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Land at Littleworth Road, Benson, Oxfordshire

Geophysical Survey (Magnetic)

by Kyle Beaverstock and Rebecca Constable

Site Code: LRB15/210

(SU 6120 9200)

Land at Littleworth Road, Benson, Oxfordshire

Geophysical Survey (Magnetic) Report

For R J and S Styles Limited

by Kyle Beaverstock and Rebecca Constable

Thames Valley Archaeological Services Ltd

Site Code LRB 15/210

November 2015

Summary

Site name: Land at Littleworth Road, Benson, Oxfordshire

Grid reference: SU 6120 9200

Site activity: Magnetometer survey

Date and duration of project: 12th November - 21st November 2015

Project manager: Steve Ford

Site supervisor: Kyle Beaverstock

Site code: LRB 15/210

Area of site: 24.8ha (14.1ha surveyed)

Summary of results: The survey was undertaken across the areas of the site which had not been subject to previous trenching. Several magnetic anomalies were identified but the majority of these appeared to be geological in origin with only a small number possibly relating to archaeological deposits.

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✓ 30.12.15
Andrew Mundin✓ 27.11.15

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Land at Littleworth Road, Benson, Oxfordshire
A Geophysical Survey (Magnetic)

by Kyle Beaverstock and Rebecca Constable

Report 15/210

Introduction

This report documents the results of a geophysical survey (magnetic) carried out on an irregular plot of land at Littleworth Road, Benson, Oxfordshire (SU 6120 9200) (Fig. 1). The work was commissioned by Ms Amanda Jacobs of West Waddy ADP, The Malthouse, 60 East St Helen Street, Abingdon, Oxon OX14 5EB on behalf of R J and S Styles Ltd, Loretto, Lower Way, Ewelme, Oxfordshire OX10 8HB.

Planning permission is to be sought from South Oxfordshire District Council for a housing development, which will also include ancillary works such as access roads, paths and public open spaces etc, located in two zones on the northern side of Littleworth Road. The results of the geophysical 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 fieldwork was undertaken by Peter Banks, Kyle Beaverstock and Rebecca Constable between the 21st October and the 12th November and the site code is LRB 15/210.

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

Location, topography and geology

Benson is located on the north bank of the River Thames, with Wallingford to the south and Dorchester-on-Thames to the north-west (Fig. 1). The site lies within a large arable field *c*.24.8ha in extent, with a trackway crossing it diagonally, and containing a cluster of small sheds and silos. The proposed site area is centred on NGR SU 61200 92000 on the northern outskirts of Benson. The south and south-west boundaries are formed by Littleworth Road; the west is bounded by a brook; in the north by Hale Farm; and in the east by housing and open fields.

The underlying drift geology on the site, from west to east, comprises Quaternary Alluvium, 1st (flood plain) and 2nd (Summertown-Radley) river terrace gravels. Beneath the drift geology lies the boundary between the Lower Cretaceous Upper Greensand and Gault (BGS 1980). The site slopes gently downward from east to west with the centre at a height of 47m above Ordnance Datum.

Site history and archaeological background

The archaeological potential of the site has been highlighted in a desk-based assessment prepared for the site (Preston 2008), which, in summary, stated that the general area is one of high archaeological potential for almost all periods. The village of Benson itself is of historical importance in Saxon times, and was the site of an early medieval castle presumed to be a simple ring work. There are also numerous previously recorded sites and monuments in the area surrounding Benson. Three Scheduled Monuments, comprising a Roman settlement and two Neolithic long barrows, are known to the west of the site. At RAF Benson, to the south, is a Neolithic ceremonial complex, comprising a *cursus* monument and several ring ditches. To the north is a large Iron Age/Roman site.

An archaeological evaluation was previously undertaken in the central area of the site (Weale 2010). The report for this evaluation concluded that the site has high archaeological potential. The evaluation produced numerous cut features of certain or possible archaeological interest, ranging from stake holes and post holes to ditches and a large linear feature that crossed the eastern area of the site. However, despite the large number of features, very few datable artefacts were produced. Chronologically, the finds ranged from a single struck flint of Mesolithic or Earlier Mesolithic date, to post-medieval pottery, showing a continuous occupation of the site. There was a dense concentration of archaeological features in the eastern field, where the most intensive occupation deposits were located. The western field shows a lower density of archaeological activity, with ditches also representing landscape activity. The report suggested that much of the site has archaeological potential which would require further mitigation in advance of development.

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 grids for the site were aligned along the major axis of the field, with all areas on the same grid alignment. The area which had been previously evaluated were not to be surveyed, and as such the grid was not set out in certain areas of the field. The grid was

successfully laid out across the entire site, with only the silos and small sheds as obstructions which were bypassed without difficult.

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 the fast yet detailed surveying 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 fluxgates 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 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.

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 -3.80 to 4.20 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 5×5	Compresses outlying magnetic points caused by interference of metal objects within the survey area.

Once processed, the results are presented as a greyscale plot shown in relation to the site (Fig. 3), followed by a second plan to present the abstraction and interpretation of the magnetic anomalies (Fig. 4). 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 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 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

Several magnetic anomalies were identified during the survey of the areas of the site that had not been previously evaluated (Figs. 4, 6 and 8). Only a small number however are likely to indicate the presence of buried archaeological deposits. These were all located in the northern area (Figs. 6 and 7) and, being positive in nature and linear in appearance, may represent buried ditches. The first anomaly is a 12m long section on an orientation of south-west to north-east **[Fig. 7: 1]** while the second is a pair of linear positive anomalies on the same alignment some 35m to the north-west **[2]**. The third, much weaker, anomaly **[3]** has identified another

37m to the north-west, again on the same alignment as the previous ones. A fourth weak linear positive anomaly was recorded at the northern end of the southern area of the site **[Fig. 10: 4]**.

