and cost-effective evaluation of the targeted features and any buried archaeology across the Survey Area (see Section 12).

Data processing was undertaken using appropriate software (Table 2), with all anomalies being digitised and geo-referenced. The final report (this document) includes 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. The survey and report conform to the Chartered Institute for Archaeologists standard for geophysical survey (CIfA, 2014a).

## 7 Survey Area

### 7.1 Location

The Survey Area comprises three plots of land as shown in Figures 1 and 2.

### 7.2 Field boundaries

The fields containing Plots 1 and 2 are bounded by stone field walls with hedging and wire fencing. The western edge of Plot 1 comprises a partially collapsed dry stone field wall. Plot 3 comprises a lane, demolished buildings and a former garden plot. Here the boundaries are of stone wall and natural rock.

### 7.3 Topography

The plots are situated on the south-eastern side of a hill with a slope descending north to south and southeast from approximately 165m OAD on the northern edge of Plot 1 to approximately 155m AOD on the southern edge of Plot 2.

#### 7.4 Land use

At the time of the survey the Survey Area was grass pasture.

#### 7.5 Geology

The majority of the Survey Area has bedrock of the Carboniferous Milton Abbot Formation which generically comprises basaltic lava and basaltic tuff with subordinate slate and olistostrome. A geological boundary lies bedrock across Plot 1 with rocks of the Carboniferous Brendon Formation forming the bedrock in the northeast. These are dark grey, locally siliceous, mudstone with laminae and thin beds of siltstone. There are scattered packets of blue-grey to grey-green coarse grained greywacke sandstone with interbedded dark grey mudstone and locally distributed units of tuff and basaltic lava. The superficial geology is not recorded in the source used (British Geological Survey, undated).

#### 7.6 Soils

The topsoil is slightly acid loamy and clayey soil with impeded drainage (Cranfield Soil and Agrifood Institute, undated).

No site-relevant geotechnical reports or borehole logs of near-surface deposits were available at the time of writing.

### 8 Archaeological background

#### 8.1 Historic environment status

None.

#### 8.2 Historic landscape

‘Post-medieval enclosures’

Enclosures of post-medieval date. Fields laid out in the C18th and C19th commonly have many surveyed dead-straight field boundaries (Devon County Council, undated).

#### 8.3 Statement of research

The Devon County Council Historic Environment Record was examined via the Heritage Gateway (Historic England, undated) to gain an appreciation of historic assets pertinent to the geophysical survey data within approximately 500m of the survey area perimeter. Whilst providing a useful context for the data analysis, this source is not comprehensive and publication of the information in commercial reports is not permitted.

### 9 Results

#### 9.1 Scope and definitions

This survey was designed to record magnetic anomalies. A magnetic anomaly is a local variation in the Earth's magnetic field. Such variations can result from differences in the magnetism of the underlying solid geology, superficial geology and other near-surface deposits including those altered and created by past human activities. Near-surface artefacts can also create magnetic anomalies.

The dimensions of magnetic anomalies mapped as representing potential buried archaeology do not represent the dimensions of any associated archaeology.

The analysis presented below identifies and characterises anomalies and anomaly groups that may relate to buried archaeology.

#### 9.2 Analysis

Figures 2 and 3 show the interpretation of the survey data and include the anomaly groups identified as possibly relating to archaeological deposits along with their identifying numbers. Table 1 is an extract of the detailed analysis of the survey data sourced from the attribute tables of the GIS project provided in the project archive.

Figures 2 and 3 along with Table 1 comprise the analysis of the survey data.

Figures 4 and 5 are plots of processed data as specified in Table 3. Figure 6 is a plot of minimally processed data as specified in Table 4. Figure 7 shows the location of the survey grid and grid data files.

## 10 Discussion

### 10.1 General points

#### Scope

Not all anomalies or anomaly groups identified in Table 1 are necessarily discussed below. All identified anomaly groups are recorded in the GIS project held in the survey archive.

#### Data collection

Data collection along the survey area edges was restricted as shown in the figures due to the presence of magnetic materials within and adjacent to boundaries. Strong magnetic responses mapped close to the boundaries are likely to relate to these materials except where otherwise indicated in Figures 2 and 3 and Table 1.

Data collection around the south-eastern boundary of Plot 1, the western and southern boundaries of Plot 2 and most of Plot 3 was restricted by high vegetation, over-grown hedges and trees.

#### Anomaly characterisation

There are a number of anomaly groups that could be interpreted as relating to large postholes or pits although most will have natural origins. Anomalies of this sort are mapped as potential archaeology when they are associated with other significant anomaly groups or otherwise formed recognisable patterns as listed in Table 1.

Anomalies thought to relate to natural features and recent man-made objects such as manholes, water management equipment, drains, cables and other services are only mapped where they comprise significant magnetic responses across the dataset that need clarification.

Numerous dipole magnetic anomalies are present within the dataset. These are likely to represent recent ferrous objects. They are only mapped if they could influence the analysis of anomaly groups thought to have an archaeological origin.

### 10.2 Data relating to the well in Plot 3

Magnetic anomaly group **301** denotes the presence of buried iron and/or steel. This anomaly group coincides with a section of dry stone retaining walling and collapsed ground on the eastern side of the lane (Plate 2 and Figure 3). The surveyors noticed a water pipe at the southern end of Plot 3 by the gate leading to a lane in Plot 3 from the Butcher Park Hill road (Plates 1 and 3 along with Figure 3). The pipe has two branches, one leading to allotments to the south of Plot 2 and the other angling into the rock face that forms part of the eastern side of the track. The approximate direction of the pipe through the rock leads towards the location of group 301. The presence of iron and/or steel at this point along with the direction of the water pipe through the rock bordering the lane leads the authors to conclude that a well or covered spring may at the point shown in Figure 3.

