WYAS Archaeological Services

Wrotham Heath Solar Farm,

Wrotham Heath,

Kent

Archaeological Evaluation

Report no. 2835
December 2015

Client: Cotswold Archaeology

Wrotham Heath Solar Farm, Wrotham Heath, Kent

Geophysical Survey

Summary

A geophysical (magnetometer) survey, covering approximately 9 hectares, was carried out on pasture and arable land to the north of Wrotham Heath, Kent between the M20 and M26 motorways. The survey was undertaken prior to the proposed development of the site. A large area of magnetic disturbance were present caused by the location of a former quarry and dumping. Anomalies corresponding to a former field division and geological variations were also noted. No anomalies of obvious archaeological potential have been identified within the survey area and consequently the archaeological potential of the site is deemed to be low.

WYAS Archaeological Services

Report Information

Client:	Cotswold Archaeology
Address:	Building 11, Kemble Enterprise Park, Kemble, Cirencester, Gloucestershire, GL7 6BQ
Report Type:	Geophysical Survey
Location:	Wrotham Heath
County:	Kent
Grid Reference:	TQ 632 588
Period(s) of activity:	Modern
Report Number:	2835
Project Number:	6273
Site Code:	WRO15
OASIS ID:	archaeol11-234111
Planning Application No.:	N/A
Museum Accession No.:	N/A
Date of fieldwork:	December 2015
Date of report:	December 2015
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	Ashely Green BS
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Photography:	Chris Sykes
Research:	N/A

Authorisation for distribution: ----------

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Contents

List of Figures

List of Plates

1 Introduction

Archaeological Services WYAS (ASWYAS) was commissioned by Cotswold Archaeology (the Client) on behalf of their clients Good Energy Development (no. 2) Limited, to undertake a geophysical (magnetometer) survey at Wrotham Heath, Kent, to inform a proposed planning application for a solar park. The work was undertaken in accordance with a Project Design (Green 2015). Guidance contained within the National Planning Policy Framework (DCLG 2012) was also followed, in line with current best practice (CIfA 2014; David *et al*. 2008). The survey was carried out between 8th and 10th December 2015, to provide additional information on the archaeological resource of the site.

Site location, topography and land-use

The Proposed Development Area (PDA) is located approximately 700m to the north of the village of Wrotham Heath and approximately 1.8km to the east of Wrotham, Kent (see Fig. 1). The site is bound to the north by the M20, to the south by the M26 and to the east by Ford Lane.

The site consists of five irregular fields, totalling approximately 18ha of which 9ha was surveyed (by a pre-defined area) and were of either arable (fallow) land or pasture. The site is at an elevation of between 70-72m above Ordnance Datum (aOD) with its highest point at 80m aOD in the northwest and is centered at TQ 632 588.

Soils and geology

The underlying geology of the survey area comprise of either the Gault Formation - a sedimentary bedrock (mudstone), or the Folkestone Formation - a sedimentary bedrock (sandstone) both formed in areas previously dominated by shallow seas (BGS 2015). No superficial deposits are recorded for the survey area. The soils of the area belong to the Fyfield 2 association (571e) - coarse loamy and sandy soil overlying sandstones (Soil Survey of England and Wales 1983).

2 Archaeological Background

A desk-based assessment produced by Cotswold Archaeology 2015 considered a minimum study area for archaeology of 1km. No designated heritage assets are recorded within the PDA; the follow information comes from this.

Just to the south of the site a Lower Palaeolithic flint flake is recorded. In 1970, approximately 300m to the east, a collection of flint implements and waste material dating from the Neolithic or early Bronze Age were found during the construction on the M26. Approximately 500m to the north lies a single round barrow.

There are no known Roman sites within the study area although the Portable Antiquities Scheme (PAS) have recorded a number of Roman finds which suggest presence in the landscape.

A single early medieval site is recorded within the study area (approximately 1km to the west of the PDA), where in 1907 and 1920 a cemetery was excavated which contained numerous inhumations complete with grave goods. A moated enclosure is located at Nepicar, to the west of the site. Only a small section of the moat remains intact, but it is likely that the moat once enclosed a high status medieval residence. A substantial and well preserved medieval tile kiln dating from the 13th or 14th centuries was excavated prior to destruction by the M26's construction in 1970. The kiln was located approximately 170m east of the PDA.

An important post-medieval settlement site is Wrotham Water, located approximately 800m to the north of the PDA. This is a Grade II Listed 16th-century farm which includes an Oast House and a large pond. A substantial ditch carries water south from the pond, which passes through the PDA (marked on Fig. 2) and feeds a mill pond situated to the west of Ford Place.

During the modern period changes within the study area were influenced by developments in the transport infrastructure, most notably, the motorway network established in the mid-20th century. In the 19th century the Severnoaks, Maidstone and Tunbridge Branch Railway was opened to the south of the site. A large sand quarry was established to the north of Ford Place in the early 20th century and expanded over the years consuming a large swath of farmland including the northeast of the PDA.

