THAMES VALLEY

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Land at Camp Road, Upper Heyford, Oxfordshire

Geophysical Survey (Magnetic)

by Daniel Bray and Tim Dawson

Site Code: CRU14/229

(SP 5194 2582)

Land at Camp Road, Upper Heyford, Oxfordshire

Geophysical Survey (Magnetic) Report

For Pye Homes Group

by Daniel Bray and Tim Dawson

Thames Valley Archaeological Services Ltd

Site Code
CRU14/229

April 2015

Summary

Site name: Land at Camp Road, Upper Heyford, Oxfordshire

Grid reference: SP 5194 2582

Site activity: Magnetometer survey

Date and duration of project: 15th-16th April 2015

Project manager: Steve Ford

Site supervisor: Daniel Bray

Site code: CRU 14/229

Area of site: 3.15ha

Summary of results: A series of magnetic anomalies were identified by the survey. Several of these may represent buried archaeological features although no specific monument types could be recognised. Most of the site has been affected by ploughing and the presence of services and modern trackways, all of which have had an affect on the site's magnetic plot and may mask any underlying archaeological activity.

Location of archive: The archive is presently held at Thames Valley Archaeological Services, Reading in accordance with TVAS digital archiving policies.

Report edited/checked by:	Steve Ford✓ 28.04.15
	Andrew Mundin✓ 28.04.15

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Land at Camp Road, Upper Heyford, Oxfordshire
A Geophysical Survey (Magnetic)

by Daniel Bray and Tim Dawson

Report 14/229b

Introduction

This report documents the results of a geophysical survey (magnetic) carried out on a plot of land to the north of Camp Road, Upper Heyford, Oxfordshire (SP 5194 2582) (Fig. 1). The project was commissioned by Mr Stuart Wright of Pye Homes Group, Langford Locks, Kidlington, Oxfordshire, OX5 1HZ.

Planning permission is to be sought for the construction of housing on the proposal site. As a consequence of the possibility of archaeological deposits on the site which may be damaged or destroyed by development, a geophysical survey has been requested. The results of the survey will be used to provide targets for any subsequent trenching. This is in accordance with the Department for Communities and Local Government's National Planning Policy Framework (NPPF 2012) and the District's policies on archaeology. The field investigation was carried out to a specification approved by Mr Richard Oram, Planning Archaeologist at Oxfordshire County Archaeological Service, based on a brief prepared by him (Oram 2015). The fieldwork was undertaken by Daniel Bray and Anna Ginger on 15th and 16th April 2015 and the site code is CRU 15/229.

The archive is presently held at Thames Valley Archaeological Services, Reading in accordance with TVAS digital archiving policies.

Location, topography and geology

The site is located on the south-eastern edge of the former RAF Upper Heyford airbase, *c*.2km to the east of the village of Upper Heyford itself and *c*.6km to the north-west of Bicester in north eastern Oxfordshire (Fig. 1). It currently consists of an irregularly shaped field which was planted with a young crop at the time of survey. The field is bordered by a hedgerow and ditch on its eastern edge, a wooden post-and-rail fence to the north, a Tar macadam drive to the west and an earth track to the south. There are fields beyond to the north and east, housing to the west and Camp Road to the south. The site slopes downhill from *c*.119.5m above Ordnance Datum (aOD) in the north-western corner to *c*.115.8m aOD in the south-eastern corner. The underlying geology is recorded as Great Oolite Limestone (BGS 1968) and the topsoil as freely draining lime-rich loamy soils (LandIS 2015).

The conditions during the survey were dry and sunny (Pl. 1-2). The ground was soft, due to recent ploughing and seeding, but dry.

Site history and archaeological background

A desk-based assessment has been prepared for the project (Ford 2015). In summary there are no known archaeology on the proposal site itself, however it lies 200m west of a major Iron Age territorial/tribal boundary (Aves Ditch). Aerial photography of surrounding areas has identified several further probable Iron Age enclosure sites, with a distinctive 'banjo' form, in the surrounding area. Roman occupation is also recorded to the north of the site. A probable Saxon cemetery adjacent to Aves Ditch has also been recorded though its location is poorly recorded being either north or south of the site.

Methodology

Sample interval

Data collection required a temporary grid to be established across the survey area using wooden pegs at 20m intervals with further subdivision where necessary. Readings were taken at 0.25m intervals along traverses 1m apart. This provides 1600 sampling points across a full 20m × 20m grid (English Heritage 2008), providing an appropriate methodology balancing cost and time with resolution. The survey grid was laid out in alignment with the field's long axis. There were no obstructions within the survey area.