### 10.3 Data relating to the possible water pipe in Plot 1

Anomaly group **302** has attributes characteristic of a narrow linear feature with a stony fill and may represent a service trench. As such, the location of group 302 may represent the site of the targeted water pipe.

### 10.4 Data with no previous archaeological provenance

Referring to Figure 2, Plot 1, anomaly group **1** may represent a disrupted linear archaeological deposit such as a former ditch. Group **2** probably represents a similar linear deposit. Group **3** may represent similar buried archaeology although a recent or natural origin cannot be ruled out.

Anomaly group 4 represents disturbed ground with stony deposits and some ferrous material. The most likely explanation is that this group represents a former quarry or similar filled pit.

Groups 5 and 6 in Plot 2 may represent two linear deposits, possibly forming a return. Given their magnetic signature, relatively stony archaeological deposits may be present although recent or natural origins cannot be ruled out.

## 11 Conclusions

The differences in magnetic responses across the Survey Area were sufficient to be able to differentiate between anomalies representing possible buried archaeology and background magnetic responses.

The main aims of this survey were to locate and map the position of a well which was recorded on historic Ordnance Survey maps in Plot 3 and to find a water pipe thought to cross Plot 1. One anomaly group (301), characterised as representing buried iron or steel and situated on the eastern side of a lane leading to now demolished buildings, may represent objects associated with the location of the former well. A small section of extant water pipe located by a gate leading from Plot 3 to the Butcher Park Hill road was mapped and photographed. It is thought to pass through rock towards the location of anomaly group 301.

One anomaly group (302) in Plot 1 may represent a service trench and is a candidate for the location of the targeted water pipe.

Six magnetic anomaly groups have been characterised as representing potential buried archaeology. Of these, five groups (1, 2 and 3 in Plot 1 along with 5 and 6 in Plot 2) may represent buried linear archaeological deposits such as fragments of former field and enclosure boundaries removed before the first edition Ordnance Survey map of the area was published in 1884-5. One anomaly group (4 in Plot 1) is likely to represent disturbed ground with some stony deposits and ferrous material, possibly a former small quarry or similar excavated pit.

## 12 Disclaimer

The description and discussion of the results presented in this report are the authors', based on their 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 programme of archaeological work of which this survey is part may also be informed by other archaeological work and analysis. It must be presumed that more archaeological features will be found than those specified in this report.

## 13 Copyright

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## 14 Archive

### 14.1 Online Access to the Index of archaeological investigationS (OASIS)

OASIS ID: substrat1-319907

The OASIS entry has been completed and the boundary file and report uploaded with six months delay in publication.

### 14.2 Substrata Limited archive

A full archive of this survey will be held by Substrata Limited on cloud and local hard drive storage as specified in Appendix 3.

- 14.3 Archaeological Data Service (ADS)  
Depending on local authority policy, an archive may be deposited with the ADS as specified in Appendix 3.
- 14.4 Historic Environment Record (HER)  
Subject to any contractual requirements on confidentiality, a PDF or printed copy of the report will be submitted to the appropriate HER within six months of completion.
- 15 Acknowledgements  
Substrata would like to thank Derek Evans, Project Manager, Cotswold Archaeology Ltd for commissioning us to complete this survey.
- 16 Bibliography  
Archaeology Data Service (undated) *Archaeology Data Service/Digital Antiquity Guides to Good Practice: Geophysical Data in Archaeology, 2nd Edition* [Online], Available: [http://guides.archaeologydataservice.ac.uk/g2gp/Geophysics\\_Toc](http://guides.archaeologydataservice.ac.uk/g2gp/Geophysics_Toc) [March 2018]
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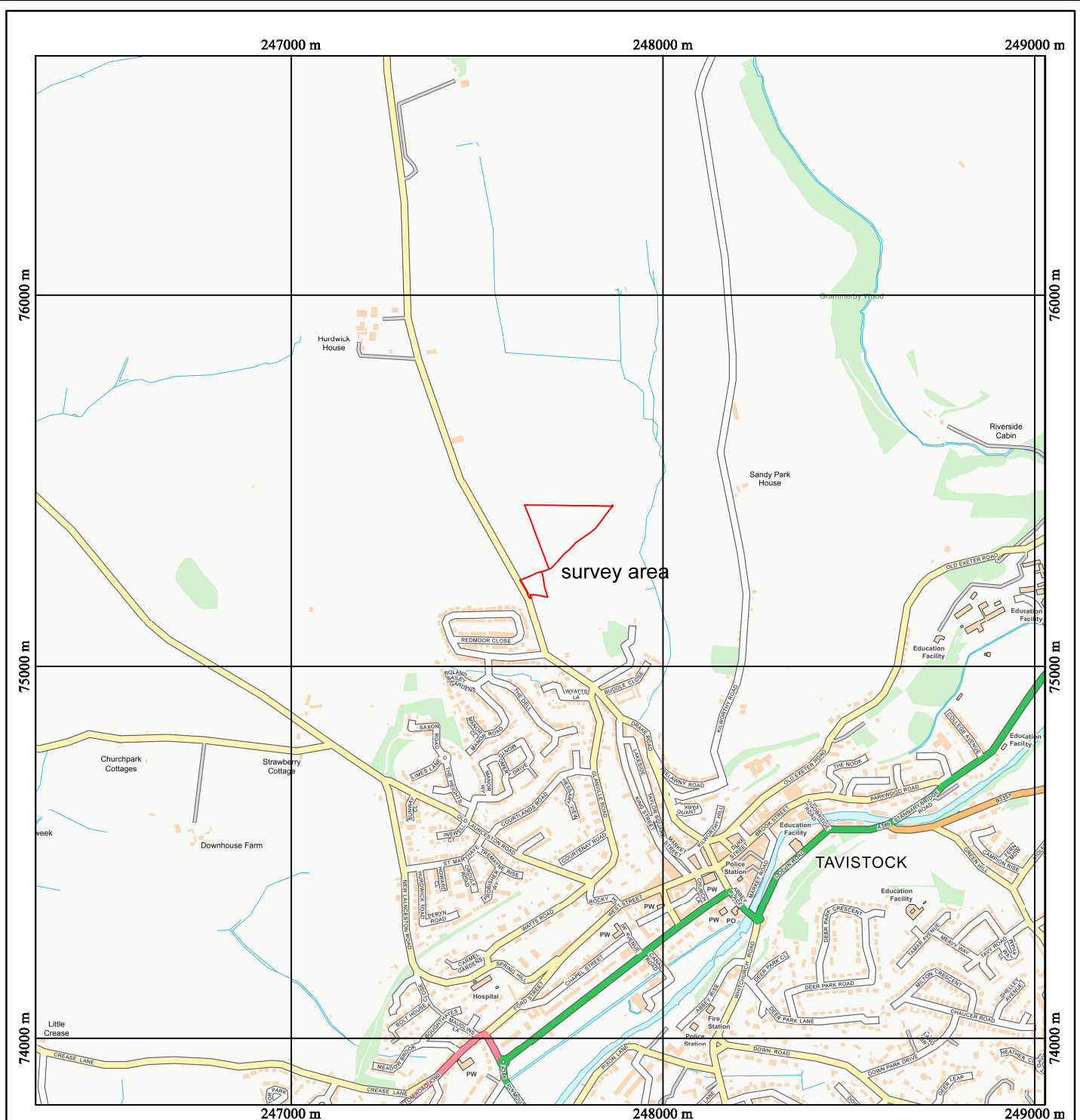