The earliest known depiction of the site is on a Tithe Map of Wrotham Parish dated to 1840. A defining feature is the straight drainage ditch running across the site from north to south which is the aforementioned ditch from Wrotham Water.

3 Aims and Methodology

The main aim of the geophysical survey was to provide sufficient information to enable an assessment to be made of the impact of the development on potential sub-surface archaeological remains and for further evaluation or mitigation proposals, if appropriate, to be recommended. To achieve this aim, a magnetometer survey covering all amenable parts of the PDA was undertaken (see Fig. 2).

The general objectives of the geophysical survey were:

- to provide information about the nature and possible interpretation of any magnetic anomalies identified;
- to therefore determine the presence/absence and extent of any buried archaeological features; and

- to prepare a report summarising the results of the survey.

Magnetometer survey

The site grid was laid out using a Trimble VRS differential Global Positioning System (Trimble 5800 model). The survey was undertaken using Bartington Grad601 magnetic gradiometers. These were employed taking readings at 0.25m intervals on zig-zag traverses 1.0m apart within 30m by 30m grids, so that 3600 readings were recorded in each grid. These readings were stored in the memory of the instrument and later downloaded to computer for processing and interpretation. Geoplot 3 (Geoscan Research) software was used to process and present the data. Further details are given in Appendix 1.

Reporting

A general site location plan, incorporating the 1:50000 Ordnance Survey (OS) mapping, is shown in Figure 1. Figure 2 displays an overview of the processed magnetometer data and Figure 3 the interpretation at a scale of 1:2500. The processed and minimally processed data, together with an interpretation of the survey results are presented in Figures 4 to 12 inclusive at a scale of 1:1250.

Technical information on the equipment used, data processing and survey methodologies are given in Appendix 1. Technical information on locating the survey area is provided in Appendix 2. Appendix 3 describes the composition and location of the archive. A copy of the OASIS form is included in Appendix 4.

The survey methodology, report and any recommendations comply with guidelines outlined by English Heritage (David *et al.* 2008) and by the Chartered Institute for Archaeologists (CIfA 2014). All figures reproduced from Ordnance Survey mapping are with the permission of the controller of Her Majesty's Stationery Office (© Crown copyright).

The figures in this report have been produced following analysis of the data in 'raw' and processed formats and over a range of different display levels. All figures are presented to most suitably display and interpret the data from this site based on the experience and knowledge of Archaeological Services staff.

4 Results and Discussion (see Figures 4-12)

Ferrous anomalies

Ferrous anomalies, as individual 'spikes', or as large discrete areas are typically caused by ferrous (magnetic) material, either on the ground surface or in the plough-soil, or the proximity of the survey area to magnetic material in boundary fences, buildings, or other above ground features. Little importance is normally given to such anomalies, unless there is any supporting evidence for an archaeological interpretation, as modern ferrous debris or

material is common on rural sites, often being present as a consequence of manuring or tipping/infilling. There is no obvious pattern or clustering to their distribution to suggest anything other than a random background scatter of ferrous debris in the plough-soil.

Field 5 is dominated by ferrous disturbance and as a former quarry was once present over part of this area, from both cartographic and photographic sources (Cotswold Archaeology, figure 6, 2015) it is likely that this is the cause. It also appears, from aerial photography that this part of the site was involved with the construction of the M20. Dumped material was also present within this area and will therefore add to the ferrous disturbance.

A large anomaly (**A**) in Field 2 denotes the location of a burnt out car; on the ground surface, an area of burning and parts of the car could be seen. Other large ferrous responses such as those at (**B**) represent the location of pylons. Ferrous disturbance along the limits of the datasets are due to metal fencing.

Geological anomalies

Anomalies in the eastern section of Field 3 have the appearance of a natural origin. It is possible that they are associated with any flooding of the ditch to the immediate east. It is equally plausible that they represent natural variations within the subsoils. Similar responses are visible in the east of Field 4.

Agricultural anomalies

A former field boundary can be seen in Field 3, this corresponds to the 1840 Tithe Map of Wrotham Parish (Cotswold Archaeology 2015) and is visible on Ordnance Survey mapping from 1870. By the 1961 map the boundary has been removed (Old-Maps 2015).

The results and subsequent interpretation of data from geophysical surveys should not be treated as an absolute representation of the underlying archaeological and non-archaeological remains. Confirmation of the presence or absence of archaeological remains can only be achieved by direct investigation of sub-surface deposits.

5 Conclusions

The magnetic survey has not detected anomalies of an archaeological origin. The majority of responses are of a ferrous origin relating to former quarrying, motorway construction, metal fencing, pylons and scatters of iron debris. A former field boundary has been identified. Responses consistent with variations in the underlying geology have also been identified. Consequently the archaeological potential of this site is deemed to be low.