The Grad 601-2 has a typical depth of penetration of 0.5m to 1.0m. This would be increased if strongly magnetic objects have been buried in the site. Under normal operating conditions it can be expected to identify buried features >0.5m in diameter. Features which can be detected include disturbed soil, such as the fill of a ditch, structures that have been heated to high temperatures (magnetic thermoremnance) and objects made from ferro-magnetic materials. The strength of the magnetic field is measured in nano Tesla (nT), equivalent to 10^{-9} Tesla, the SI unit of magnetic flux density.

Equipment

The purpose of the survey was to identify geophysical anomalies that may be archaeological in origin in order to inform a targeted archaeological investigation of the site prior to development. The survey and report generally follow the recommendations and standards set out by both English Heritage (2008) and the Chartered Institute *for* Archaeologists (2002, 2011, 2014).

Magnetometry was chosen as a survey method as it offers the most rapid ground coverage and responds to a wide range of anomalies caused by past human activity. These properties make it ideal for fast yet detailed survey of an area.

The detailed magnetometry survey was carried out using a dual sensor Bartington Instruments Grad 601-2 fluxgate gradiometer. The instrument consists of two probes mounted 1m vertically apart with a second set positioned at 1m horizontal distance. This enables readings to be taken of both the general background magnetic field and any localised anomalies with the difference being plotted as either positive or negative buried features. All sensors are calibrated to cancel out the local magnetic field and react only to anomalies above or below this base line. On this basis, strong magnetic anomalies such as burnt features (kilns and hearths) will give a high response as will buried ferrous objects. More subtle anomalies such as pits and ditches, can be seem from their infilling soils containing higher proportions of humic material, rich in ferrous oxides, compared to the undisturbed subsoil. This will stand out in relation to the background magnetic readings and appear in plan following the course of a linear feature or within a discrete area.

A Trimble Geo7x handheld GPS system with sub-decimetre real-time accuracy was used to tie the site grid into the Ordnance Survey national grid. This unit offers both real-time correction and post-survey processing; enabling a high level of accuracy to be obtained both in the field and in the final post-processed data.

Data gathered in the field was processed using the TerraSurveyor software package. This allows the survey data to be collated and manipulated to enhance the visibility of anomalies, particularly those likely to be of archaeological origin. The table below lists the processes applied to this survey, full survey and data information is recorded in Appendix 1.

Process	**Effect**
Clip from -1.80 to 2.20 nT	Enhance the contrast of the image to improve the appearance of possible archaeological anomalies.
Interpolate: *y* doubled	Increases the resolution of the readings in the *y* axis, enhancing the shape of anomalies.
De-stripe: median, all sensors	Removes the striping effect caused by differences in sensor calibration, enhancing the visibility of potential archaeological anomalies.
De-spike: threshold 1, window size 3×3	Compresses outlying magnetic points caused by interference of metal objects within the survey area.
Search & Replace: from: ±30 nT to: ±1000 nT with: dummy	Removes extreme values resulting from magnetic interference caused by near-by ferromagnetic objects.
De-stagger: all grids, both by -1 intervals	Cancels out effects of site's topography on irregularities in the traverse speed.

Once processed, the results are presented as a greyscale plot shown in relation to the site (Fig. 4), followed by a second plan to present the abstraction and interpretation of the magnetic anomalies (Fig. 5). Anomalies are

shown as colour-coded lines, points and polygons. The grid layout and georeferencing information (Fig. 2) is prepared in EasyCAD v.7.58.00, producing a .FC7 file format, and printed as a .PDF for inclusion in the final report.

The greyscale plot of the raw (Fig. 3) processed (Fig. 4) data is exported from TerraSurveyor in a georeferenced portable network graphics (.PNG) format, a raster image format chosen for its lossless data compression and support for transparent pixels, enabling it to easily be overlaid onto an existing site plan. The data plot is combined with grid and site plans in QGIS 2.6.1 Brighton and exported again in .PNG format in order to present them in figure templates in Adobe InDesign CS5.5, creating .INDD file formats. Once the figures are finalised they are exported in .PDF format for inclusion within the finished report.

Results

A range of magnetic anomalies were recoded across the entire survey area (Fig. 4). These were primarily caused by modern agricultural activity but there were also some of which are likely to be archaeological in origin and a few which may represent natural features (Fig. 5). The magnetic anomalies of possible archaeological origin are recognisable as both positive and negative variations in the site's general magnetic field. The positive anomalies usually represent buried cut features such as ditches or pits whereas negative anomalies are indicative of earthen banks.

