GEOPHYSICAL SURVEY REPORT

South of Station Road, Cowfold, West Sussex

Client

RPS Consulting Services

Survey Report

01259

Date

November 2020

Survey Report 01259: South of Station Road, Cowfold, West Sussex

Survey dates	12 November 2020
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2. SURVEY TECHNIQUE

Detailed magnetic survey (magnetometry) was chosen as the most efficient and effective method of locating the type of archaeological anomalies which might be expected at this site.

Bartington Grad 601-2 Traverse Interval 1.0m Sample Interval 0.25m

3 SUMMARY OF RESULTS

3.1 A detailed magnetometer survey was conducted over two parcels of land to the south of Station Road, Cowfold, West Sussex. A series of possible kilns, potentially linked to the presumed pottery making industry in the vicinity, have been detected in the results, along with a series of divisions associated with former allotment gardens. A few linear trends of uncertain origin have also been mapped, along with a former footpath / track and evidence for ridge and furrow.

4 INTRODUCTION

4.1 **SUMO Geophysics Ltd** were commissioned to undertake a geophysical survey of an area outlined for development. This survey forms part of an archaeological investigation being undertaken by **RPS Consulting Services**.

4.2 Site details

NGR / Postcode	TQ 210 228 / RH13 8DB
Location	The site is located to the west of Cowfold, West Sussex. Station Road forms the northern boundary of the site, with St Peters Church of England Primary School to the east, a wooded copse to the south and south-west and agricultural land to the north-west.
HER	West Sussex
District	Horsham
Parish	Cowfold CP
Topography	Mostly flat
Current Land Use	Pasture
Geology (BGS 2020)	Solid: Horsham Stone Member - sandstone is recorded across the north of the site, with Weald Clay Formation - mudstone across the south. Superficial: none recorded.
Soils (CU 2020)	Soilscape 18: slowly permeable seasonally wet slightly acid but base-rich loamy and clayey soils.
Archaeology (RPS 2020)	There is no evidence for prehistoric or Roman remains within the site or wider area. Cowfold itself is first documented in 1232, and the survey area lies within an Archaeological Notification Area as defined by West Sussex Historic Environment Record, which is associated with a medieval or post-medieval pottery industry. A number of field names within immediate vicinity of the site, such as 'Potter's Field', 'Potter's Barn' and 'Potter's Mead' are noted on the HER, suggesting the presence of medieval or post-medieval pottery kilns (HER Ref. MWS7815, MWS7816, MWS7817, MWS7818).
Survey Methods	Magnetometer survey (fluxgate gradiometer)
Study Area	*c.* 3.8 ha

4.3 **Aims and Objectives**

To locate and characterise any anomalies of possible archaeological interest within the study area.

5 RESULTS

The survey has been divided into two survey areas (Areas 1-2) and specific anomalies have been given numerical labels [1] [2] *which appear in the text below, as well as on the Interpretation Figure(s).*

5.1 *Probable / Possible Archaeology*

5.1.1 No magnetic responses have been recorded that could be interpreted as being of definite archaeological interest beyond the areas of possible kilns – see below.

5.2 *Possible Kilns*

5.2.1 A series of discrete, thermoremanent type responses [1] have been identified in the south-west of Area 2. Given their proximity to the possible medieval or post-medieval pottery making centre, and the fact that they lie immediately north of a former brick field (Fig. 03 it seems likely that they are associated with former kilns and waster heaps. However, their close proximity to the former allotment gardens (5.4.1 below) to the north might imply an alternative explanation.

5.3 *Uncertain*

5.3.1 An area of slightly enhanced readings and a series of tentative linear and curvilinear trends [2] have been mapped at the south of Area 1 and have an undetermined provenance. They could have an archaeological explanation, though such an interpretation is tentative at best; they are thought more likely to be associated with an extension of the allotments or have other agricultural origins.

5.4 *Agricultural – Ridge and Furrow / Allotments*

5.4.1 A series of linear anomalies and areas of magnetic disturbance [3] can be seen in the north of Area 2. The responses are situated within former allotment gardens (Fig. 03), visible as such on historic Ordnance Survey maps, with the linear anomalies being indicative of the divisions defining individual allotment plots.

5.4.2 Widely spaced, slightly curved, parallel linear anomalies are present across the south of both Areas 1 and 2. They are indicative of former ridge and furrow cultivation.

5.5 *Former Footpath / Track*

5.5.1 Two closely spaced parallel linear anomalies [4] have been identified running approximately north-south in the west of Area 1. These correspond with the location of a former footpath or track, visible on historic maps (Fig. 03) of the site.