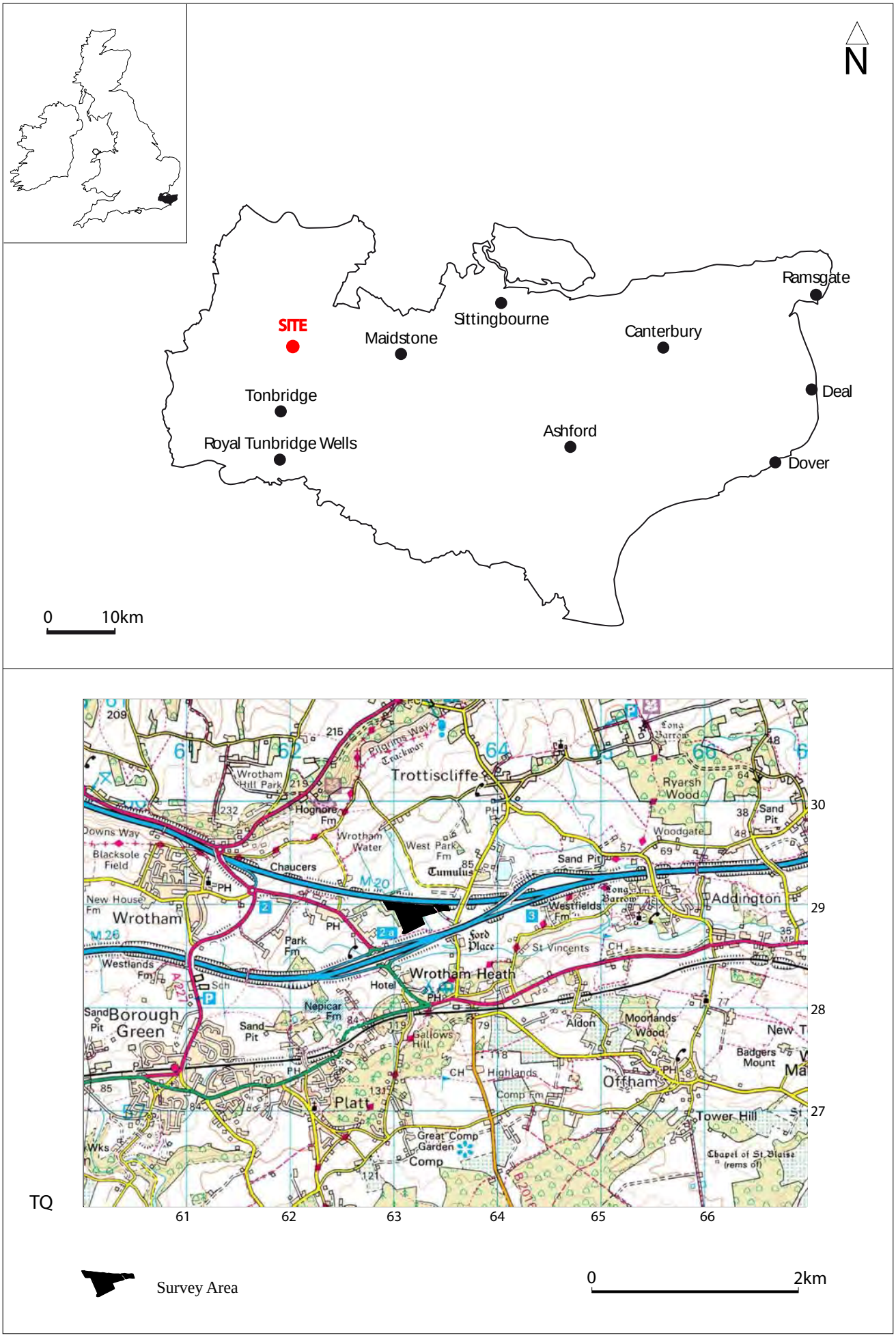

Fig. 1. Site location

SURVEY BOUNDARY

SECTOR BOUNDARY

1 LOCATION AND DIRECTION OF PLATES

N

SECTOR 1
SEE FIGS 4-6

FIELD 1

FIELD 2

FIELD 4

FIELD 5

DRAINAGE DITCH

FIELD 3

SECTOR 2
SEE FIGS 7-9

SECTOR 3
SEE FIGS 10-12

2.0
-1.0
nT

1590 00

1586 00

563 00

563 400

0 100m

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Tel: 0113 383 7500 Fax:0113 383 7501

Fig. 2. Survey overview showing greyscale magnetometer data (1:2500 @ A3)

