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Land off B4019, Broad Blunsdon, Swindon, Wiltshire

Geophysical Survey (Magnetic)

by Ashley Kruger

Site Code: BBB18/219

(SU 1491 9017)

Land off B4019, Broad Blunsdon, Swindon, Wiltshire

Geophysical Survey (Magnetic) Report

For The GreenSquare Group

by

Ashley Kruger

Site Code BBB 18/219

April 2019

Summary

Site name: Land off B4019, Broad Blunsdon, Swindon, Wiltshire

Grid reference: SU 1490 9017

Site activity: Magnetometer survey

Date and duration of project: 24th to 30th April 2019

Project coordinator: Tim Dawson

Site supervisor: Kyle Beaverstock

Site code: BBB 18/219

Area of site: 2.3ha

Summary of results: While no magnetic anomalies of archaeological provenance were detected over the course of the survey, the extensive areas of magnetic disturbance and the various dipolar anomalies that have been recorded may mask weaker magnetic signatures that are archaeological in nature.

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✓ 30.04.19
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Land off B4019, Broad Blunsdon, Swindon, Wiltshire
A Geophysical Survey (Magnetic)

by Ashley Kruger

Report 18/219

Introduction

This report documents the results of a geophysical survey (magnetic) carried out at Parcel of land off B4019, Broad Blunsdon, Swindon, Wiltshire (SU 14906 90172) (Fig. 1). The work was commissioned by David Curtis of the GreenSquare group, Methuen Park, Chippenham, SN14 0GU.

Planning permission (S/OUT/19/0294) has been sought from Swindon Borough Council to construct 43 new residential units with associated services and access on *c*2.3ha parcel of land situated north of the B4019 in Broad Blunsdon, Swindon, Wiltshire (SU 1490 9017). In order to mitigate damage to possible underlying archaeology caused by the development a geophysical survey has been proposed. The results of the survey will be used to inform the design of a methodology in the event of further mitigation works requested by the local authority. This is in accordance with the Department for Communities and Local Government's National Planning Policy Framework (NPPF 2018), and the Borough's policies on archaeology. The field investigation was carried out to a specification approved by Ms Melanie Pomeroy-Kellinger, County Archaeologist for Wiltshire Council. The fieldwork was undertaken by Kyle Beaverstock, Ashley Kruger and Jamie Williams on the 24th, 29th and 30th of April, and the site code is BBB 18/219.

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 approximately 5.2 km north of Swindon town centre, adjacent to the B4109 on the southern edge of the village of Broad Blunsdon (Fig. 1). The entirety of the survey area is covered in well kept grass and is currently being utilized as pasture and for the stabling of horses; while larger mature species of tree and brush populate the peripheries of the site. Situated at an elevation of *c*.145m above Ordnance Datum the survey area sits on a natural terrace on the south-eastern edge of Stubbs Hill and is generally level with barely perceptible undulation at the southern edge of the survey area where Stubbs Hill descends towards Swindon town. The underlying geology is Highworth Limestone formation with no recorded superficial deposits (BGS 1974). The

total area of the site of investigation is calculated to be around *c.*2.3ha; however, the area has been subdivided into 7 irregularly sized and shaped paddocks, separated by a number of wooden and metallic fences.

Site history and archaeological background

The archaeological potential of the site has been highlighted by a desktop study (Baljkas 2018) In summary it is primarily defined by the area's proximity to the Roman road of Ermine Street, a small portion of which is thought to survive on a north-west/south-east trajectory, some 100m to the west of the boundary of the survey area (Fig. 1). It is thought that due to the site's location and the propensity for Roman settlements to develop along these ancient highways that there is a high probability of a Roman roadside settlement in or around the area of investigation.

Methodology

Sample interval

Data collection involved the traversing of the survey area along straight and parallel lines using two cart-mounted Bartington Grad601-2 fluxgate gradiometers. Even coverage was achieved with the use of regularly spaced markers at the ends of traverses and the real-time positional trace plot. Readings were taken at 0.25m intervals along traverses 1m apart, providing an appropriate methodology balancing cost and time with resolution. Traverses were walked at an alternating east to west zig-zag orientation across the northern survey area and north-west to south-east in the eastern field.