5.6 *Ferrous / Magnetic Disturbance*

5.6.1 Ferrous responses close to boundaries are due to adjacent fences and gates. Smaller scale ferrous anomalies ("iron spikes") are present throughout the data and are characteristic of small pieces of ferrous debris (or brick / tile) in the topsoil; they are commonly assigned a modern origin. Only the most prominent of these are highlighted on the interpretation diagram.

6 DATA APPRAISAL & CONFIDENCE ASSESSMENT

6.1 Historic England guidelines (EH 2008) Table 4 states that the typical magnetic response on the local soils / geology is generally good. The results from this survey indicate the presence of former allotment features and possible kilns. As a consequence, the technique is deemed to have been effective.

7 CONCLUSION

7.1 The survey on land south of Station Road, Cowfold has not identified any anomalies of definite archaeological interest, however possible thermoremanent anomalies in the south of the area may be associated with former kilns; it is likely that they are linked to the pottery or brick-making industries known within the vicinity. A few weak linear trends are of uncertain origin but are thought most likely to be agricultural. A series of divisions associated with a former allotment garden have been mapped, along with evidence for ridge and furrow cultivation and a former footpath or trackway.

8 REFERENCES

BGS 2020 British Geological Survey, Geology of Britain viewer [accessed 27/11/2020] *website*: (http://www.bgs.ac.uk/opengeoscience/home.html?Accordion1=1#maps)

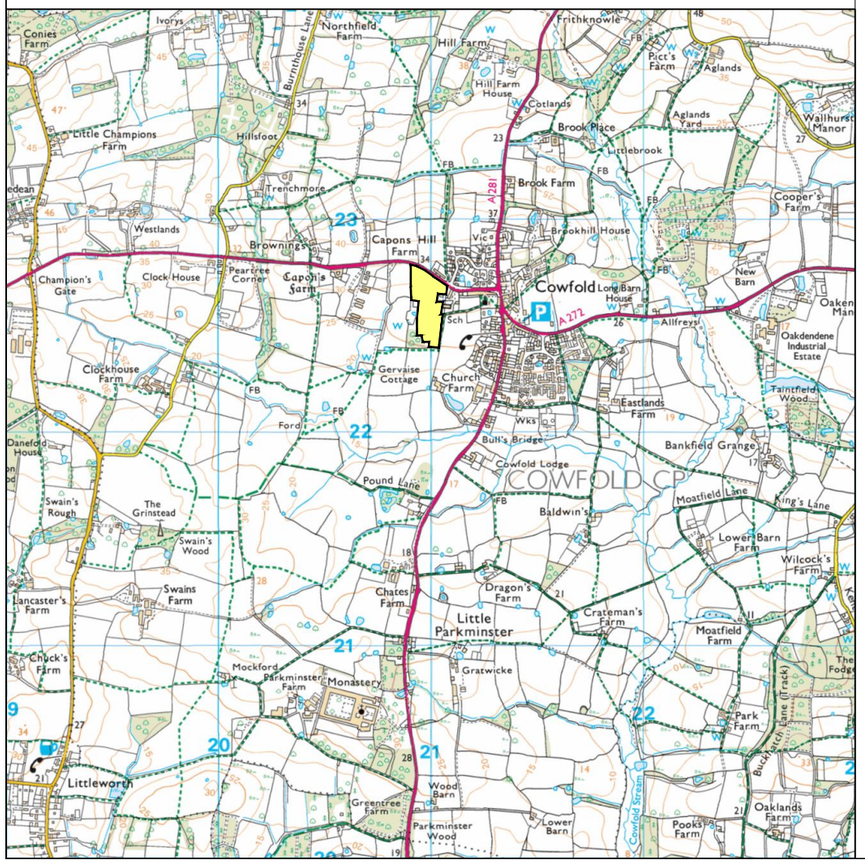
CIfA 2014 *Standard and Guidance for Archaeological Geophysical Survey.* Amended 2016. CIfA Guidance note. Chartered Institute for Archaeologists, Reading http://www.archaeologists.net/sites/default/files/CIfAS%26GGeophysics_2.pdf