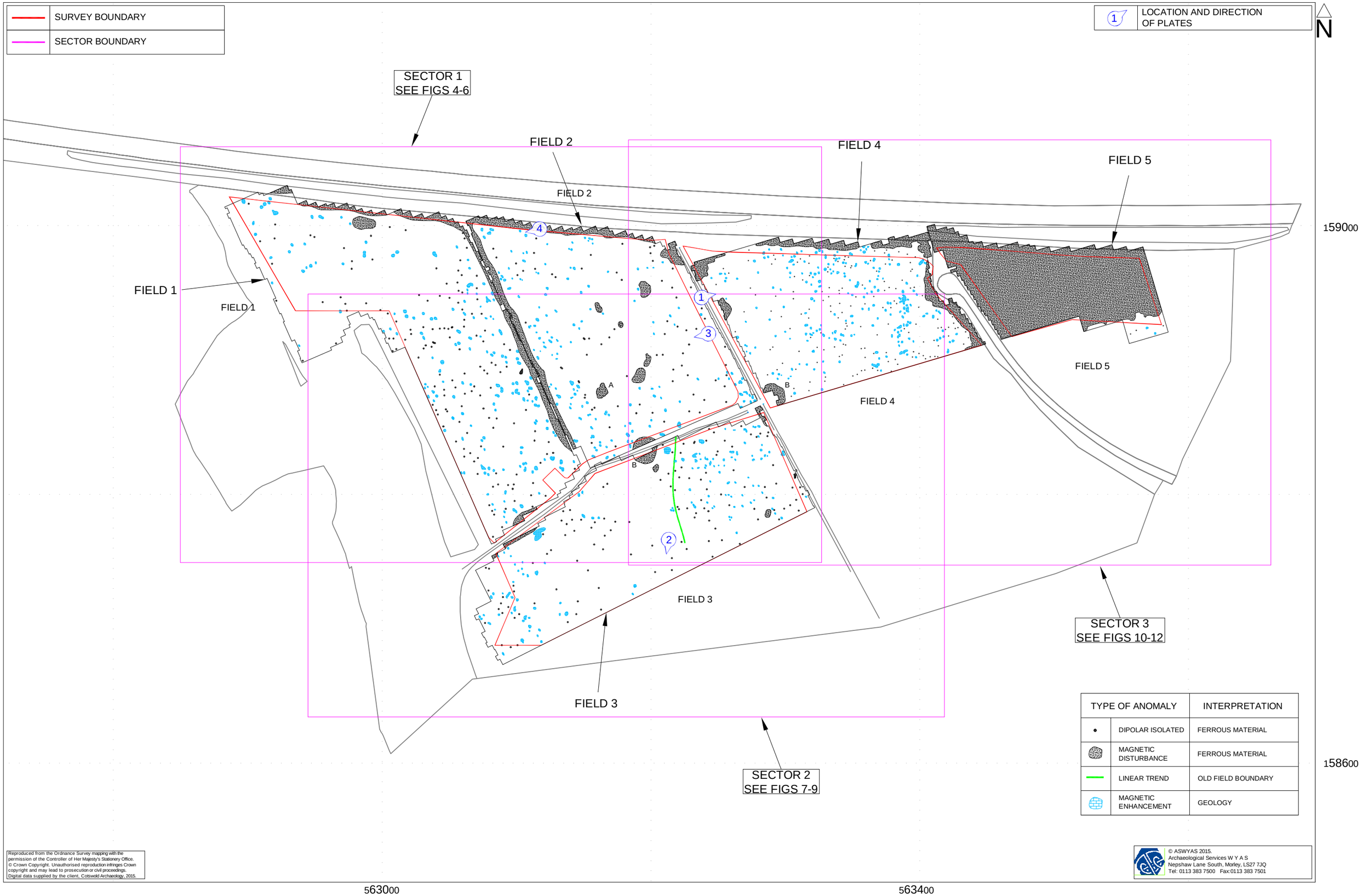

Fig. 3. Survey overview showing interpretation of magnetometer data (1:2500 @ A3)

SECTOR BOUNDARY

N

FIELD 1

FIELD 2

2.0

-1.0

nT

159000

158800

563000

563200

0 50m

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Fig. 4. Processed greyscale magnetometer data; Fields 1 and 2 (1:1250 @ A3)

SECTOR BOUNDARY

N

FIELD 1

FIELD 2

20.0 nT/cm

1590 00

1588 00

5630 00

5632 00

0 50m

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Fig. 5. XY trace plot of minimally processed magnetometer data; Fields 1 and 2 (1:1250 @ A3)

SECTOR BOUNDARY

N

FIELD 1

FIELD 2

A

A

B

B

1590 00

1588 00

5630 00

5632 00

TYPE OF ANOMALY		INTERPRETATION
•	DIPOLAR ISOLATED	FERROUS MATERIAL
	MAGNETIC DISTURBANCE	FERROUS MATERIAL
	LINEAR TREND	OLD FIELD BOUNDARY
	MAGNETIC ENHANCEMENT	GEOLOGY

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0 50m

Fig. 6. Interpretation plot of minimally processed magnetometer data; Fields 1 and 2 (1:1250 @ A3)