The majority of the positive anomalies of possible archaeological origin appear perpendicular to a line which extends between the south-western corner and northern edge of the field. The south-westernmost are a pair of almost parallel linear shapes *c*.12m long an *c*.14m apart, which are aligned north-west - south-east **[Fig. 5: 1]**. A second pair, one of which has a weaker field strength, were located a further 32m to the north-east **[2]**. The weaker linear anomaly appears to extend further to the north-west after a short break and terminates with a much stronger anomaly, which may represent a buried pit. A short distance to the north-east is another, shorter, length of linear positive anomaly **[3]**, again on the same orientation as those described above. Approximately 30m to the north is another linear strong positive anomaly with a second one at a slight angle to it another 17m to the north-east **[4]**. Some 10m to the north is another set of linear positive anomalies **[5]**. This time they appear to form approximately two thirds of an almost circular enclosure with two short linear anomalies on a similar alignment to those to the south-west extending from its south-eastern sector. Another short linear positive anomaly runs from the south-western end of the enclosure inwards towards the centre of the circle. Further to the north-east, another group of weaker linear positive anomalies appears to form a fragmented line **[6]** which

extends north-eastwards for *c*.20m before turning northwards for *c*.15m. It terminates with a slightly stronger discreet anomaly, possibly representing a buried pit, of which there are others to the north-west and west.

In the centre of the southern end of the field the survey recorded a strong linear positive anomaly **[7]** that appeared much more defined than the surrounding plough marks. It runs northwards for *c*.60m, possibly flanked by two negative anomalies, suggesting buried built features. The positive anomaly appears to end but the negative anomalies continue **[8]**, stretching from the southern end of **[3]** to the northern end of **[4]**. The two sections are divided by an positive anomaly of organic appearance **[9]** which may represent a natural feature within the geology underlying the site.

A series of several linear positive anomalies can be clearly seen running parallel to one another at set intervals from north to south. These are the result of plough furrows. A number of areas of magnetic disturbance were noted along the southern and eastern edges of the survey area and in its north-western corner. These will have been caused by fencing in the east, the close proximity to the track that leads up the site's western side in the west and what appears to be a modern service which runs along the southern edge of the site. There is a scatter of strong positive/negative magnetic spikes across the site. These most likely represent buried ferrous objects, such as plough fragments.

Conclusion

The geophysical survey of the site at Camp Road was successfully undertaken and succeeded in identifying several magnetic anomalies which may represent buried archaeological features. These appear to extend from the site's south-western corner to the centre of its northern edge although their layout does not immediately suggest a specific form of archaeological feature. The magnetic plot of the entire site has been affected by modern agricultural activity with a very clear set of plough marks covering the area. In addition, the signature of a service pipe or cable was detected along the southern edge of the site and, together, these anomalies have the potential to mask others which may indicate the presence of potential archaeological features.

References

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Appendix 1. Survey and data information

Programme:
Name: TerraSurveyor
Version: 3.0.25.0

Raw data
Instrument Type: Grad 601 (Magnetometer)
Units: nT
Survey corner coordinates (X/Y):
Northwest corner: 451856.19, 225958.46 m
Southeast corner: 452056.19, 225718.46 m
Direction of 1st Traverse: 95.99 deg
Collection Method: ZigZag
Sensors: 2 @ 1.00 m spacing.
Dummy Value: 2047.5

Dimensions
Composite Size (readings): 800 x 240
Survey Size (meters): 200 m x 240 m
Grid Size: 20 m x 20 m
X Interval: 0.25 m
Y Interval: 1 m

Stats
Max: 100.00
Min: -100.00
Std Dev: 9.42
Mean: 0.24
Median: 0.25
Composite Area: 4.8 ha
Surveyed Area: 3.0609 ha