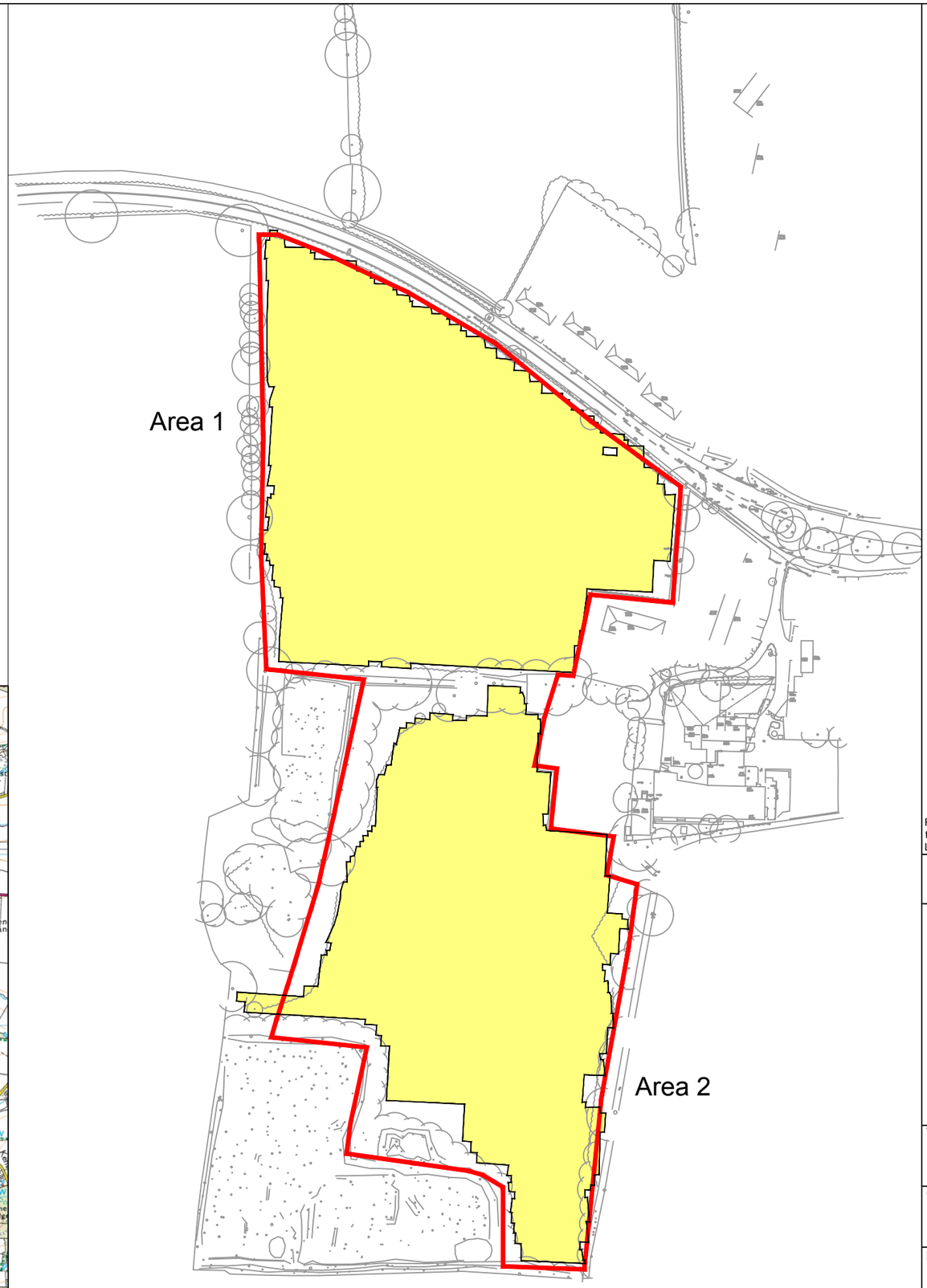
CU 2020 The Soils Guide. Available: www.landis.org.uk. Cranfield University, UK. [accessed 27/11/2020] *website: http://mapapps2.bgs.ac.uk/ukso/home.html*

EAC 2016 *EAC Guidelines for the Use of Geophysics in Archaeology,* European Archaeological Council, Guidelines 2.

EH 2008 *Geophysical Survey in Archaeological Field Evaluation.* English Heritage, Swindon https://content.historicengland.org.uk/images-books/publications/geophysical-survey-in-archaeological-field-evaluation/geophysics-guidelines.pdf/

RPS 2020 *Archaeological Desk-Based Assessment - Land South of Station Road, Cowfold, West Sussex.* RPS Consulting Services; unpublished report.