The majority of the magnetic anomalies recorded appear to reflect variations in the site's underlying geology **[Figs. 7, 10: 5]**. These appear as water retaining patches of negative and positive anomalies primarily in the eastern half of the site area. Several strong magnetic spikes were also identified across the site, probably representing ferromagnetic debris within the topsoil and subsoil while areas of strong magnetic interference were recorded near to modern structures such as the sheds and silos in the centre of the site.

Conclusion

The survey was successfully undertaken across the areas of the site which had not been subject to previous trenching. Several magnetic anomalies were identified but the majority of these appeared to be geological in origin with only a small number possibly relating to archaeological deposits. However, due to their parallel layout, the latter may represent furrows associated with previous agricultural activity. The underlying geology does not seem particularly conducive to gaining a good contrast between the possible archaeological and geological anomalies. Areas of magnetic disturbance were also recorded near the modern buildings, which, due to their strength, may mask weaker anomalies, including those of archaeological origin, in the vicinity.

References

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English Heritage, 2008, *Geophysical Survey in Archaeological Field Evaluation*, English Heritage, Portsmouth (2nd edn)

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Preston, S, 2008, 'Land off Littleworth Road, Benson, Oxfordshire: An archaeological desk-based assessment', Thames Valley Archaeological Services report 08/31a, Reading

Weale, A, 2010, 'Land at Littleworth Road, Benson, Oxfordshire: An archaeological evaluation', Thames Valley Archaeological Services report 08/31b, Reading

Appendix 1. Survey and data information

Programme:
Name: TerraSurveyor
Version: 3.0.25.0

Raw data
Instrument Type: Bartington (Gradiometer)
Units: nT
Survey corner coordinates (X/Y):
Northwest corner: 461206.59, 191735.48 m
Southeast corner: 461786.59, 191155.48 m
Direction of 1st Traverse: 334.99 deg
Collection Method: ZigZag
Sensors: 2 @ 1.00 m spacing.
Dummy Value: 2047.5

Dimensions
Composite Size (readings): 2320 x 580
Survey Size (meters): 580 m x 580 m
Grid Size: 20 m x 20 m
X Interval: 0.25 m
Y Interval: 1 m

Stats
Max: 97.66
Min: -100.00
Std Dev: 10.86
Mean: 0.68
Median: 0.59
Composite Area: 33.64 ha
Surveyed Area: 14.107 ha

Source Grids: 408
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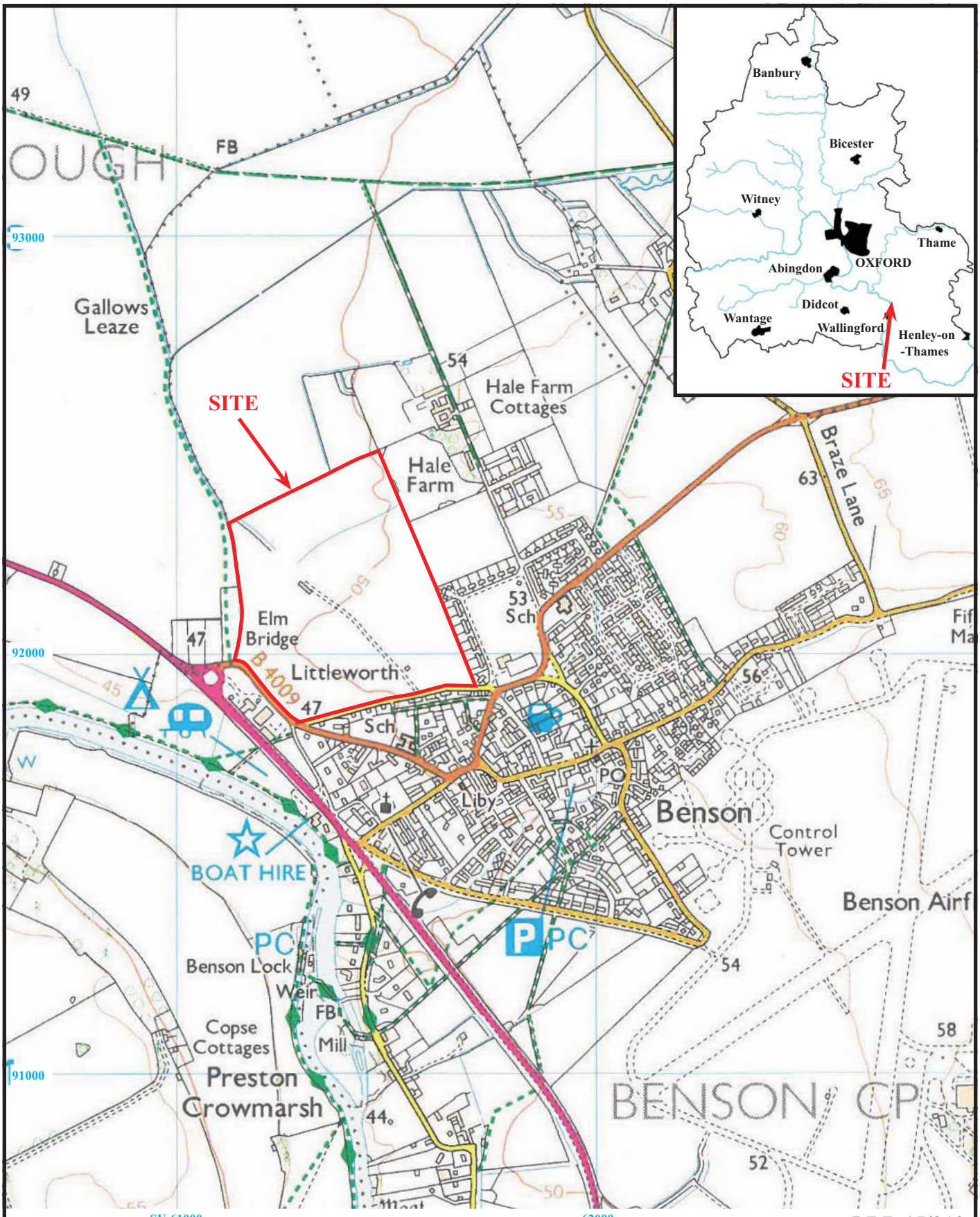