## Appendix 1     Figures

### 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.

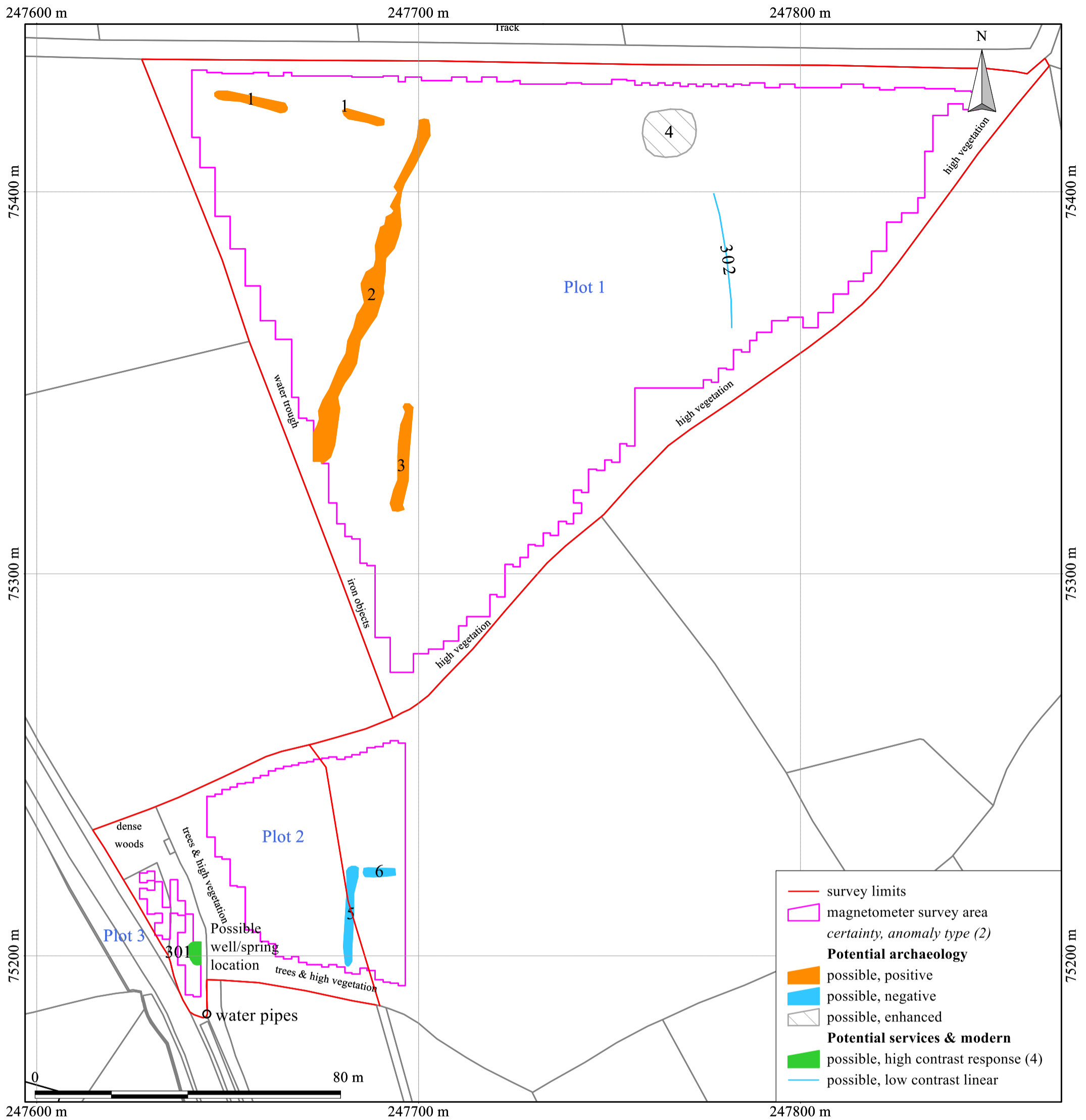


British Grid  
 centre X: 247669.93 m, centre Y: 75232.78 m

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Scale: 1:10000 @ A3. Spatial Units: Meter. Do not scale off this drawing