Survey Areas

N

sumo Survey
GEOPHYSICS FOR ARCHAEOLOGY & ENGINEERING

Title:
Site Location

Client:
RPS Consulting Services

Project:
01259 - South of Station Road, Cowfold, West Sussex

Scale:
NOT TO SCALE

Fig No:
01

Area 1

Area 2

Area 1

4

2

3

1

Area 2

N

+2nT

-1nT

KEY

	Possible thermoremanent response (discrete anomaly / enhanced response)
	Uncertain Origin (discrete anomaly / trend)
	Former allotment division
	Former footpath / track (corroborated)
	Agriculture (ridge and furrow)
	Magnetic disturbance
	Ferrous

sumo Survey

GEOPHYSICS FOR ARCHAEOLOGY & ENGINEERING

Title:
Magnetometer Survey -
Greyscale Plots and Interpretation

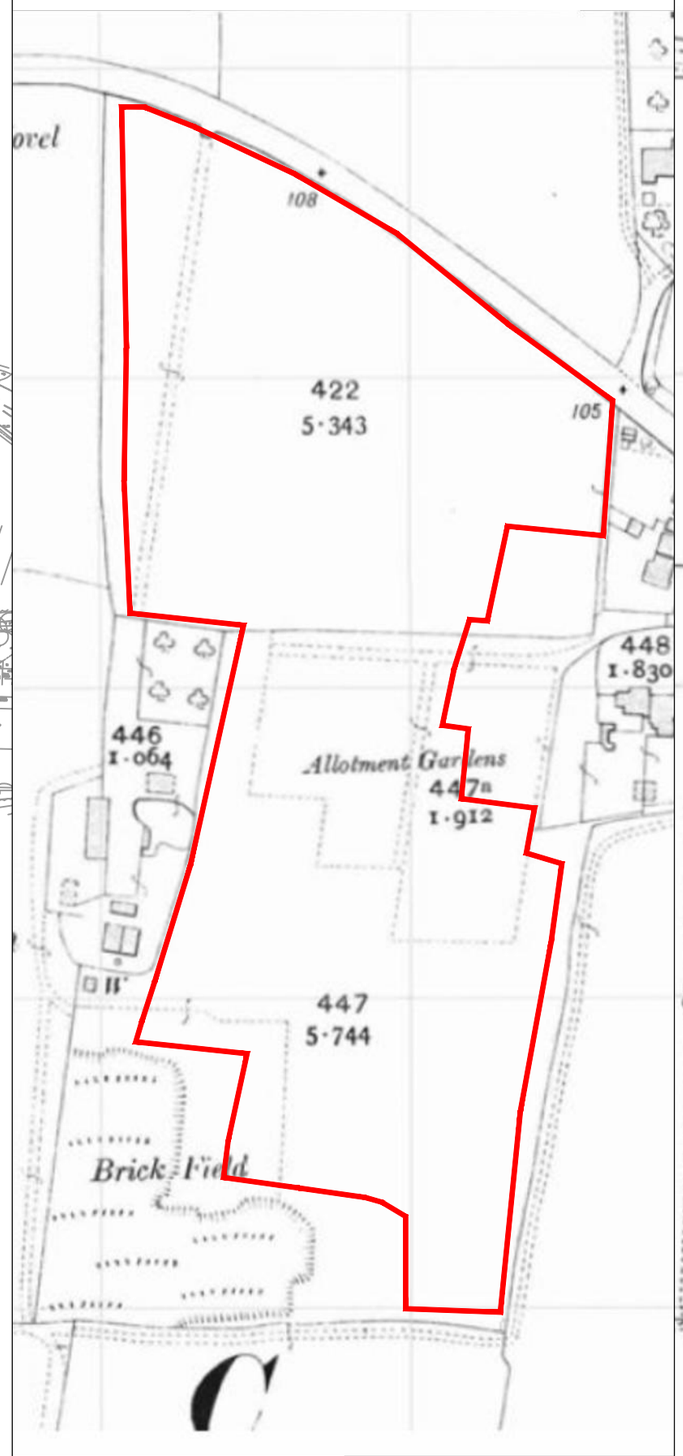
Client:
RPS Consulting Services

Project:
01259 - South of Station Road, Cowfold, West Sussex