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Land at Littleworth Road, Benson, Oxfordshire, 2015
Geophysical Survey (Magnetic)

Figure 1. Location of site within Benson and Oxfordshire

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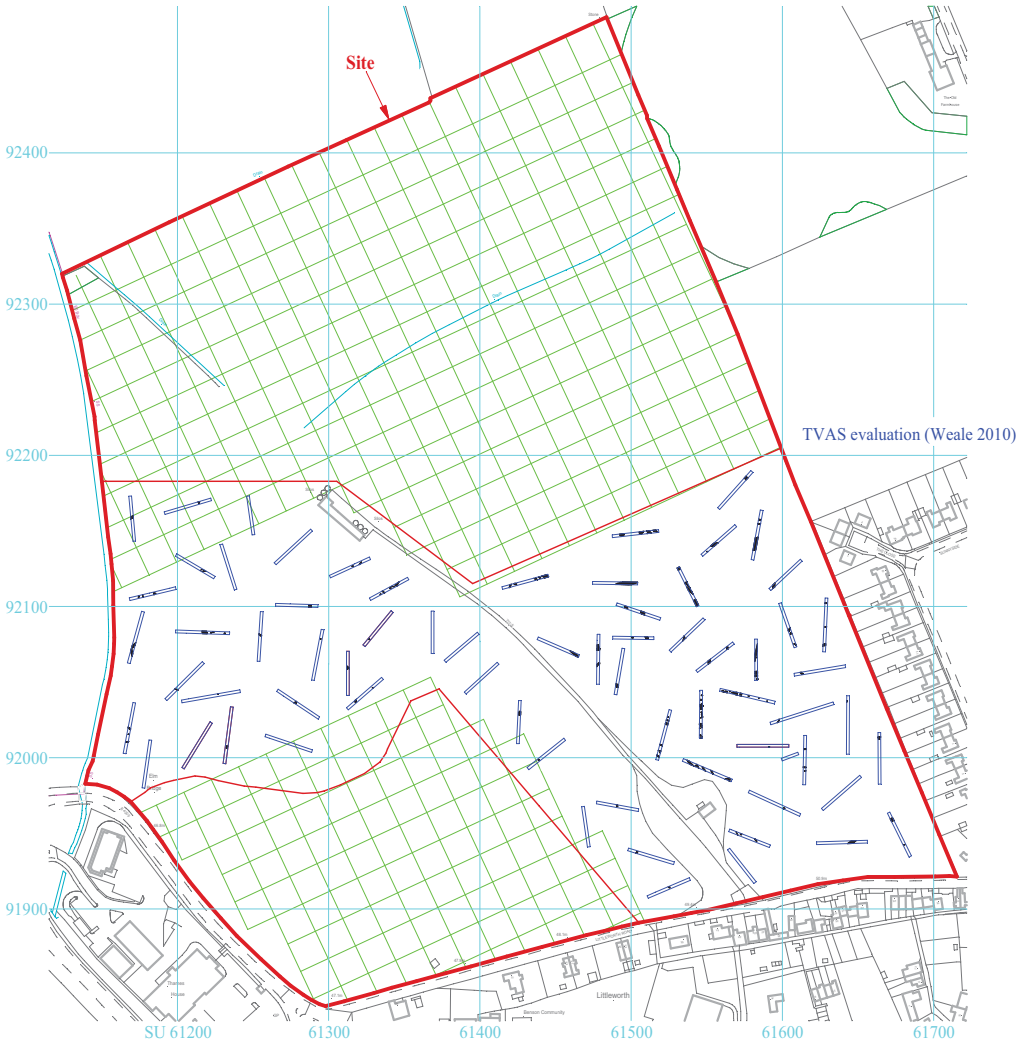

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Land at Littleworth Road, Benson, Oxfordshire, 2015 Geophysical Survey (Magnetic)

Figure 2. Survey grid layout.