Source Grids: 102
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2 Col:0 Row:2 grids\02.xgd
3 Col:0 Row:3 grids\03.xgd
4 Col:0 Row:4 grids\04.xgd
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6 Col:0 Row:6 grids\06.xgd
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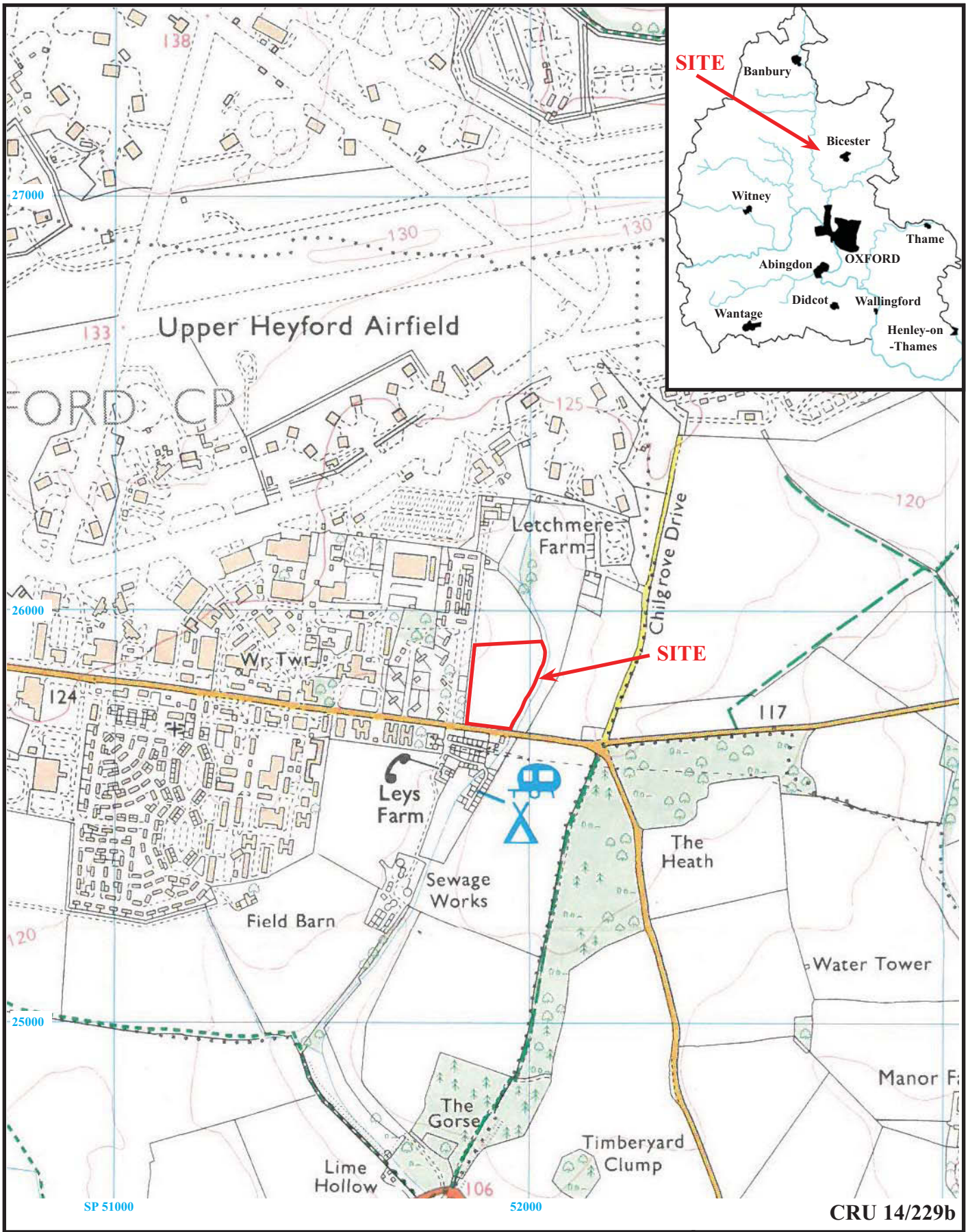
99 Col:9 Row:1 grids\99.xgd
100 Col:9 Row:2 grids\100.xgd
101 Col:9 Row:3 grids\101.xgd
102 Col:9 Row:4 grids\102.xgd

Processed data
Stats
Max: 2.20
Min: -1.80
Std Dev: 0.77
Mean: 0.06
Median: 0.01

Processes: 8
1 Base Layer
2 DeStripe Median Sensors: All

3 Search & Replace From: -1000 To: -30 With: Dummy
4 Search & Replace From: 30 To: 1000 With: Dummy
5 De Stagger: Grids: All Mode: Both By: -2 intervals
6 Despike Threshold: 1 Window size: 3x3
7 Interpolate: Y Doubled.
8 Clip from -1.80 to 2.20 nT



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Land at Camp Road, Upper Heyford,
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Geophysical Survey (Magnetic)