<p>An archaeological magnetometer survey          Land at Butcher Park Hill, Tavistock, Devon          Centred on NGR (E/N): 247730,075310          Report: 1805TAV-R-1</p>	<p>Figure 1: location map</p>	<p>Substrata Limited          Langstrath, Goodleigh          Barnstaple, Devon EX32 7LZ          Tel: 01271 342721          Email: <a href="mailto:enquiries@substrata.co.uk">enquiries@substrata.co.uk</a>          Web: <a href="http://substrata.co.uk">substrata.co.uk</a></p>
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British Grid  
centre X: 247732.65 m, centre Y: 75302.82 m

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Base map: Ordnance Survey (c) Crown Copyright 2018.  
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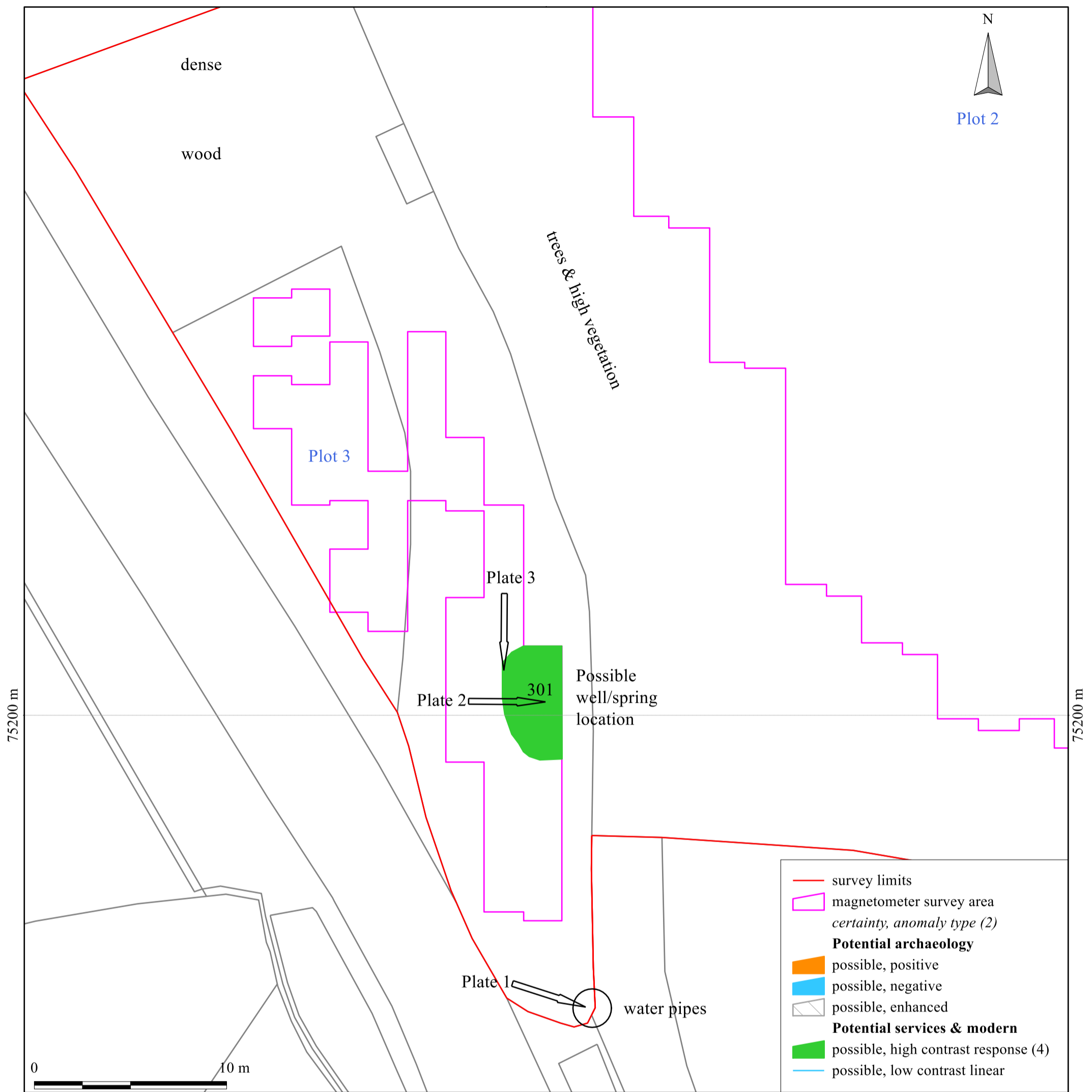
Scale: 1:1000 @ A3. Spatial Units: Meter. Do not scale off this drawing

- Notes:
1. This is a preliminary assessment and may change
  2. All interpretations are provisional

An archaeological magnetometer survey  
Land at Butcher Park Hill, Tavistock, Devon  
Centred on NGR (E/N): 247730,075310  
Report: 1805TAV-R-1

Figure 2: survey interpretation

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British Grid  
 centre X: 247642.15 m, centre Y: 75208.60 m

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Scale: 1:200 @ A3. Spatial Units: Meter. Do not scale off this drawing