0 250m

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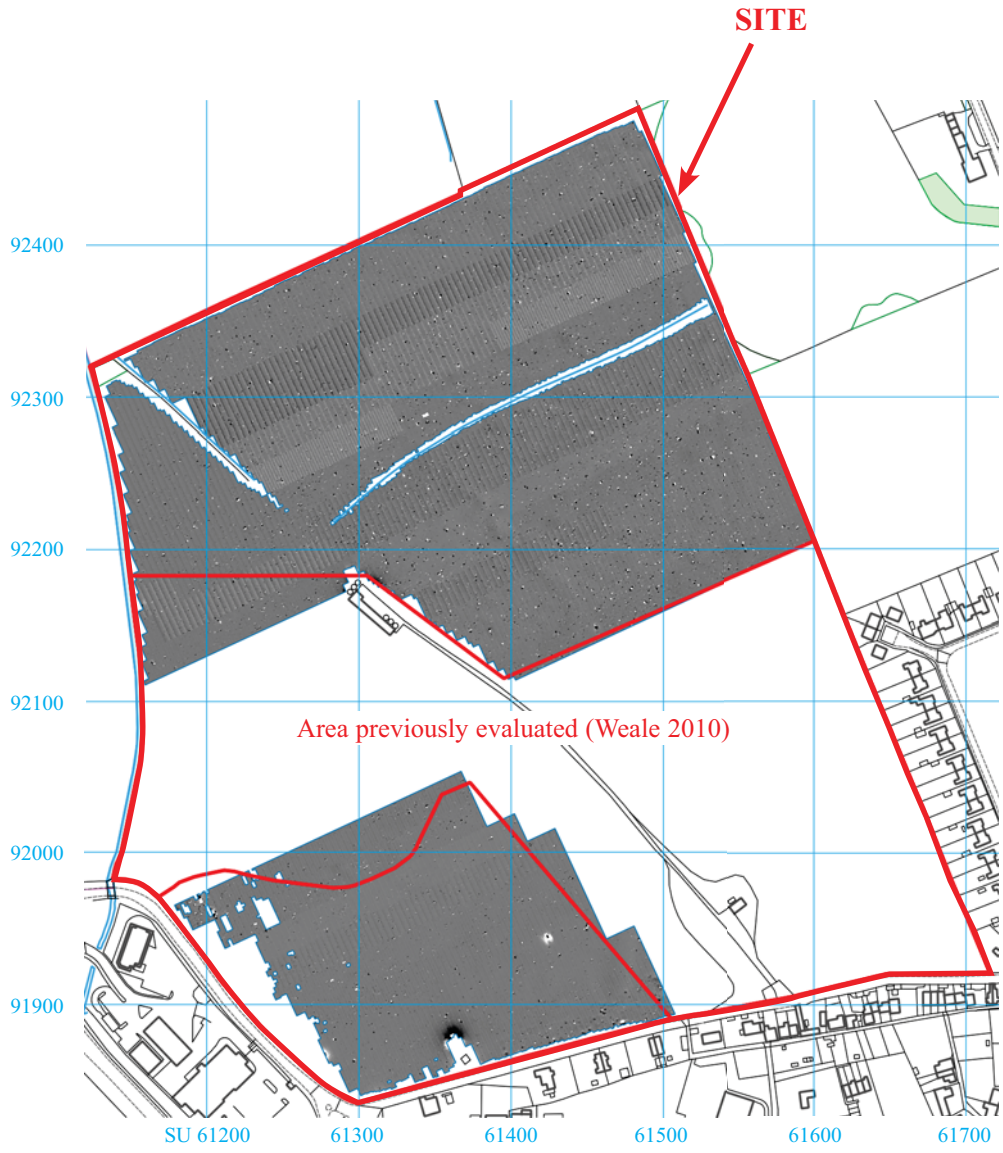

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Land at Littleworth Road, Benson, Oxfordshire, 2015
Geophysical Survey (Magnetic)

Figure 3. Plot of raw gradiometer data.

0m 250m

+100 nT

-100 nT

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Land at Littleworth Road, Benson, Oxfordshire, 2015
Geophysical Survey (Magnetic)

Figure 4. Plot of minimally processed gradiometer data.

0m 250m

+4.2 nT
-3.8 nT

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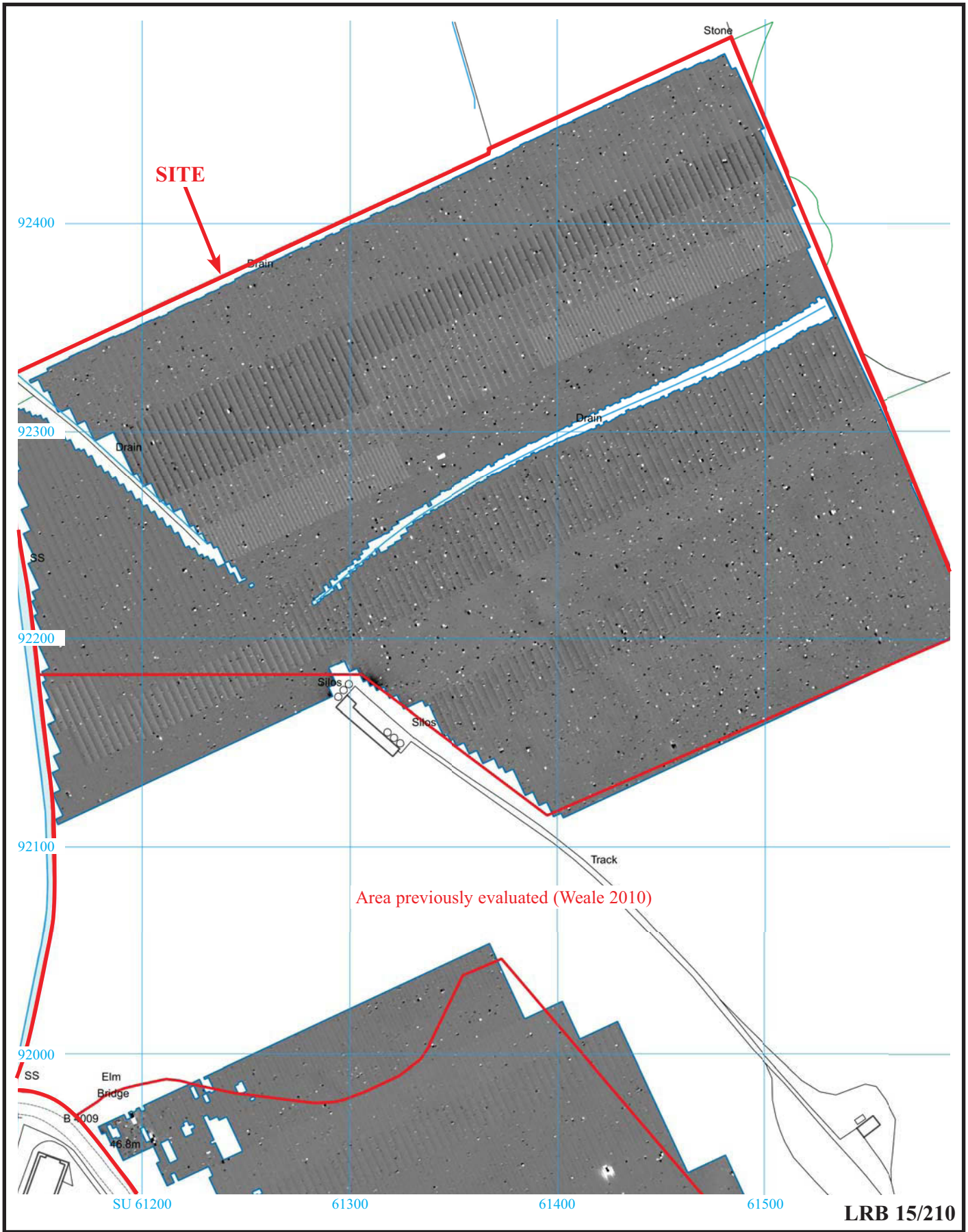