In terms of survey conditions, the area of investigation provided the optimal environment for a cart based magnetometry survey, allowing for an efficient and productive pace. However, the seven further subdivisions of the site formed obstacles and barriers. While the majority of the survey progressed as defined by the agreed methodology, the field subdivisions on the north-western quarter of the site, along with various other obstructions such as stables, jumps and paddocks, created conditions in which it was impossible to complete a clean transect with the cart. These conditions forced a change in methodology in order to optimise the total area surveyed in this portion.

For the remaining area of the site 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 (EAC 2015), providing an appropriate methodology balancing cost and time with resolution.

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 European Archaeological Council (EAC 2015) and the Chartered Institute *for* Archaeologists (2002, 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 the fast yet detailed surveying of an area.

The detailed magnetometry survey was carried out using two dual sensor Bartington Instruments Grad 601-2 fluxgate gradiometers mounted upon a Bartington non-magnetic cart. A two-wheeled lightweight structure pushed by hand, the cart consisted a bank of four vertically-mounted Bartington Grad601-2 magnetic sensor tubes at 1m apart and a Trimble Geo 7x centimetre edition GPS. Readings were collected by two Bartington Grad601-2 loggers and collated using MLgrad601 software on a Linx 12x64 tablet running Windows 10 mounted at the rear of the cart. 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 seen 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.

The Trimble Geo7x centimetre edition GPS system with centimetre real-time accuracy was used to tie the cart traverses 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 -4.80 to 5.20 nT	Enhance the contrast of the image to improve the appearance of possible archaeological 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.
De-stagger: all grids, both by -1 intervals	Cancels out effects of site's topography on irregularities in the traverse speed.

The raw data plot is presented as a greyscale plot shown in relation to the site (Fig. 2) with the processed data then presented as a second figure (Fig. 3), followed by a third plan to present the abstraction and interpretation of the magnetic anomalies (Fig. 4). Anomalies are shown as colour-coded lines, points and polygons.

The greyscale plot of the processed 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 3.6.1 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

No magnetic anomalies likely to represent buried archaeological features were detected over the course of the survey. A series of weaker positive and negative linear anomalies are visible in the eastern fields which may indicate the presence of buried ridges and furrows associated with previous cultivation of the site. However, the data has highlighted extensive areas of magnetic disturbance produced by boundary fencing constructed with ferrous elements, as well as the service pipeline that extends the length of the site on a north-west/south-east

trajectory. Established structures, such as the stables located at the extreme south-western edge of the survey area, and their associated groundworks have also produced significant areas of disturbance.

In addition to the magnetic disturbance that has been recorded across the site, several dipolar magnetic spikes were recorded at random intervals across the area. The magnetic signatures of dipolar spikes are typically indicative of buried ferrous objects and/or magnetic debris of a variety of descriptions.

Conclusion

While no magnetic anomalies of likely archaeological provenance were detected over the course of the survey, the extensive areas of magnetic disturbance evident in the data may mask weaker signals that are archaeological in nature.

References

Baljkas, G, 2019, Land off B4019, Broad Blunsdon, Swindon, Wiltshire, an archaeological desk-based assessment, Thames Valley Archaeological Services report 18/219, Reading

BGS, 1974, *British Geological Survey*, 1:50 000, Sheet 252, solid and drift Edition, Keyworth

CI*f*A, 2014, 'Standard and Guidance for archaeological geophysical survey', Reading

EAC, 2015, *EAC Guidelines for the use of Geophysics in Archaeology: Questions to Ask and Points to Consider*, EAC Guidelines 2, Namur

IFA, 2002, 'The Use of Geophysical Techniques in Archaeological Evaluation', IFA Paper No. 6, Reading

NPPF, 2018, *National Planning Policy Framework*, Ministry of Housing, Communities & Local Government, London

Appendix 1. **Survey and data information**

Programme:
Name: TerraSurveyor
Version: 3.0.35.10

Main site area
Raw data
Instrument Type: MLgrad Import
Units: nT
UTM Zone: 30
Survey corner coordinates (X/Y):
Northwest corner: 414862.187827331, 190253.761092903 m
Southeast corner: 415017.407827331, 190087.751092903 m
Direction of 1st Traverse: 90 deg
Collection Method: Parallel
Sensors: 2 @ 1 m spacing.
Dummy Value: 32702