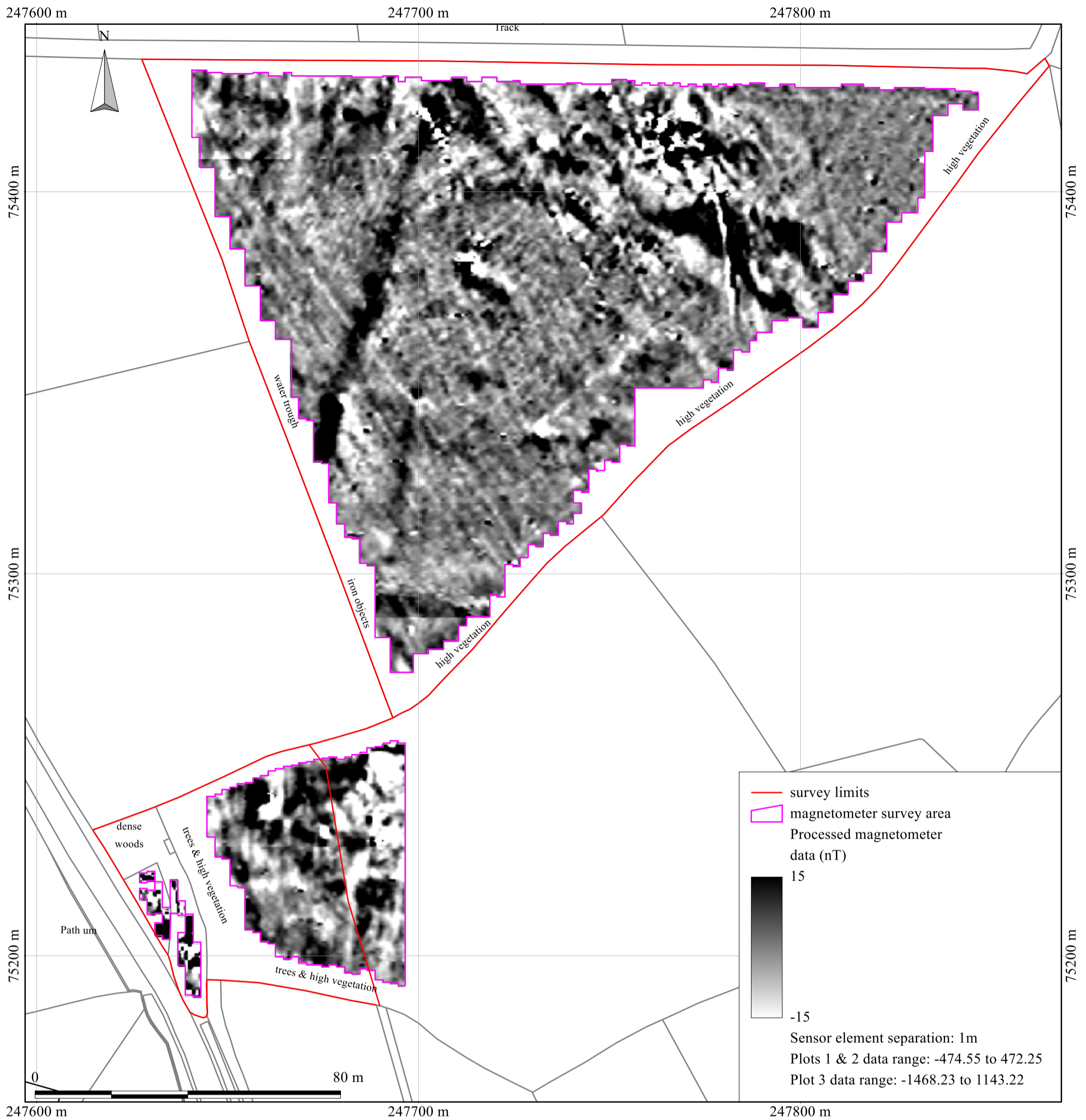
Notes:

1. All interpretations are provisional and represent potential archaeological deposits.
2. 'Anomaly type' is a description of the magnetic anomaly. See the report text or GIS for an archaeological characterisation.
3. Anomalies designated "likely archaeology" have supporting evidence e.g. historical maps and or visible earthworks.
4. Not all instances are mapped.
5. Anomalies likely to represent recent deposits or ground disturbance, or geological and other natural deposits are not mapped unless relevant to potential buried archaeology.

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Figure 3: survey interpretation, Plot 3