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Land at Littleworth Road, Benson, Oxfordshire, 2015
Geophysical Survey (Magnetic)

Figure 5. Plot of raw gradiometer data (north).

+100 nT

-100 nT

0m 100m

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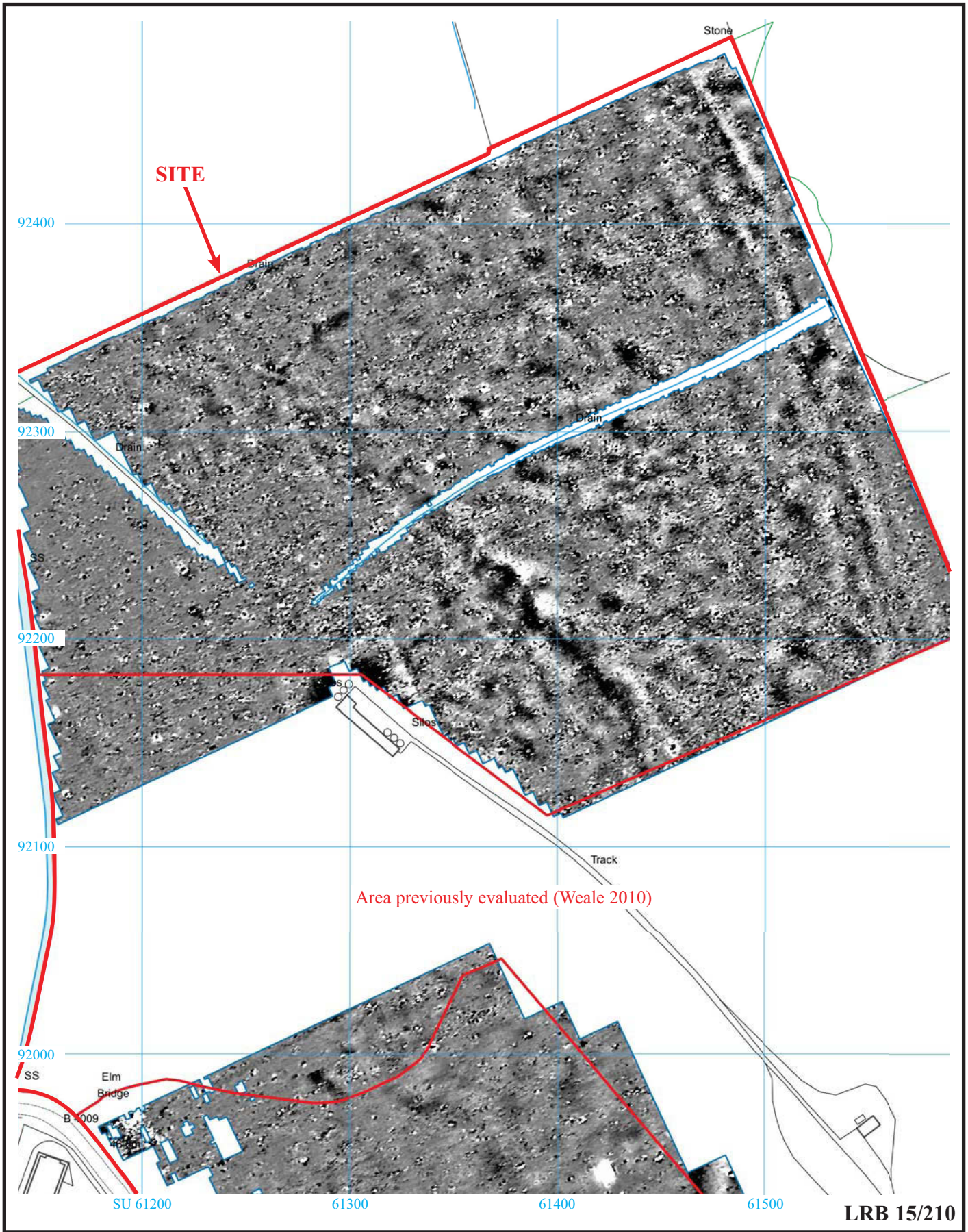

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Land at Littleworth Road, Benson, Oxfordshire, 2015
Geophysical Survey (Magnetic)

Figure 6. Plot of minimally processed gradiometer data (north).