Dimensions
Survey Size (meters): 155 m x 166 m
X&Y Interval: 0.13 m
Source GPS Points: Active: 45759, Recorded: 45759

Stats
Max: 107.65
Min: -109.76
Std Dev: 32.92
Mean: -6.86
Median: 1.83
Composite Area: 2.5768 ha
Surveyed Area: 1.3969 ha

Processed data
Stats
Max: 5.72
Min: -5.30
Std Dev: 2.99
Mean: -0.20
Median: 0.02

GPS based Proce6
1 Base Layer.
2 Unit Conversion Layer (Lat/Long to UTM).
3 DeStripe Median Traverse:
4 Despike Threshold: 1 Window dia: 3
5 Clip at 1.00 SD
6 Clip from -4.80 to 5.20

Western site area
Raw data
Instrument Type: Grad 601 (Magnetometer)
Units: nT
Survey corner coordinates (X/Y):
Northwest corner: 414782.85, 190184.63 m
Southeast corner: 414922.85, 190044.63 m
Direction of 1st Traverse: 60.5616 deg
Collection Method: ZigZag
Sensors: 2 @ 1 m spacing.
Dummy Value: 2047.5

Dimensions
Survey Size (meters): 140 m x 140 m
X&Y Interval: 0.25 m

Stats
Max: 96.88
Min: -100.00
Std Dev: 28.87
Mean: -0.92
Median: 2.46
Composite Area: 1.96 ha
Surveyed Area: 0.63445 ha

Source Grids: 31
1 Col:0 Row:0 grids\30.xgd
2 Col:0 Row:1 grids\01.xgd
3 Col:0 Row:2 grids\02.xgd
4 Col:0 Row:3 grids\03.xgd
5 Col:1 Row:0 grids\31.xgd
6 Col:1 Row:1 grids\04.xgd
7 Col:1 Row:2 grids\05.xgd
8 Col:1 Row:3 grids\06.xgd
9 Col:1 Row:4 grids\07.xgd
10 Col:2 Row:1 grids\08.xgd
11 Col:2 Row:2 grids\09.xgd
12 Col:2 Row:3 grids\10.xgd
13 Col:2 Row:4 grids\11.xgd
14 Col:3 Row:0 grids\12.xgd
15 Col:3 Row:1 grids\13.xgd
16 Col:3 Row:5 grids\29.xgd
17 Col:3 Row:6 grids\28.xgd
18 Col:4 Row:0 grids\14.xgd
19 Col:4 Row:1 grids\15.xgd
20 Col:4 Row:3 grids\23.xgd
21 Col:4 Row:4 grids\22.xgd
22 Col:4 Row:5 grids\26.xgd
23 Col:4 Row:6 grids\27.xgd
24 Col:5 Row:2 grids\19.xgd
25 Col:5 Row:3 grids\20.xgd
26 Col:5 Row:4 grids\21.xgd
27 Col:5 Row:5 grids\24.xgd
28 Col:5 Row:6 grids\25.xgd
29 Col:6 Row:2 grids\16.xgd
30 Col:6 Row:3 grids\17.xgd
31 Col:6 Row:4 grids\18.xgd

Processed data
Stats
Max: 7.20
Min: -5.80
Std Dev: 4.02
Mean: 0.77
Median: 0.73

Processes: 6
1 Base Layer
2 Move (Area: Top 40, Left 240, Bottom 139, Right 559) to X -160, Y -20
3 DeStripe Median Sensors: Grids: All
4 Despike Threshold: 1 Window size: 3x3
5 Interpolate: Y Doubled.
6 Clip from -5.80 to 7.20 nT