British Grid  
centre X: 247732.65 m, centre Y: 75302.82 m

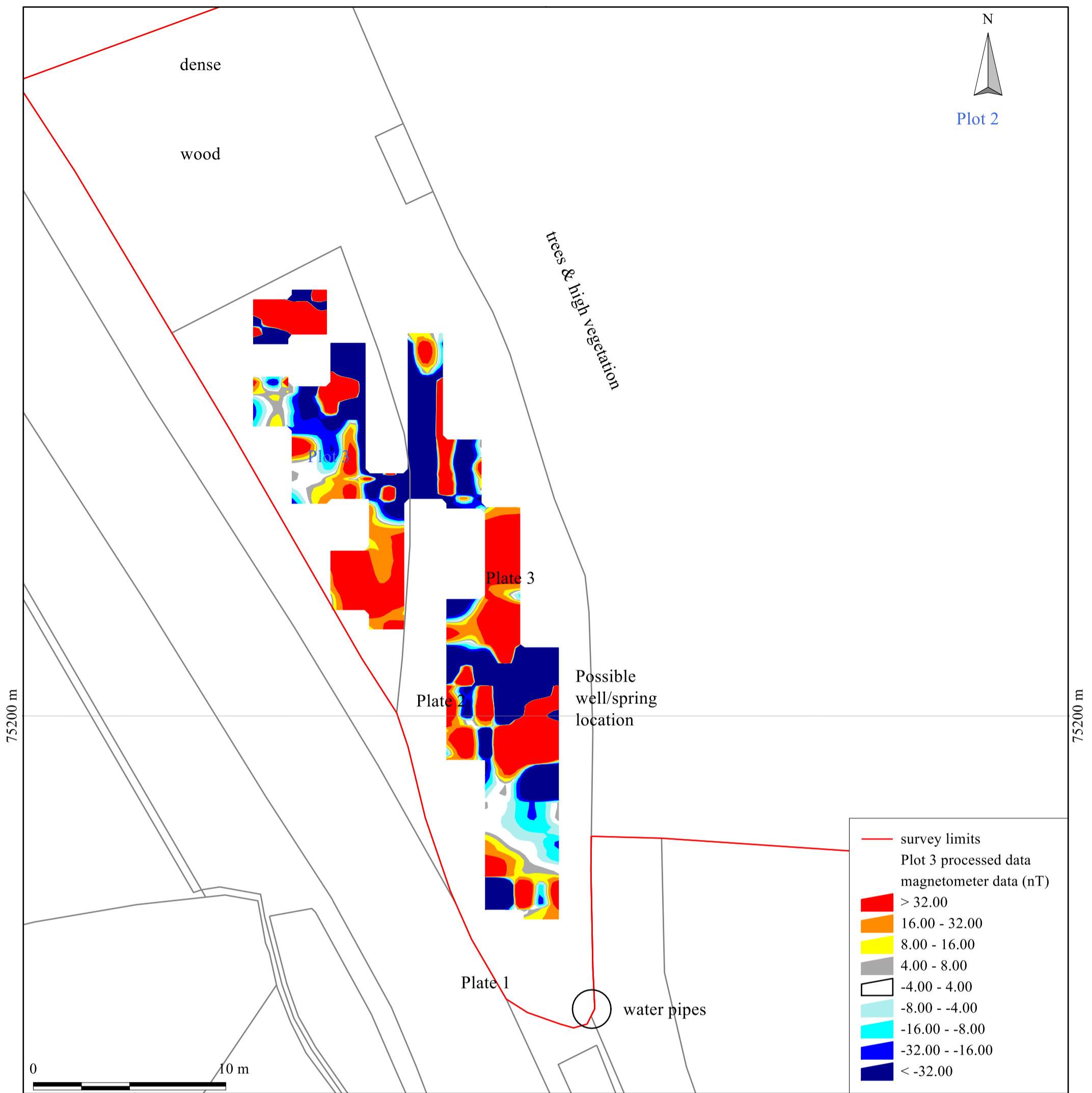
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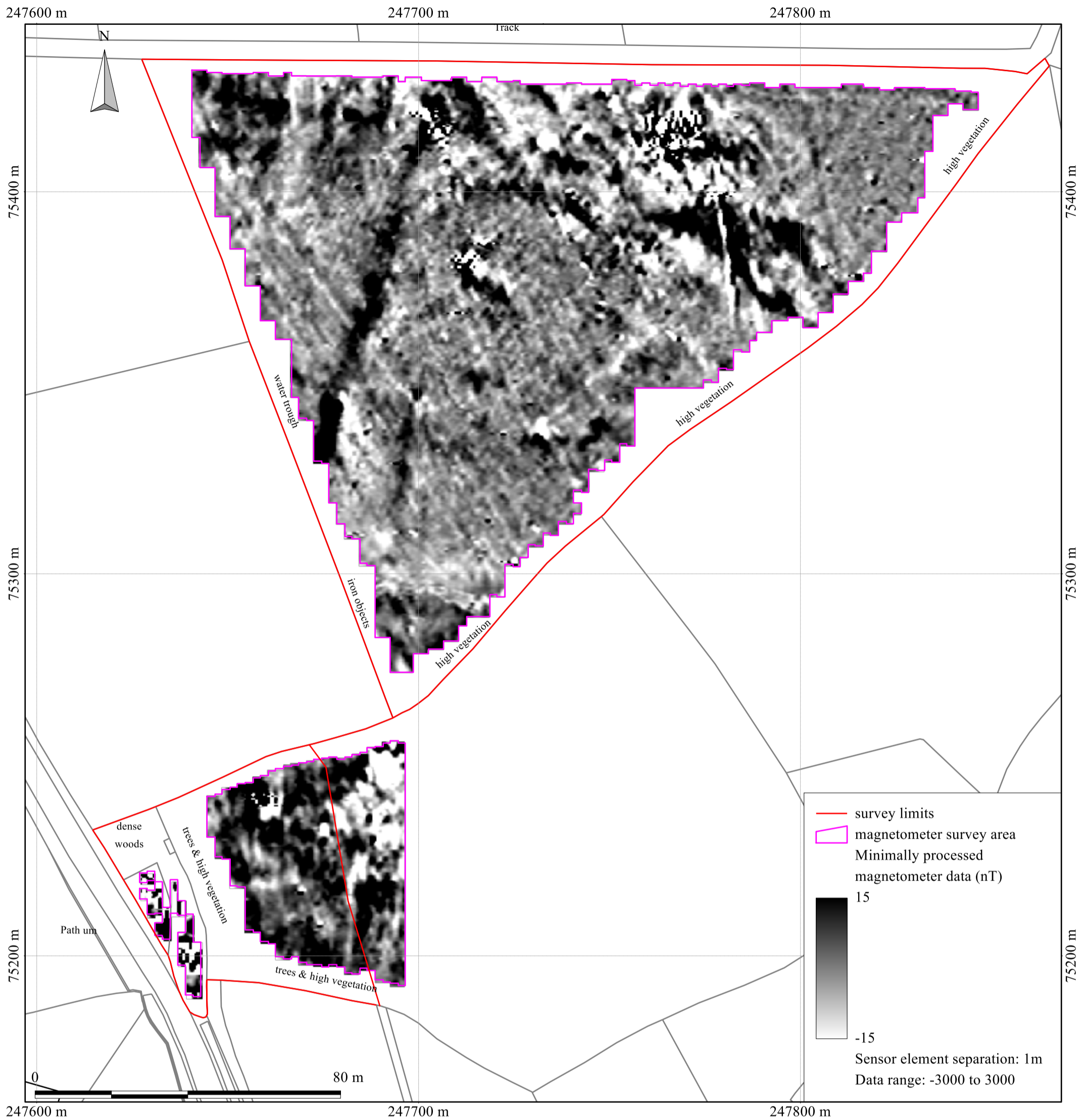
Scale: 1:1000 @ A3. Spatial Units: Meter. Do not scale off this drawing