+4.2 nT

-3.8 nT

0m 100m

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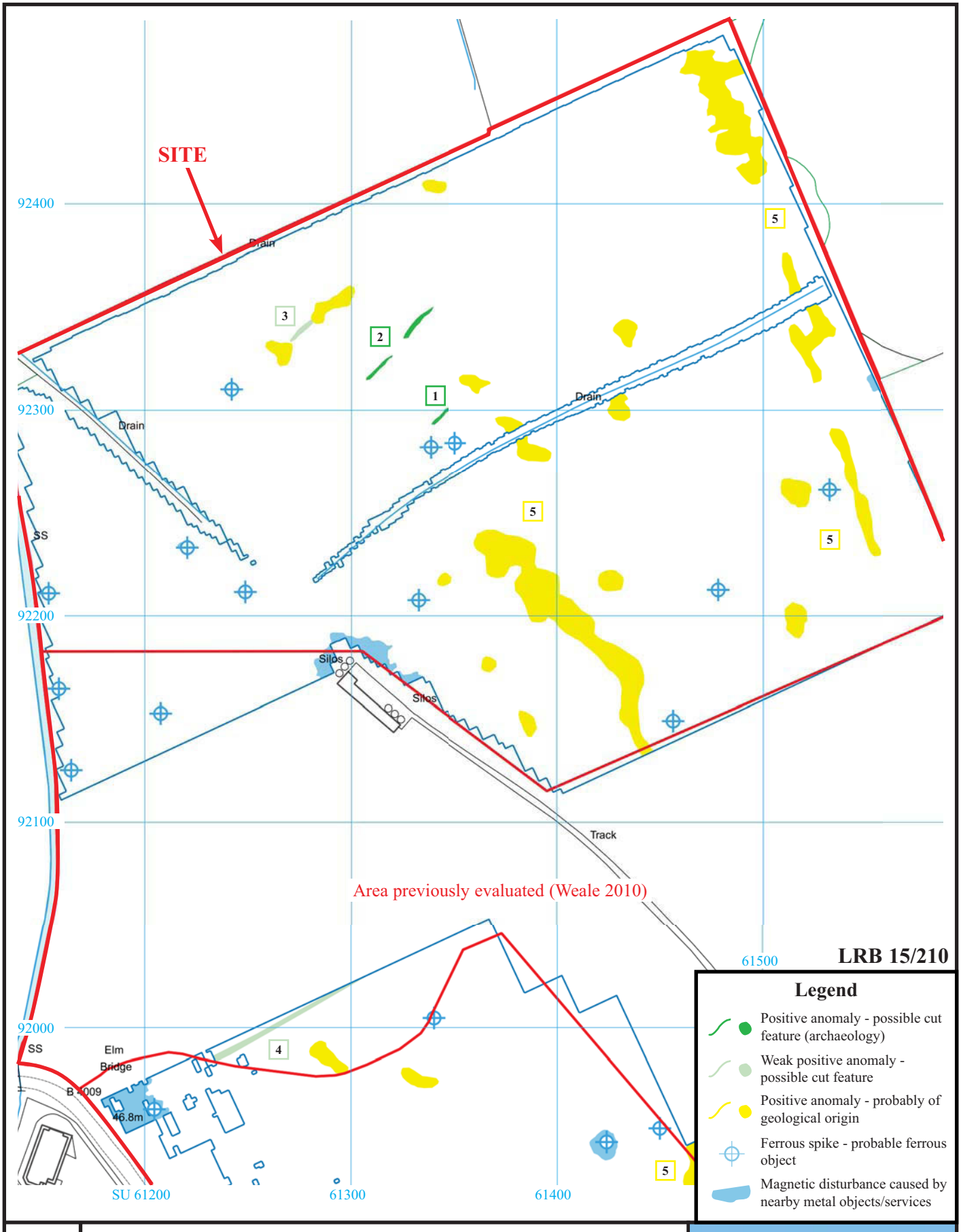

Land at Littleworth Road, Benson, Oxfordshire, 2015
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Figure 7. Interpretation plot (north).