SECTOR BOUNDARY

N

FIELD 4

FIELD 3

2.0

-1.0

nT

158800

563000

563200

0 50m

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Nepshaw Lane South, Morley, LS27 7JQ
Tel: 0113 383 7500 Fax:0113 383 7501

Fig. 7. Processed greyscale magnetometer data; Field 3 (1:1250 @ A3)

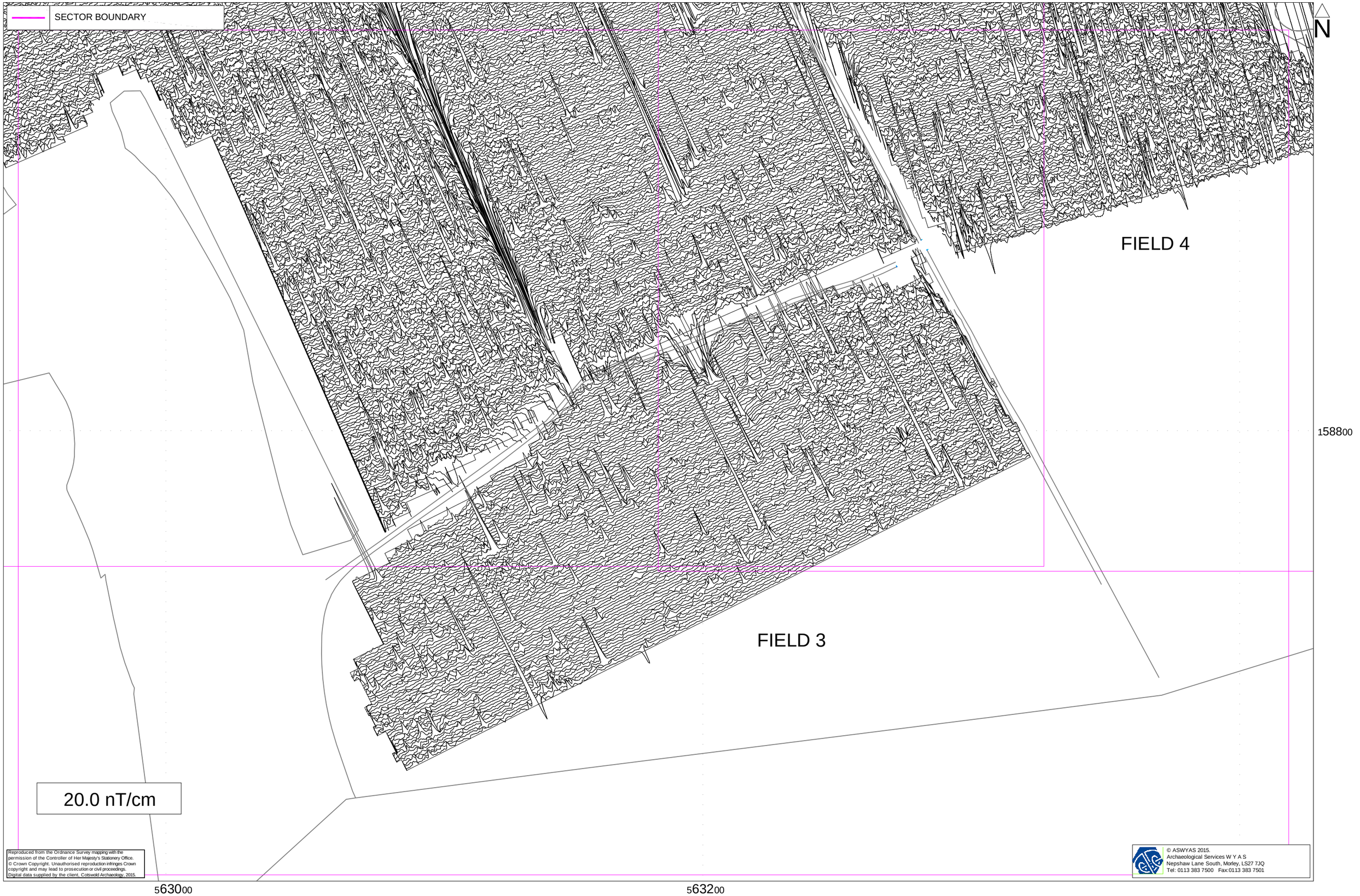

Fig. 8. XY trace plot of minimally processed magnetometer data; Field 3 (1:1250 @ A3)

SECTOR BOUNDARY

N

A

B

B

FIELD 4

FIELD 3

TYPE OF ANOMALY		INTERPRETATION
•	DIPOLAR ISOLATED	FERROUS MATERIAL
	MAGNETIC DISTURBANCE	FERROUS MATERIAL
	LINEAR TREND	OLD FIELD BOUNDARY
	MAGNETIC ENHANCEMENT	GEOLOGY

Archaeological Services W Y A S
Nepshaw Lane South, Morley, LS27 7JQ
Tel: 0113 383 7500 Fax:0113 383 7501