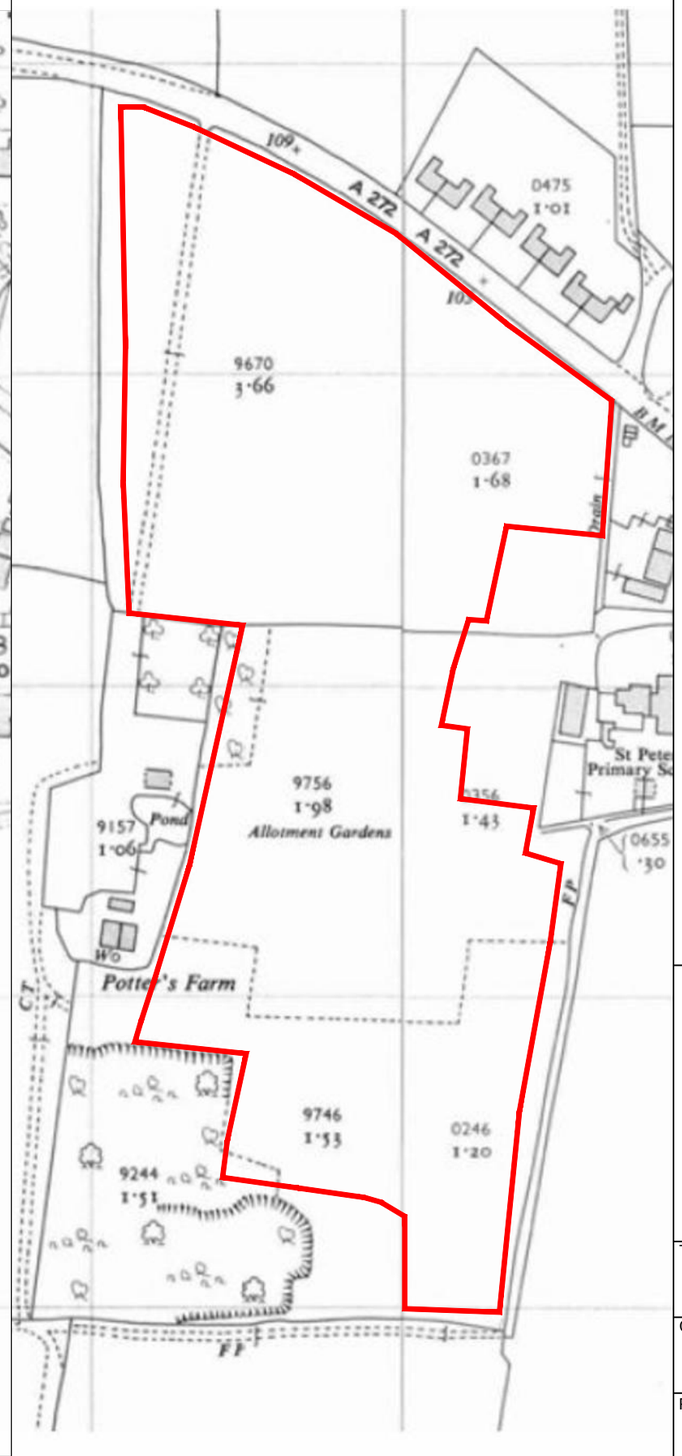
Scale:
0 metres 75
1:1500 @ A3

Fig No:
02

1911 Ordnance Survey Map (RPS; Figure 12)



1956 Ordnance Survey Map (RPS; Figure 13)



N

sumo Survey
GEOPHYSICS FOR ARCHAEOLOGY & ENGINEERING

Title:
Greyscale Plots with
1911 and 1956 Ordnance Survey Maps

Client:
RPS Consulting Services

Project:
01259 - South of Station Road, Cowfold, West Sussex

Scale:
0 metres 100
1:2000 @ A3

Fig No:
03

Area 1

Area 2

+2nT

-1nT

50nT

N

+2nT

-1nT

KEY

	Possible thermoremanent response (discrete anomaly / enhanced response)
	Uncertain Origin (discrete anomaly / trend)
	Former allotment division
	Former footpath / track (corroborated)
	Agriculture (ridge and furrow)
	Natural (e.g. geological / pedological)
	Magnetic disturbance
	Ferrous