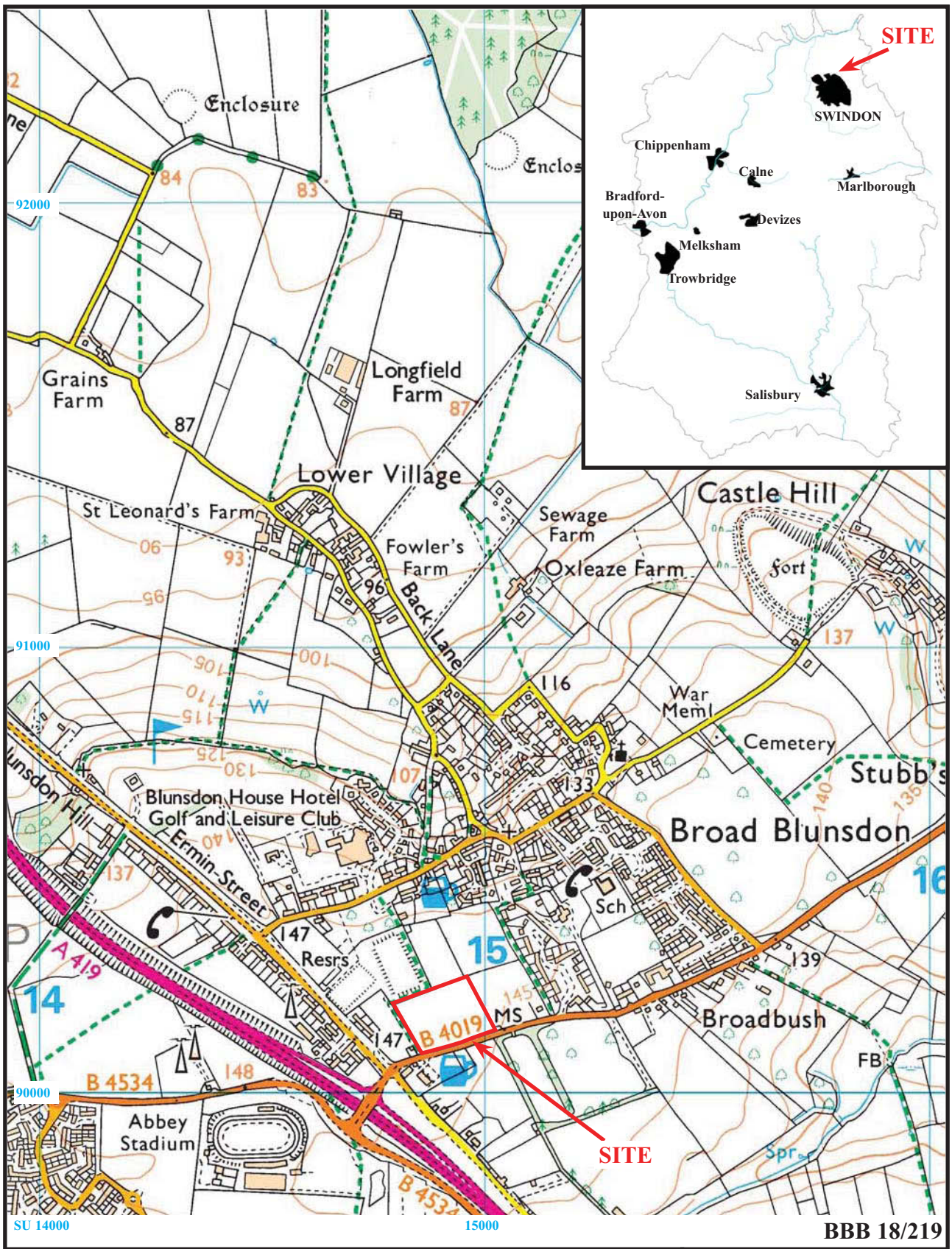

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Figure 1. Location of site within Broad Blunsdon and Wiltshire.