158800

563000

563200

0 50m

Fig. 9. Interpretation plot of minimally processed magnetometer data; Field 3 (1:1250 @ A3)

SECTOR BOUNDARY

N

FIELD 5

FIELD 4

2.0

-1.0

nT

1590 00

1588 00

5634 00

5636 00

0 50m

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Fig. 10. Processed greyscale magnetometer data; Fields 4 and 5 (1:1250 @ A3)

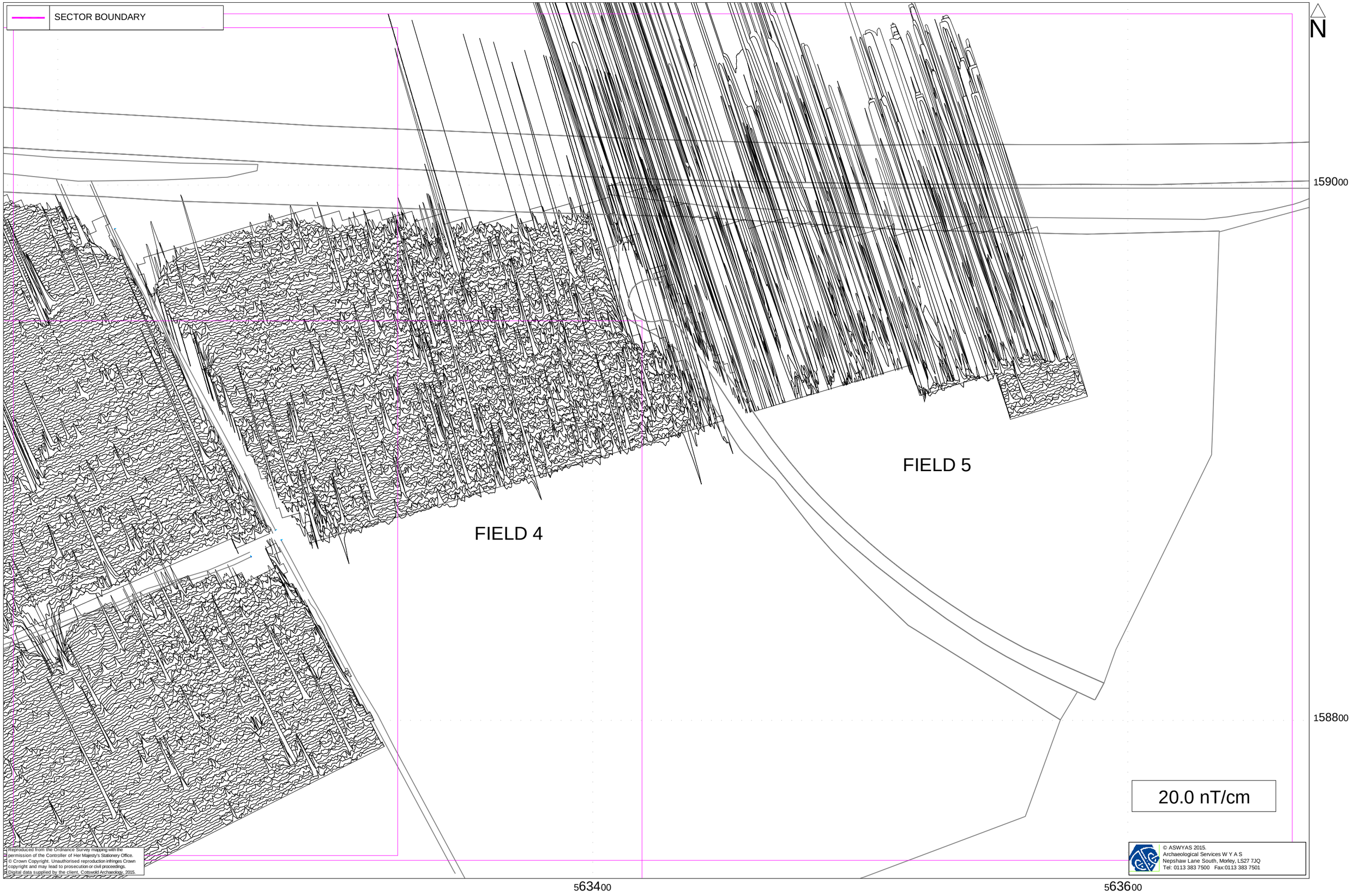

Fig. 11. XY trace plot of minimally processed magnetometer data; Fields 4 and 5 (1:1250 @ A3)

SECTOR BOUNDARY

N

FIELD 4

FIELD 5

B

B

TYPE OF ANOMALY		INTERPRETATION
•	DIPOLAR ISOLATED	FERROUS MATERIAL
	MAGNETIC DISTURBANCE	FERROUS MATERIAL
	LINEAR TREND	OLD FIELD BOUNDARY
	MAGNETIC ENHANCEMENT	GEOLOGY