sumo Survey

GEOPHYSICS FOR ARCHAEOLOGY & ENGINEERING

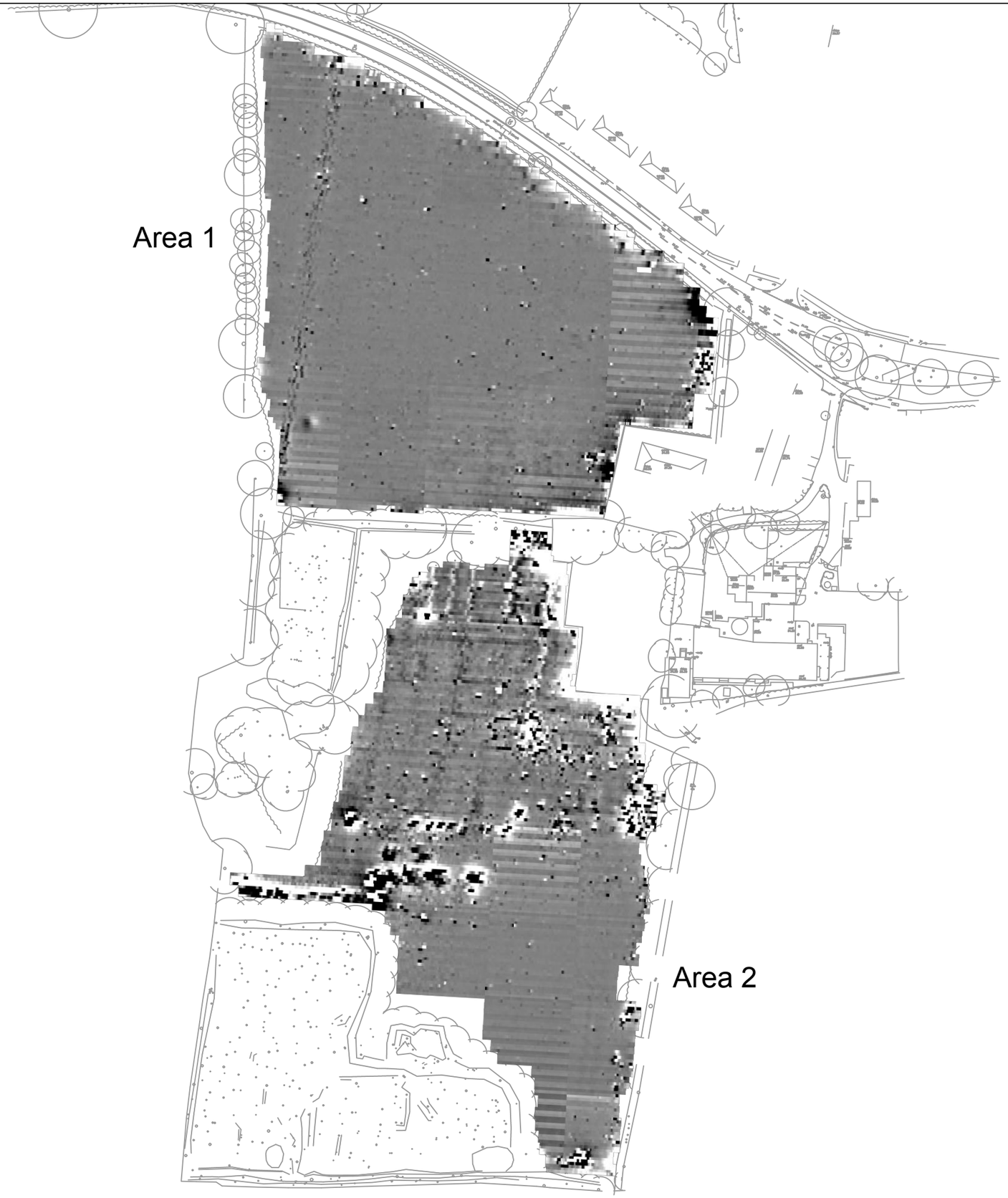
Title:
Magnetometer Survey - Greyscale Plots and XY Traceplots clipped at +/-50nT

Client:
RPS Consulting Services

Project:
01259 - South of Station Road, Cowfold, West Sussex

Scale:
0 metres 75
1:1500 @ A3

Fig No:
04



N

+10nT

-10nT

sumo Survey
GEOPHYSICS FOR ARCHAEOLOGY & ENGINEERING

Title:
Minimally Processed Data - Greyscale Plots

Client:
RPS Consulting Services

Project:
01259 - South of Station Road, Cowfold, West Sussex

Scale:
0 metres 75
1:1500 @ A3

Fig No:
05

Appendix A - Technical Information: Magnetometer Survey Method, Processing and Presentation

Standards & Guidance

This report and all fieldwork have been conducted in accordance with the latest guidance documents issued by Historic England (EH 2008) (then English Heritage), the Chartered Institute for Archaeologists (CIfA 2014) and the European Archaeological Council (EAC 2016).