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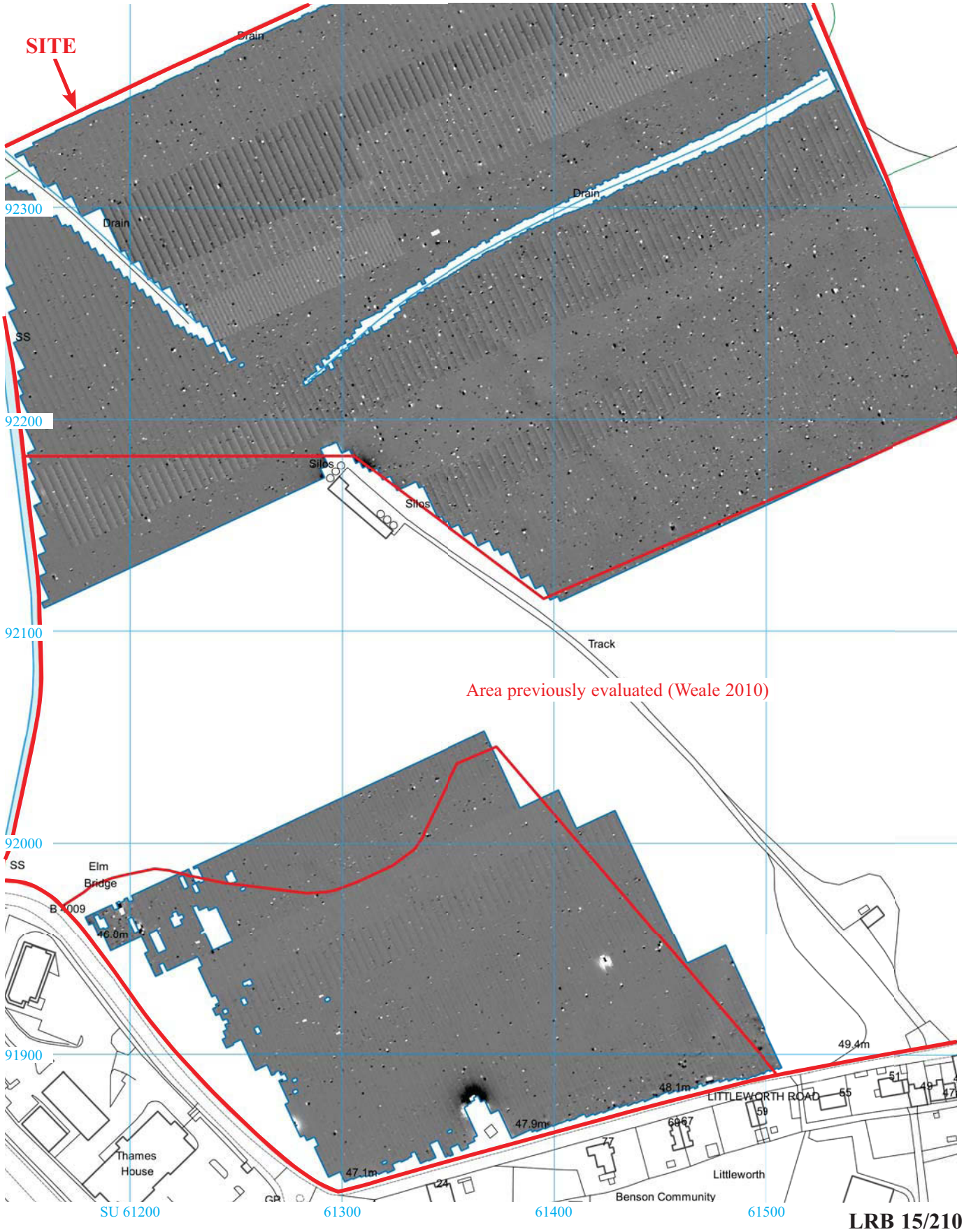

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Figure 8. Plot of raw gradiometer data (south).

+100 nT

-100 nT

0m 100m

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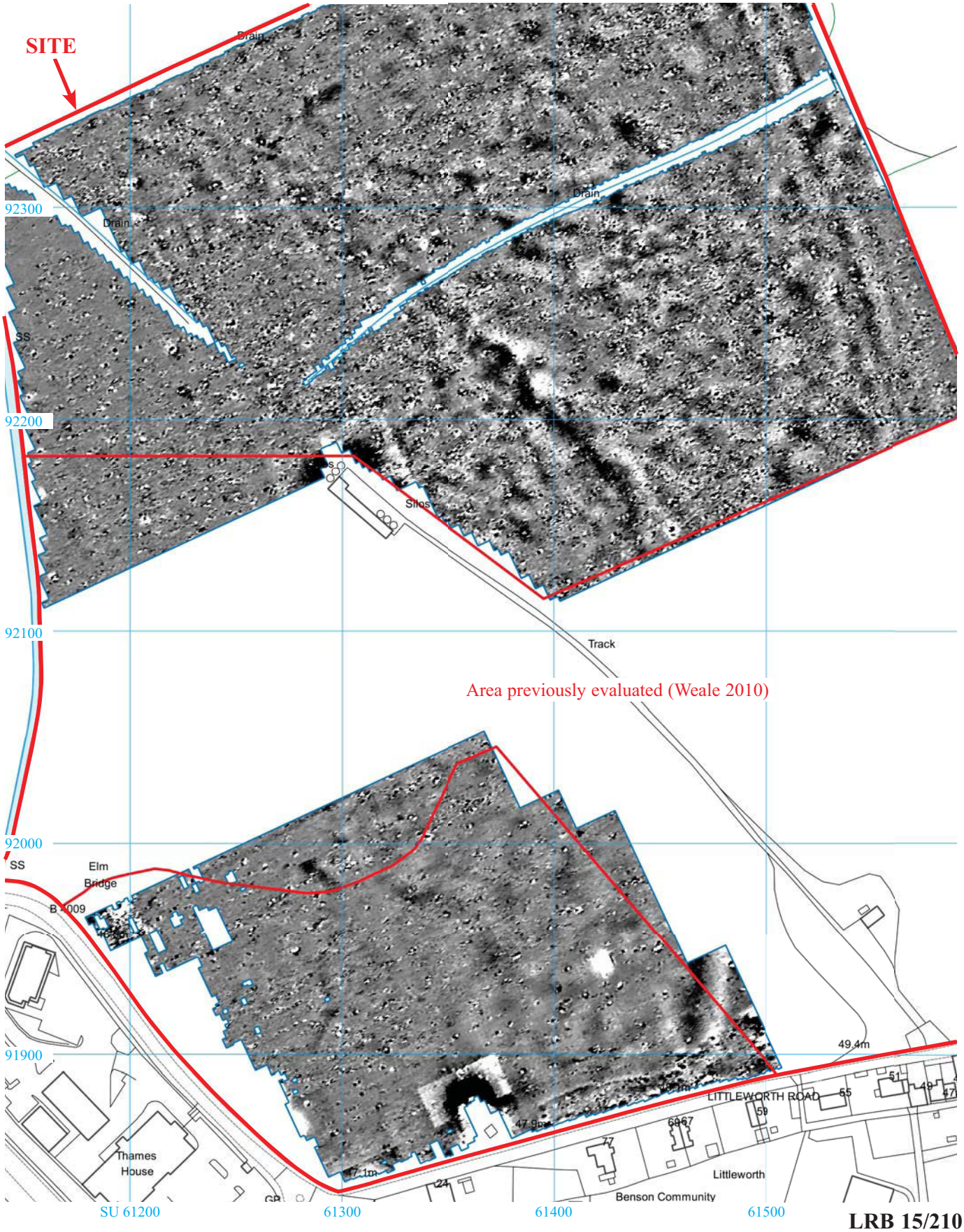

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Land at Littleworth Road, Benson, Oxfordshire, 2015
Geophysical Survey (Magnetic)

Figure 9. Plot of minimally processed gradiometer data (south).