Figure 1. Location of site within Upper Heyford and Oxfordshire

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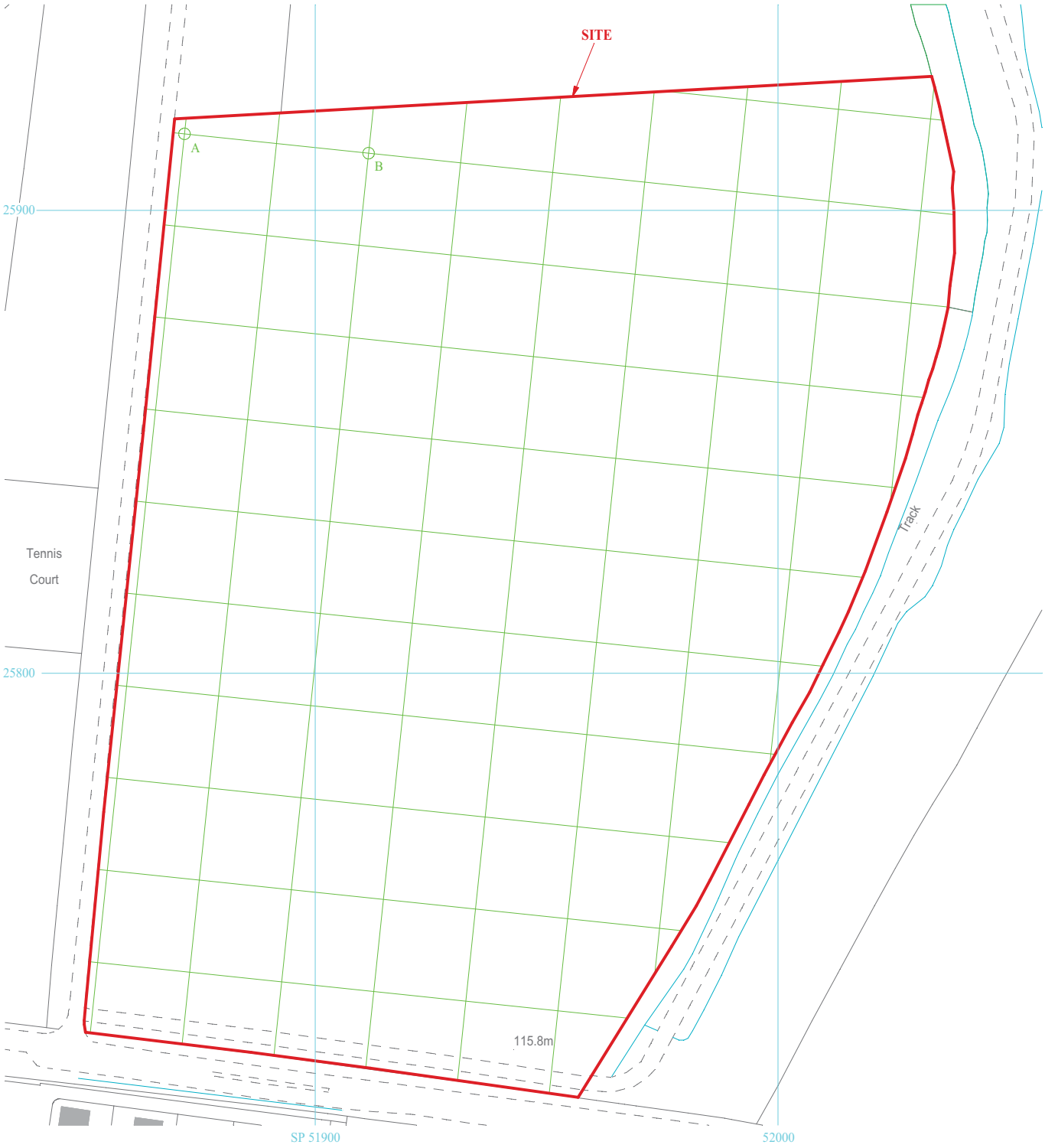

Georeferencing:
A. E 451871, N 225916
B. E 451911, N 225912

CRU 14/229b

N

Land at Camp Road, Upper Heyford, Oxfordshire, 2015 Geophysical Survey (Magnetic)

Figure 2. Survey grid layout.