An archaeological magnetometer survey  
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Figure 4: shade plot of processed data

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British Grid  
 centre X: 247732.65 m, centre Y: 75302.82 m

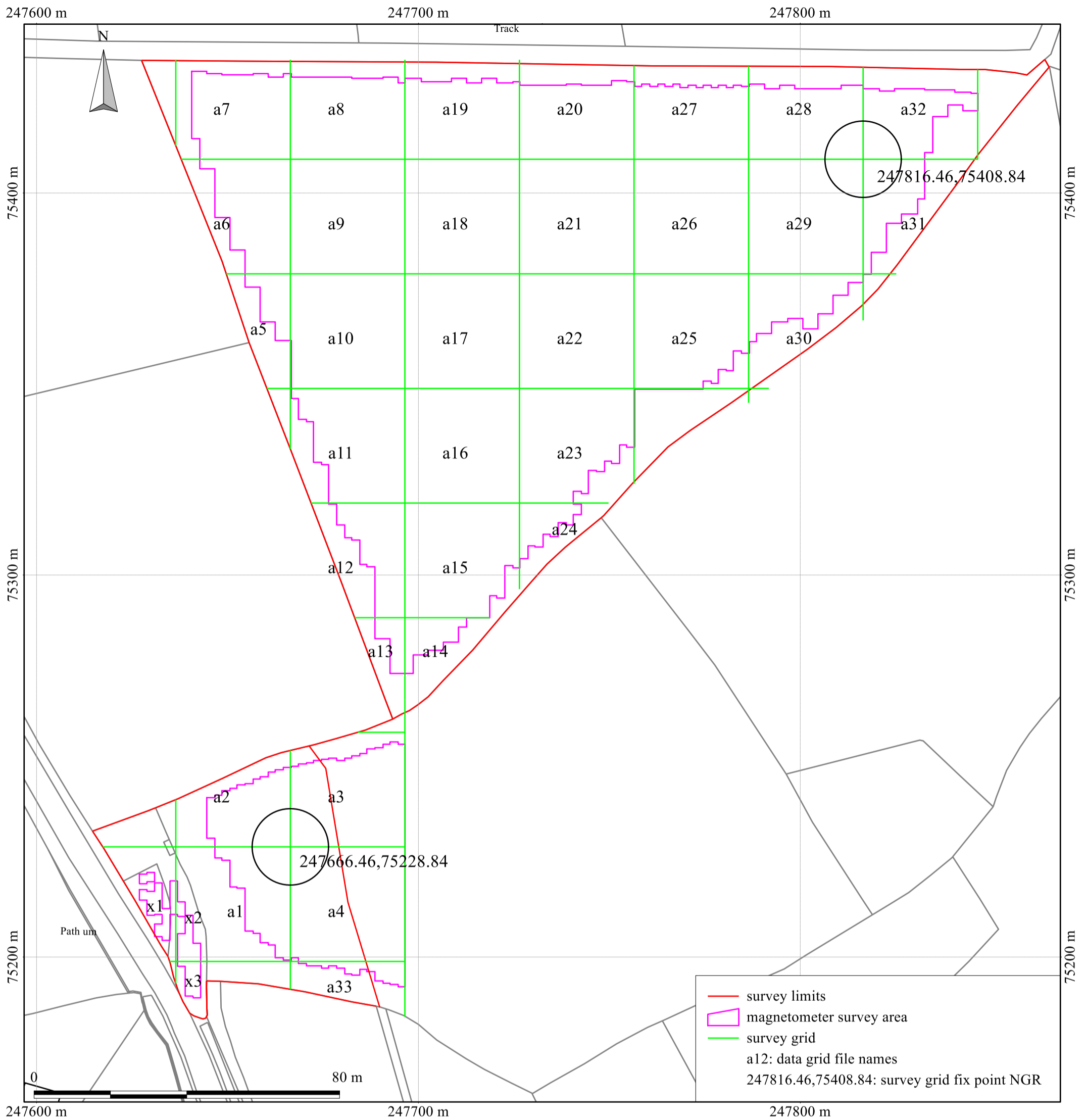
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Figure 6: shade plot of minimally processed data

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British Grid  
 centre X: 247732.43 m, centre Y: 75303.13 m

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Figure 7: survey grid plan and location

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## Appendix 2 Tables

Site: An archaeological magnetometer survey  
 Land at Butcher Park Hill, Tavistock, Devon  
 Centred on NGR: 247730,075310  
 Report: 1805TAV-R-1

plot	anomaly group	associated anomalies	anomaly characterisation certainty & class	anomaly form	additional archaeological characterisation	comments	supporting evidence
1	1		possible, positive	disrupted linear			
	2		possible, positive	linear			
	3		possible, positive	linear	buried archaeology or natural deposit		
	4	302	possible, enhanced	sub-circular	stonery material, disturbed ground and ferrous material	anomaly group may represent a former quarry similar feature now filled with rubble and some ferrous material (iron and/or steel)	nearby quarry recorded in the Devon County Council HER (entry MDV114275)
	302		possible, low contrast linear		service trench	possible location of the targeted water pipe	
2	5	6	possible, negative	linear	buried archaeology or, less likely, natural deposits	anomaly groups 5 and 6 and a may form a return	
	6	5	possible, negative	linear	buried archaeology or, less likely, natural deposits	anomaly groups 5 and 6 and a may form a return	
3	301		possible, high contrast response		ferrous material	anomaly group is close to but does not coincide with the location of the target well as shown on historic Ordnance Survey maps; the group represents one or more near-surface iron or steel objects which approximately correspond to the apparent destination of a partially exposed water pipe noted by the surveyors and so may represent objects associated with the target well	Ordnance Survey maps 1884-5 1:2500 to 1938 1:10560 surveyor observation