Grid Positioning

For hand held gradiometers the location of the survey grids has been plotted together with the referencing information. Grids were set out using a Trimble R8 Real Time Kinematic (RTK) VRS Now GNSS GPS system.

An RTK GPS (Real-time Kinematic Global Positioning System) can locate a point on the ground to a far greater accuracy than a standard GPS unit. A standard GPS suffers from errors created by satellite orbit errors, clock errors and atmospheric interference, resulting in an accuracy of 5m-10m. An RTK system uses a single base station receiver and a number of mobile units. The base station re-broadcasts the phase of the carrier it measured, and the mobile units compare their own phase measurements with those they received from the base station. This results in an accuracy of around 0.01m.

Technique	Instrument	Traverse Interval	Sample Interval
Magnetometer	Bartington Grad 601-2	1m	0.25m

Instrumentation: Bartington *Grad* 601-2

Bartington instruments operate in a gradiometer configuration which comprises fluxgate sensors mounted vertically, set 1.0m apart. The fluxgate gradiometer suppresses any diurnal or regional effects. The instruments are carried, or cart mounted, with the bottom sensor approximately 0.1-0.3m from the ground surface. At each survey station, the difference in the magnetic field between the two fluxgates is measured in nanoTesla (nT). The sensitivity of the instrument can be adjusted; for most archaeological surveys the most sensitive range (0.1nT) is used. Generally, features up to 1m deep may be detected by this method, though strongly magnetic objects may be visible at greater depths. The Bartington instrument can collect two lines of data per traverse with gradiometer units mounted laterally with a separation of 1.0m. The readings are logged consecutively into the data logger which in turn is daily down-loaded into a portable computer whilst on site. At the end of each site survey, data is transferred to the office for processing and presentation.

Data Processing

Zero Mean Traverse	This process sets the background mean of each traverse within each grid to zero. The operation removes striping effects and edge discontinuities over the whole of the data set.
Step Correction (De-stagger)	When gradiometer data are collected in 'zig-zag' fashion, stepping errors can sometimes arise. These occur because of a slight difference in the speed of walking on the forward and reverse traverses. The result is a staggered effect in the data, which is particularly noticeable on linear anomalies. This process corrects these errors.

Display

Greyscale/ Colourscale Plot	This format divides a given range of readings into a set number of classes. Each class is represented by a specific shade of grey, the intensity increasing with value. All values above the given range are allocated the same shade (maximum intensity); similarly, all values below the given range are represented by the minimum intensity shade. Similar plots can be produced in colour, either using a wide range of colours or by selecting two or three colours to represent positive and negative values. The assigned range (plotting levels) can be adjusted to emphasise different anomalies in the data-set.

Presentation of results and interpretation

The presentation of the results includes a ‘minimally processed data’ and a ‘processed data’ greyscale plot. Magnetic anomalies are identified, interpreted and plotted onto the ‘Interpretation’ drawings.

When interpreting the results, several factors are taken into consideration, including the nature of archaeological features being investigated and the local conditions at the site (geology, pedology, topography etc.). Anomalies are categorised by their potential origin. Where responses can be related to other existing evidence, the anomalies will be given specific categories, such as: Abbey Wall or Roman Road. Where the interpretation is based largely on the geophysical data, levels of confidence are implied, for example: Probable, or Possible Archaeology. The former is used for a confident interpretation, based on anomaly definition and/or other corroborative data such as cropmarks. Poor anomaly definition, a lack of clear patterns to the responses and an absence of other supporting data reduces confidence, hence the classification Possible.

Interpretation Categories

In certain circumstances (usually when there is corroborative evidence from desk-based or excavation data) very specific interpretations can be assigned to magnetic anomalies (for example, *Roman Road, Wall,* etc.) and where appropriate, such interpretations will be applied. The list below outlines the generic categories commonly used in the interpretation of the results.