0 100m

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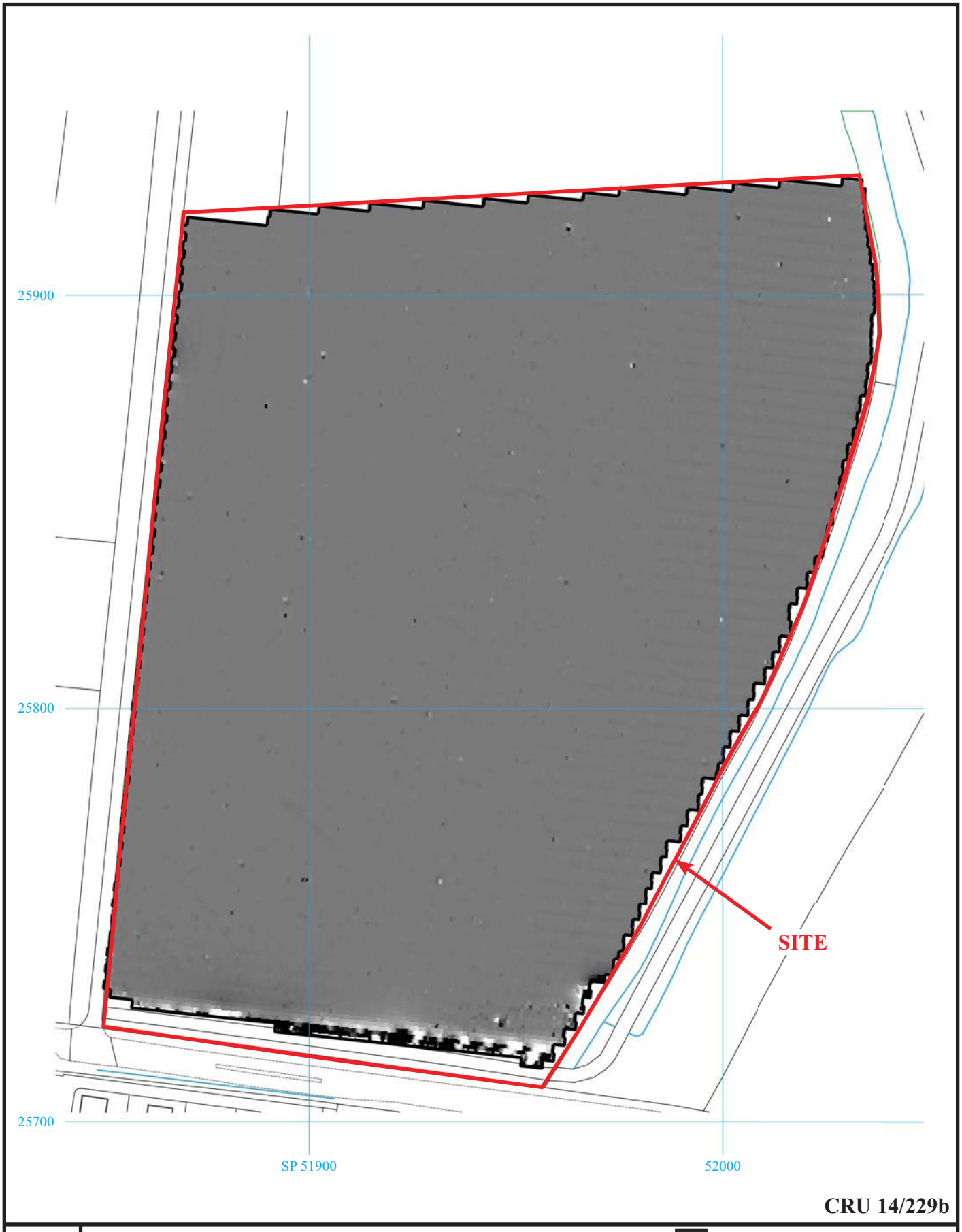

CRU 14/229b

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Land at Camp Road, Upper Heyford, Oxfordshire, 2015
Geophysical Survey (Magnetic)

Figure 3. Plot of raw gradiometer data.