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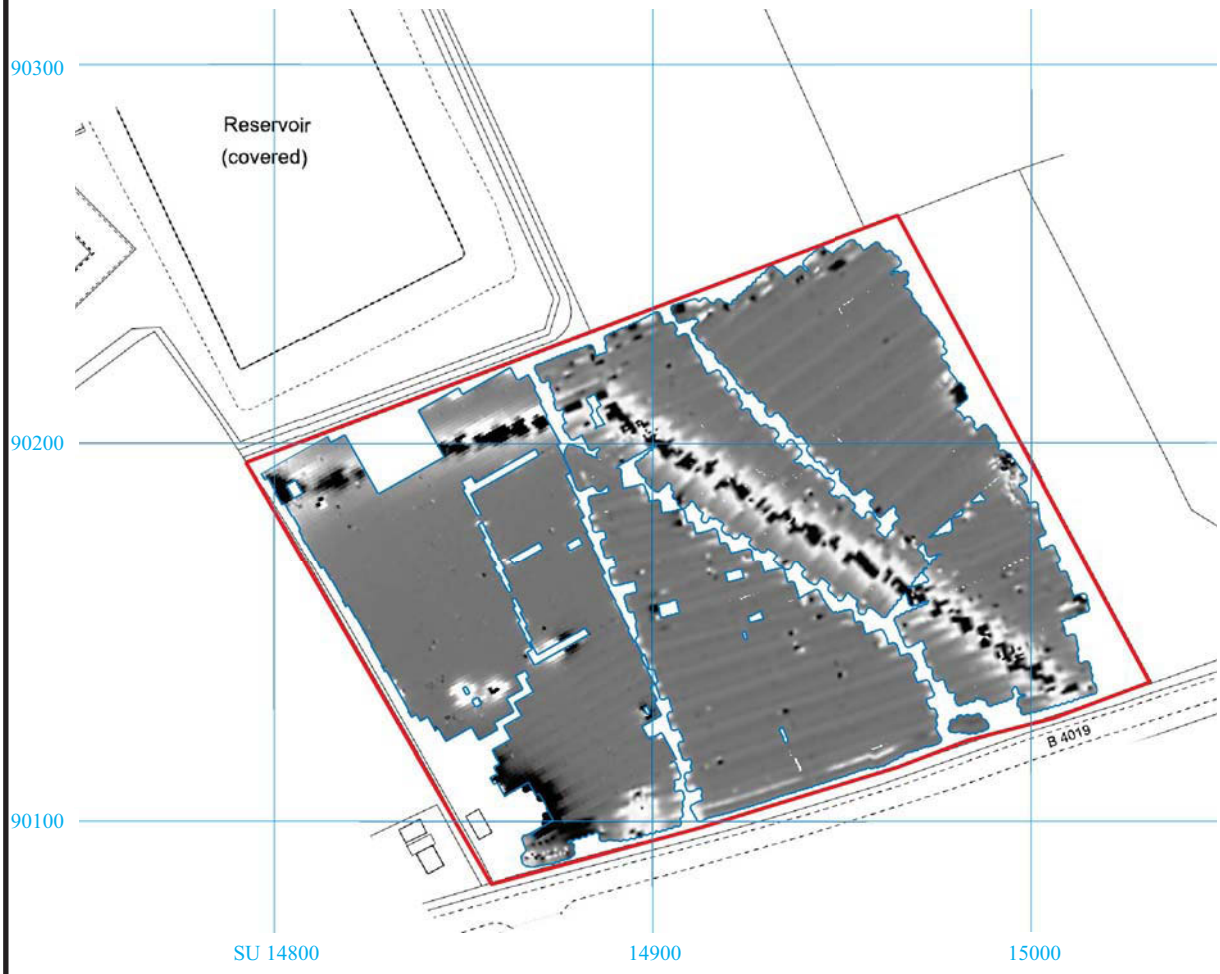

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Figure 2. Plot of raw gradiometer data.