0m 100m

+4.2 nT

-3.8 nT

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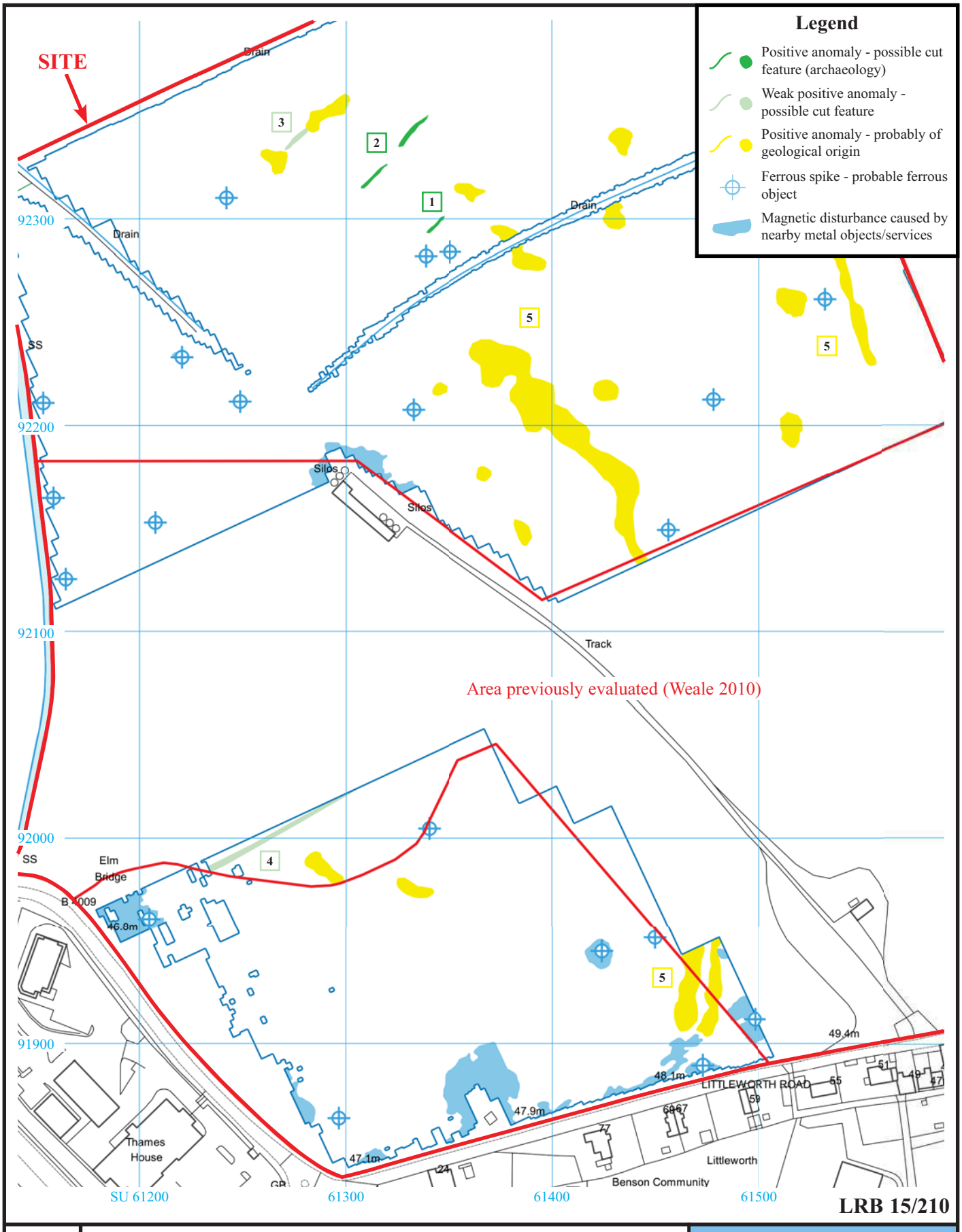

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Land at Littleworth Road, Benson, Oxfordshire, 2015
Geophysical Survey (Magnetic)
Figure 10. Interpretation plot (south).

0m 100m

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Plate 1. The northern site area, looking north-east.

Plate 2. The southern site area, looking east.

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Land at Littleworth Road, Benson,
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Geophysical Survey (Magnetic)
Plates 1 - 2.

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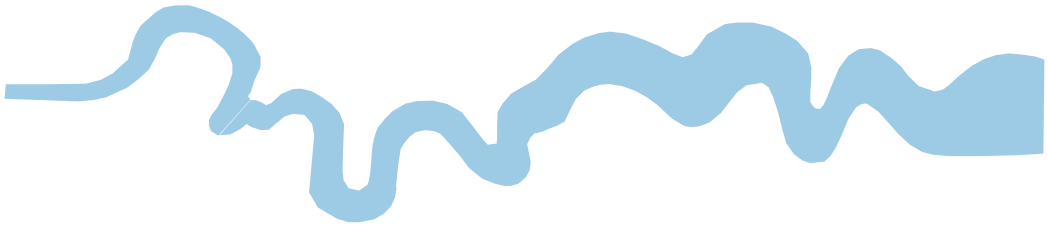
TIME CHART

	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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