0m 100m

+100 nT

-100 nT

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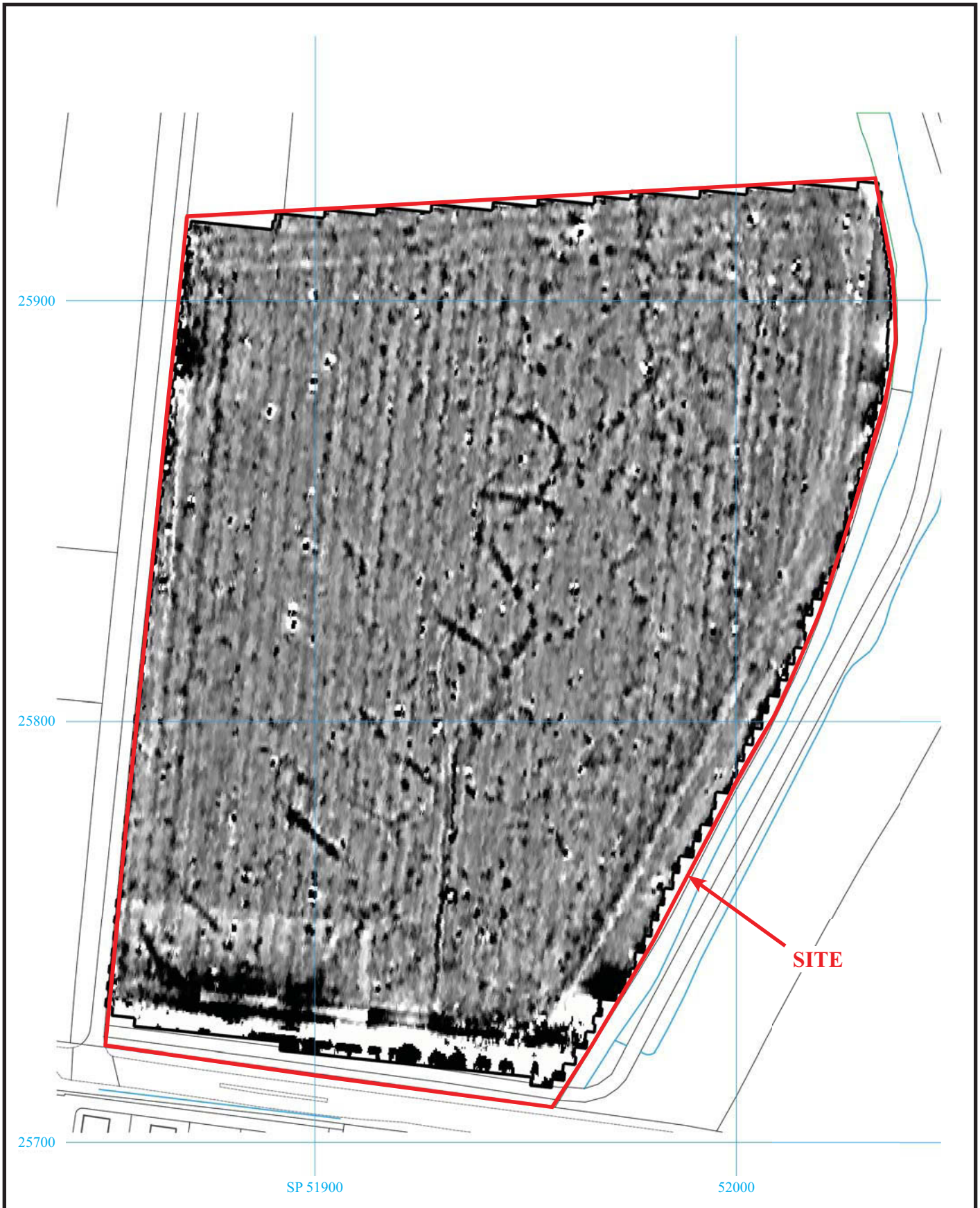

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Land at Camp Road, Upper Heyford, Oxfordshire, 2015
Geophysical Survey (Magnetic)

Figure 4. Plot of minimally processed gradiometer data.