Archaeology / Probable Archaeology	This term is used when the form, nature and pattern of the responses are clearly or very probably archaeological and /or if corroborative evidence is available. These anomalies, whilst considered anthropogenic, could be of any age.
Possible Archaeology	These anomalies exhibit either weak signal strength and / or poor definition, or form incomplete archaeological patterns, thereby reducing the level of confidence in the interpretation. Although the archaeological interpretation is favoured, they may be the result of variable soil depth, plough damage or even aliasing as a result of data collection orientation.
Industrial / Burnt-Fired	Strong magnetic anomalies that, due to their shape and form or the context in which they are found, suggest the presence of kilns, ovens, corn dryers, metal-working areas or hearths. It should be noted that in many instances modern ferrous material can produce similar magnetic anomalies.
Former Field Boundary (probable & possible)	Anomalies that correspond to former boundaries indicated on historic mapping, or which are clearly a continuation of existing land divisions. Possible denotes less confidence where the anomaly may not be shown on historic mapping but nevertheless the anomaly displays all the characteristics of a field boundary.
Ridge & Furrow	Parallel linear anomalies whose broad spacing suggests ridge and furrow cultivation. In some cases, the response may be the result of more recent agricultural activity.
Agriculture (ploughing)	Parallel linear anomalies or trends with a narrower spacing, sometimes aligned with existing boundaries, indicating more recent cultivation regimes.
Land Drain	Weakly magnetic linear anomalies, quite often appearing in series forming parallel and herringbone patterns. Smaller drains may lead and empty into larger diameter pipes, which in turn usually lead to local streams and ponds. These are indicative of clay fired land drains.
Natural	These responses form clear patterns in geographical zones where natural variations are known to produce significant magnetic distortions.
Magnetic Disturbance	Broad zones of strong dipolar anomalies, commonly found in places where modern ferrous or fired materials (e.g. brick rubble) are present.
Service	Magnetically strong anomalies, usually forming linear features are indicative of ferrous pipes/cables. Sometimes other materials (e.g. pvc) or the fill of the trench can cause weaker magnetic responses which can be identified from their uniform linearity.
Ferrous	This type of response is associated with ferrous material and may result from small items in the topsoil, larger buried objects such as pipes, or above ground features such as fence lines or pylons. Ferrous responses are usually regarded as modern. Individual burnt stones, fired bricks or igneous rocks can produce responses similar to ferrous material.
Uncertain Origin	Anomalies which stand out from the background magnetic variation, yet whose form and lack of patterning gives little clue as to their origin. Often the characteristics and distribution of the responses straddle the categories of *Possible Archaeology* / *Natural* or (in the case of linear responses) *Possible Archaeology* / *Agriculture*; occasionally they are simply of an unusual form.

Where appropriate some anomalies will be further classified according to their form (positive or negative) and relative strength and coherence (trend: weak and poorly defined).

Appendix B - Technical Information: Magnetic Theory

Detailed magnetic survey can be used to effectively define areas of past human activity by mapping spatial variation and contrast in the magnetic properties of soil, subsoil and bedrock. Although the changes in the magnetic field resulting from differing features in the soil are usually weak, changes as small as 0.1 nanoTeslas (nT) in an overall field strength of 48,000 (nT), can be accurately detected.

Weakly magnetic iron minerals are always present within the soil and areas of enhancement relate to increases in *magnetic susceptibility* and permanently magnetised *thermoremanent* material.

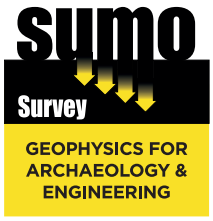
Magnetic susceptibility relates to the induced magnetism of a material when in the presence of a magnetic field. This magnetism can be considered as effectively permanent as it exists within the Earth's magnetic field. Magnetic susceptibility can become enhanced due to burning and complex biological or fermentation processes.

Thermoremanence is a permanent magnetism acquired by iron minerals that, after heating to a specific temperature known as the Curie Point, are effectively demagnetised followed by re-magnetisation by the Earth's magnetic field on cooling. Thermoremanent archaeological features can include hearths and kilns; material such as brick and tile may be magnetised through the same process.

Silting and deliberate infilling of ditches and pits with magnetically enhanced soil creates a relative contrast against the much lower levels of magnetism within the subsoil into which the feature is cut. Systematic mapping of magnetic anomalies will produce linear and discrete areas of enhancement allowing assessment and characterisation of subsurface features. Material such as subsoil and non-magnetic bedrock used to create former earthworks and walls may be mapped as areas of lower enhancement compared to surrounding soils.

Magnetic survey is carried out using a fluxgate gradiometer which is a passive instrument consisting of two sensors mounted vertically 1m apart. The instrument is carried about 30cm above the ground surface and the top sensor measures the Earth's magnetic field whilst the lower sensor measures the same field but is also more affected by any localised buried feature. The difference between the two sensors will relate to the strength of a magnetic field created by this feature, if no field is present the difference will be close to zero as the magnetic field measured by both sensors will be the same.

Factors affecting the magnetic survey may include soil type, local geology, previous human activity and disturbance from modern services.



- Archaeological
- Geophysical
- Laser Scanning
- Measured Building
- Topographic
- Utility Mapping

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