Table 1: data analysis

<p><b>Grid</b>  <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><b>Equipment</b>  <i>Instrument:</i> Bartington Instruments grad601-2  <i>Firmware:</i> version 6.1</p>	<p><b>Data Capture</b>  <i>Sample Interval:</i> 0.25m  <i>Traverse Interval:</i> 1 metre  <i>Traverse Method:</i> zigzag  <i>Traverse Orientation:</i> GN</p>
<p><b>Data Processing, Analysis and Presentation Software</b>  IntelliCAD 8.4  DW Consulting TerraSurveyor3  Manifold System 8 GIS  Microsoft Corp. Office 365: Excel, Publisher, Word  Adobe Systems Inc Adobe Acrobat 9 Pro Extended</p>	

Table 2: methodology information

<b>Instrument</b> Type: Bartington Grad-601 gradiometer Units: nT Direction of 1st Traverse: see below Collection Method: ZigZag Sensors: 2 @ 1.00 m spacing, each with 1m separation Dummy Value: 32702	
<b>Program</b> Name: TerraSurveyor Version: 3.0.33.6	
<b>Plots 1 and 2</b> <u>Statistics</u> Max: 472.25 Min: -474.55 Std Dev: 25.25 Mean: 0.80 Median: 0.00	<u>Processing</u> 1 Base Layer 2 Clip at 4.00 SD 3 De Stagger: Grids: a33.xgd a1.xgd a4.xgd a2.xgd a3.xgd By: 0 intervals, 50.00cm 4 De Stagger: Grids: a12.xgd a15.xgd a24.xgd a11.xgd a16.xgd a23.xgd By: 0 intervals, 50.00cm 5 De Stagger: Grids: a17.xgd a18.xgd By: 0 intervals, 50.00cm 6 De Stagger: Grids: a25.xgd a26.xgd a27.xgd By: 0 intervals, 50.00cm 7 DeStripe Median Sensors: Grids: All  Interpolate match x & y double is imposed on export to the GIS
<b>Plot 3</b> <u>Statistics</u> Max: 1143.22 Min: -1468.23 Std Dev: 577.18 Mean: -99.54 Median: 0.00	<u>Processing</u> 1 Base Layer 2 Clip at 1.00 SD 3 De Stagger: Grids: All By: 0 intervals, 50.00cm 4 DeStripe Median Sensors: Grids: All  Interpolate match x & y double is imposed on export to the GIS

Table 3: processed data metadata

<b>Instrument</b>	
Type:	Bartington Grad-601 gradiometer
Units:	nT
Direction of 1st Traverse:	see below
Collection Method:	ZigZag
Sensors:	2 @ 1.00 m spacing, each with 1m separation
Dummy Value:	32702
<b>Program</b>	
Name:	TerraSurveyor
Version:	3.0.33.6
<b>Plots 1 and 2</b>	
<u>Statistics</u>	Processing
Max: 3000.00	1 Base Layer
Min: -3000.00	
Std Dev: 117.04	Interpolate match x & y double is imposed on export to the GIS
Mean: 0.50	
Median: 0.00	
<b>Plot 3</b>	
<u>Statistics</u>	Processing
Max: 3000.00	1 Base Layer
Min: -3000.00	
Std Dev: 1281.58	Interpolate match x & y double is imposed on export to the GIS
Mean: -158.75	
Median: -1.10	

Table 4: minimally processed data metadata

## Appendix 3 Project archive contents

### A3.1 Substrata Limited archive

A full archive of this survey will be held by Substrata Limited on cloud and local hard drive storage as follows:

Report:	Adobe PDF format
Raw grid & composite files:	DW Consulting TerraSurveyor 3 format xyz files
Final data processing composite files: (excluding interpolation processes)	DW Consulting TerraSurveyor 3 format xyz files
GIS project:	GIS project Manifold 8 .map format ESRI shape files
AutoCAD version of the survey interpretation: (if generated)	AutoCAD DXF
All project working files:	various (Table 2)

### A3.2 Online Access to the Index of archaeological investigationS (OASIS)

Metadata:	online form
Georeferenced survey boundary file:	ESRI shape file
Report:	Adobe PDF format

### A3.3 Archaeological Data Service

Depending on local authority policy, an archive may be deposited with the ADS as follows:

Raw data composite file:	xyz file
Processed data plot:	rendered images in TIFF format
Survey grid plot:	image in TIFF format
Details of data processing:	image in TIFF format
Interpretation plot:	rendered images in TIFF format
Metadata:	Microsoft Excel format

### A3.4 Historic Environment Record (HER)

Subject to any contractual requirements on confidentiality, a PDF copy of the report will be submitted to the appropriate HER within 6 months of the completion of this report via the OASIS process or by other means, depending on the relevant HER process.

## Appendix 4 Plates



Plate 1: water pipes at the southern entrance to Plot 3, looking east-south-east  
(0.5m and 0.2cm scales)





Plate 2: location of anomaly 301 (centre of image) representing buried iron and/or steel objects, looking east (0.5m and 0.2cm scales)



Plate 3: the lane with the location of anomaly 301 to the left and the gate leading to Butchers Park Hill road where the water pipes are located on the left hand side, looking south