Archaeological Services W Y A S
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Tel: 0113 383 7500 Fax:0113 383 7501

1590 00

1588 00

5634 00

5636 00

0 50m

Fig. 12. Interpretation plot of minimally processed magnetometer data; Fields 4 and 5 (1:1250 @ A3)

Plate 1. General view of Areas 4 and 5, looking east

Plate 2. General view of Area 3, looking south-west

Plate 3. General view of Areas 1 and 2, looking west

Plate 4. General view of Areas 1 and 2, looking west

Appendix 1: Magnetic survey - technical information

Magnetic Susceptibility and Soil Magnetism

Iron makes up about 6% of the Earth's crust and is mostly present in soils and rocks as minerals such as maghaemite and haemetite. These minerals have a weak, measurable magnetic property termed magnetic susceptibility. Human activities can redistribute these minerals and change (enhance) others into more magnetic forms. Areas of human occupation or settlement can then be identified by measuring the magnetic susceptibility of the topsoil because of the attendant increase (enhancement) in magnetic susceptibility. If the enhanced material subsequently comes to fill features, such as ditches or pits, localised isolated and linear magnetic anomalies can result whose presence can be detected by a magnetometer (fluxgate gradiometer).

In general, it is the contrast between the magnetic susceptibility of deposits filling cut features, such as ditches or pits, and the magnetic susceptibility of topsoils, subsoils and rocks into which these features have been cut, which causes the most recognisable responses. This is primarily because there is a tendency for magnetic ferrous compounds to become concentrated in the topsoil, thereby making it more magnetic than the subsoil or the bedrock. Linear features cut into the subsoil or geology, such as ditches, that have been silted up or have been backfilled with topsoil will therefore usually produce a positive magnetic response relative to the background soil levels. Discrete feature, such as pits, can also be detected. The magnetic susceptibility of a soil can also be enhanced by the application of heat and the fermentation and bacterial effects associated with rubbish decomposition. The area of enhancement is usually quite large, mainly due to the tendency of discard areas to extend beyond the limit of the occupation site itself, and spreading by the plough.

Types of Magnetic Anomaly

In the majority of instances anomalies are termed 'positive'. This means that they have a positive magnetic value relative to the magnetic background on any given site. However some features can manifest themselves as 'negative' anomalies that, conversely, means that the response is negative relative to the mean magnetic background.

It should be noted that anomalies interpreted as modern in origin might be caused by features that are present in the topsoil or upper layers of the subsoil. Removal of soil to an archaeological or natural layer can therefore remove the feature causing the anomaly.

The types of response mentioned above can be divided into five main categories that are used in the graphical interpretation of the magnetic data:

Isolated dipolar anomalies (iron spikes)

These responses are typically caused by ferrous material either on the surface or in the topsoil. They cause a rapid variation in the magnetic response giving a characteristic 'spiky' trace. Although ferrous archaeological artefacts could produce this type of response, unless

there is supporting evidence for an archaeological interpretation, little emphasis is normally given to such anomalies, as modern ferrous objects are common on rural sites, often being present as a consequence of manuring.

Areas of magnetic disturbance

These responses can have several causes often being associated with burnt material, such as slag waste or brick rubble or other strongly magnetised/fired material. Ferrous structures such as pylons, mesh or barbed wire fencing and buried pipes can also cause the same disturbed response. A modern origin is usually assumed unless there is other supporting information.

Linear trend

This is usually a weak or broad linear anomaly of unknown cause or date. These anomalies are often caused by agricultural activity, either ploughing or land drains being a common cause.

Areas of magnetic enhancement/positive isolated anomalies

Areas of enhanced response are characterised by a general increase in the magnetic background over a localised area whilst discrete anomalies are manifest by an increased response on two or three successive traverses. In neither instance is there the intense dipolar response characteristic exhibited by an area of magnetic disturbance or of an 'iron spike' anomaly (see above). These anomalies can be caused by infilled discrete archaeological features such as pits or post-holes or by kilns. They can also be caused by pedological variations or by natural infilled features on certain geologies. Ferrous material in the subsoil can also give a similar response. It can often therefore be very difficult to establish an anthropogenic origin without intrusive investigation or other supporting information.

Linear and curvilinear anomalies

Such anomalies have a variety of origins. They may be caused by agricultural practice (recent ploughing trends, earlier ridge and furrow regimes or land drains), natural geomorphological features such as palaeochannels or by infilled archaeological ditches.

Methodology: Gradiometer Survey

The main method of using the fluxgate gradiometer for commercial evaluations is referred to as ***detailed survey*** and requires the surveyor to walk at an even pace carrying the instrument within a grid system. A sample trigger automatically takes readings at predetermined points, typically at 0.25m intervals, on traverses 1m apart. These readings are stored in the memory of the instrument and are later dumped to computer for processing and interpretation.