0m 100m

+100
nT
-100

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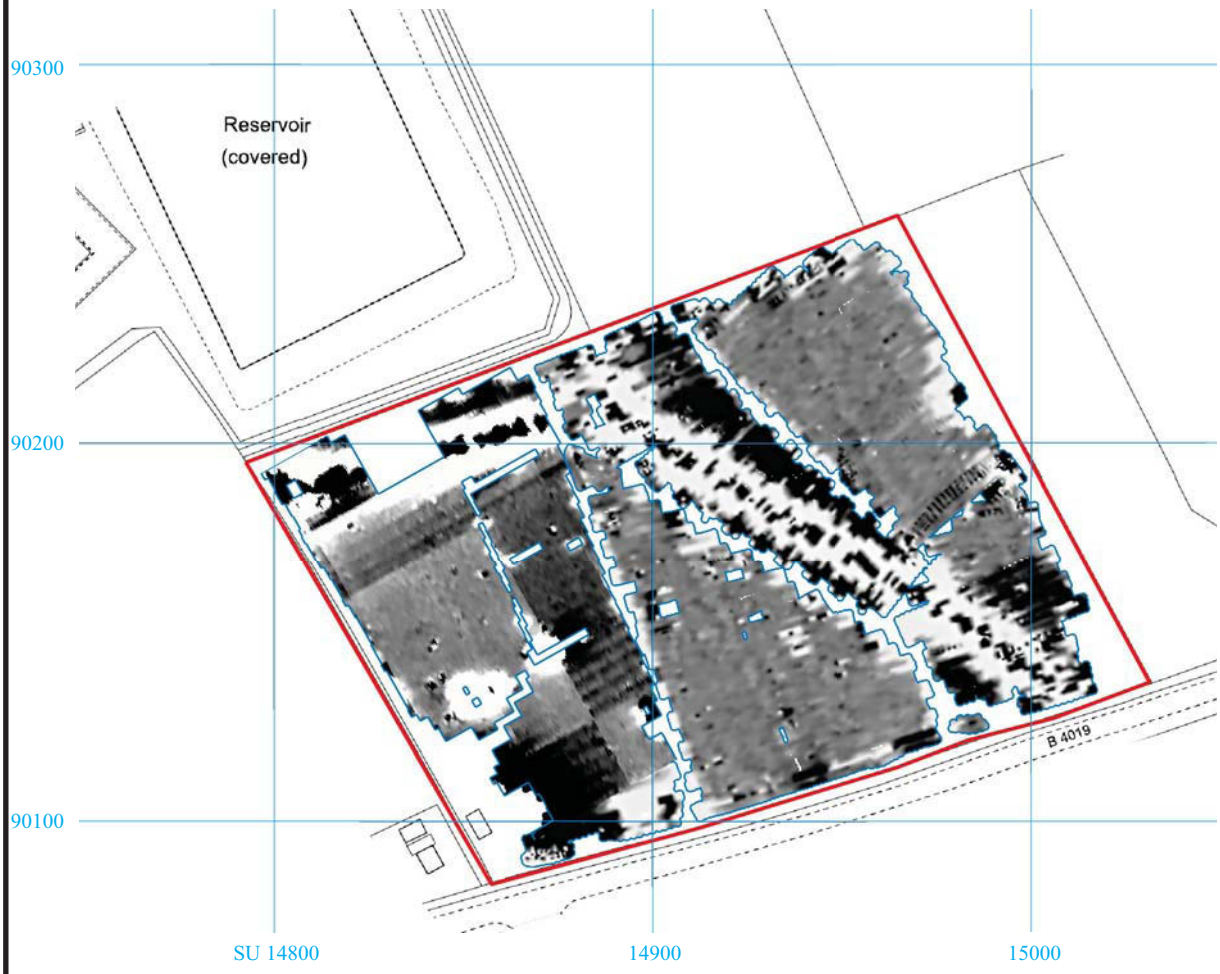

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N

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Figure 3. Plot of minimally processed gradiometer data.

0m 100m

+5.2
nT
-4.8

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Figure 4. Interpretation plot.

0m 100m

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Plate 1. Full legth of site, looking Southeast

Plate 2. Stables and associated structures, looking southeast

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Land off B4019, Broad Blunsdon,
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Plates 1 and 2.

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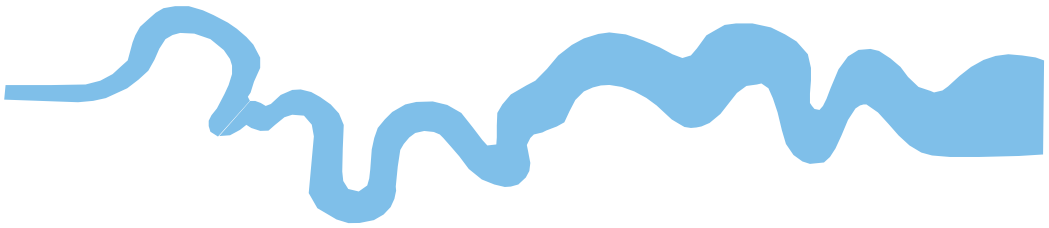
Plate 3. Access point for service pipeline, looking east

Plate 4. Show jumping paddock with associated obstacles, looking southeast

TIME CHART

	Calendar Years
Modern	AD 1901
Victorian	AD 1837
Post Medieval	AD 1500
Medieval	AD 1066
Saxon	AD 410
Roman	AD 43
	AD 0 BC
Iron Age	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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