0m 100m

+2.2 nT
-1.8 nT

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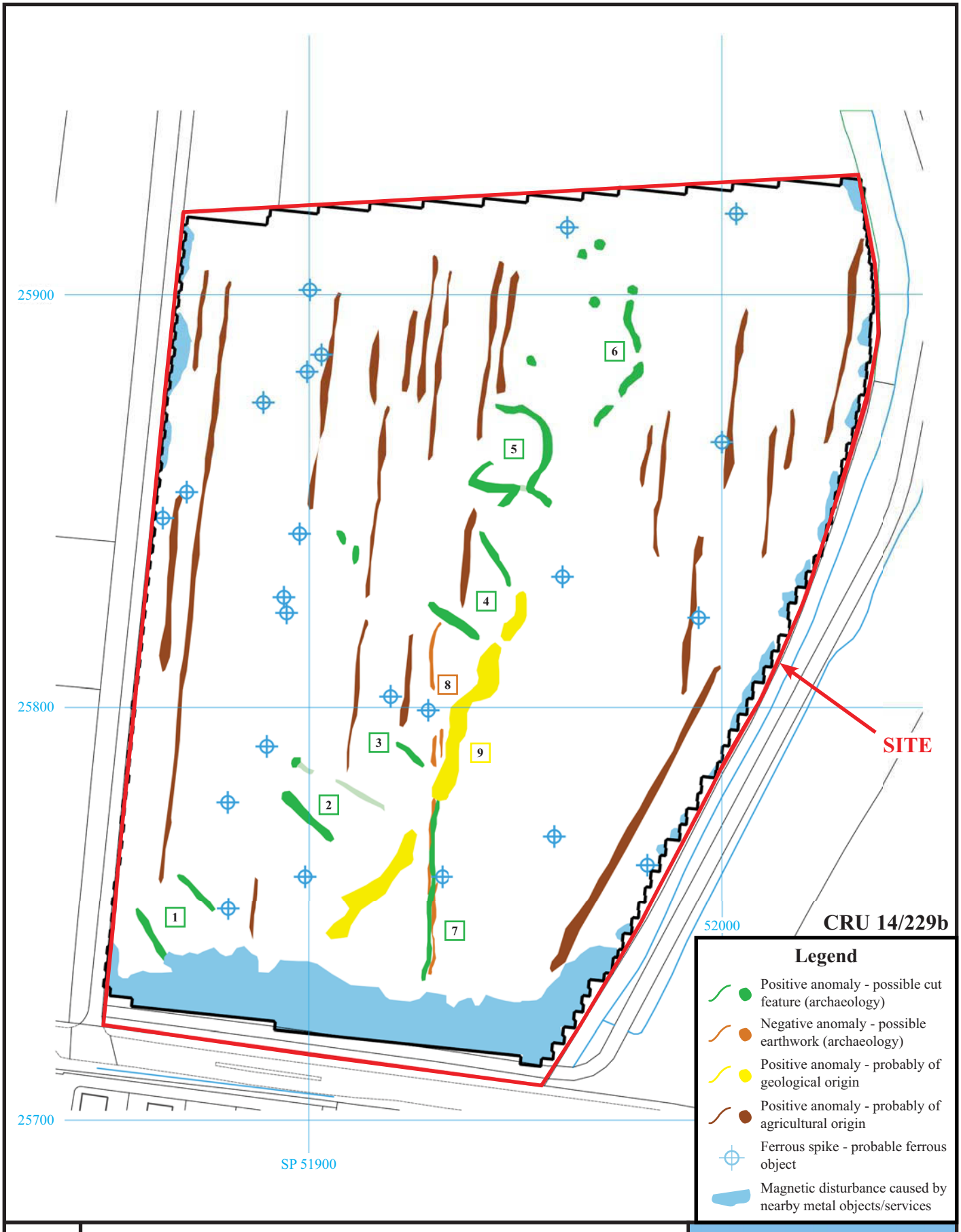

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Land at Camp Road, Upper Heyford, Oxfordshire, 2015
Geophysical Survey (Magnetic)

Figure 5. Interpretation plot.

0m 100m

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Plate 1. The site, looking south-west from the north-eastern corner.

Plate 2. The site, looking north-east from the south-western corner.

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Land at Camp Road, Upper Heyford,
Oxfordshire, 2015
Geophysical Survey (Magnetic)

Plates 1 and 2.

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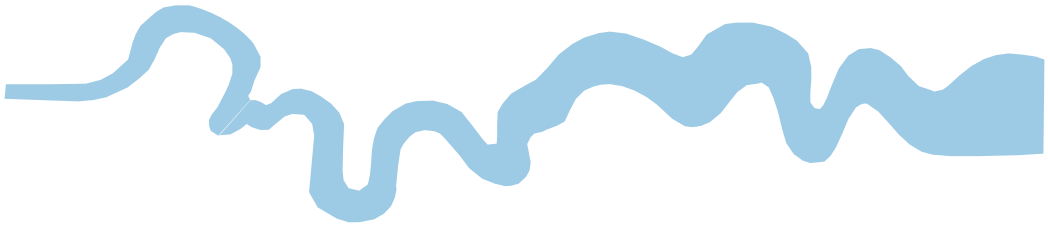
TIME CHART

	Calendar Years
Modern	AD 1901
Victorian	AD 1837
Post Medieval	AD 1500
Medieval	AD 1066
Saxon	AD 410
Roman	AD 43
Iron Age	BC/AD 750 BC
Bronze Age: Late	1300 BC
Bronze Age: Middle	1700 BC
Bronze Age: Early	2100 BC
Neolithic: Late	3300 BC
Neolithic: Early	4300 BC
Mesolithic: Late	6000 BC
Mesolithic: Early	10000 BC
Palaeolithic: Upper	30000 BC
Palaeolithic: Middle	70000 BC
Palaeolithic: Lower	2,000,000 BC



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