During this survey a Bartington Grad601 magnetic gradiometer was used taking readings on the 0.1nT range, at 0.25m intervals on zig-zag traverses 0.5m apart within 30m by 30m square grids. The instrument was checked for electronic and mechanical drift at a common point and calibrated as necessary. The drift from zero was not logged.

The gradiometer data have been presented in this report in processed greyscale format. The data in the greyscale images have been interpolated and selectively filtered to remove the effects of drift in instrument calibration and other artificial data constructs and to maximise the clarity and interpretability of the archaeological anomalies.

The results and subsequent interpretation of data from geophysical surveys should not be treated as an absolute representation of the underlying archaeological and non-archaeological remains. Confirmation of the presence or absence of archaeological remains can only be achieved by direct investigation of sub-surface deposits

Appendix 2: Survey location information

An initial survey station was established using a Trimble VRS differential Global Positioning System (Trimble R6 model). The data were geo-referenced using the geo-referenced survey station with a Trimble RTK differential Global Positioning System (Trimble R6 model). The accuracy of this equipment is better then 0.01m. The survey grids were then super-imposed onto a base map provided by the client to produce the displayed block locations. However, it should be noted that Ordnance Survey positional accuracy for digital map data has an error of 0.5m for urban and floodplain areas, 1.0m for rural areas and 2.5m for mountain and moorland areas. This potential error must be considered if co-ordinates are measured off hard copies of the mapping rather than using the digital co-ordinates.

Archaeological Services WYAS cannot accept responsibility for errors of fact or opinion resulting from data supplied by a third party.

Appendix 3: Geophysical archive

The geophysical archive comprises:-

- an archive disk containing compressed (WinZip 8) files of the raw data, report text (Microsoft Word 2000), and graphics files (Adobe Illustrator CS2 and AutoCAD 2008) files; and
- a full copy of the report.

At present the archive is held by Archaeological Services WYAS although it is anticipated that it may eventually be lodged with the Archaeology Data Service (ADS). Brief details may also be forwarded for inclusion on the English Heritage Geophysical Survey Database after the contents of the report are deemed to be in the public domain (i.e. available for consultation in the Kent Environment Record).

Appendix 4: OASIS form

OASIS DATA COLLECTION FORM: England

Printable version

OASIS ID: archaeol11-234111

Project details

Project name	Wrotham Heath Solar Park, Wrotham Heath, Kent
Short description of the project	A geophysical (magnetometer) survey, covering approximately 9 hectares, was carried out on pasture and arable land to the north of Wrotham Heath, Kent between the M20 and M26 motorways. The survey was undertaken prior to the proposed development of the site. A large area of magnetic disturbance were present caused by the location of a former quarry and dumping. Anomalies corresponding to a former field division, geological variations and field drains were also noted. No anomalies of obvious archaeological potential have been identified within the survey area and consequently the archaeological potential of the site is deemed to be low.
Project dates	Start: 08-12-2015 End: 10-12-2015
Previous/future work	No / Not known
Any associated project reference codes	6273 - Sitecode
Type of project	Field evaluation
Current Land use	Cultivated Land 2 - Operations to a depth less than 0.25m
Monument type	FIELD BOUNDARY Post Medieval
Significant Finds	FIELD BOUNDARY Post Medieval
Methods & techniques	"Geophysical Survey"
Development type	Solar park
Prompt	National Planning Policy Framework - NPPF
Position in the planning process	Not known / Not recorded
Solid geology	LOWER GREENSAND
Drift geology	SAND AND GRAVEL OF UNCERTAIN AGE OR ORIGIN
Techniques	Magnetometry

Project location

Country	England
Site location	KENT TONBRIDGE AND MALLING WROTHAM Wrotham Heath Solar Park, Wrotham Heath
Study area	9 Hectares

Site coordinates	TQ 632 588 51.304348216405 0.341512251925 51 18 15 N 000 20 29 E Point
Height OD / Depth	Min: 70m Max: 80m

Project creators

Name of Organisation	Archaeological Services WYAS
Project brief originator	Cotswold Archaeology
Project design originator	Cotswold Archaeology
Project director/manager	C. Sykes
Project supervisor	B Goulding

Project archives

Physical Archive Exists?	No
Digital Archive recipient	Cotswold Archaeology
Digital Contents	"Survey"
Digital Media available	"Geophysics","Images raster / digital photography","Text"
Paper Archive Exists?	No

Project bibliography 1

Publication type	Grey literature (unpublished document/manuscript)
Title	Wrotham Heath Solar Farm, Wrotham Heath, Kent
Author(s)/Editor(s)	Brunning, E
Date	2015
Issuer or publisher	ASWYAS
Place of issue or publication	Leeds
Description	A4 report with A3 figures

Entered by	Emma Brunning (Emma.Brunning@aswyas.com)
Entered on	11 December 2015

OASIS:

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