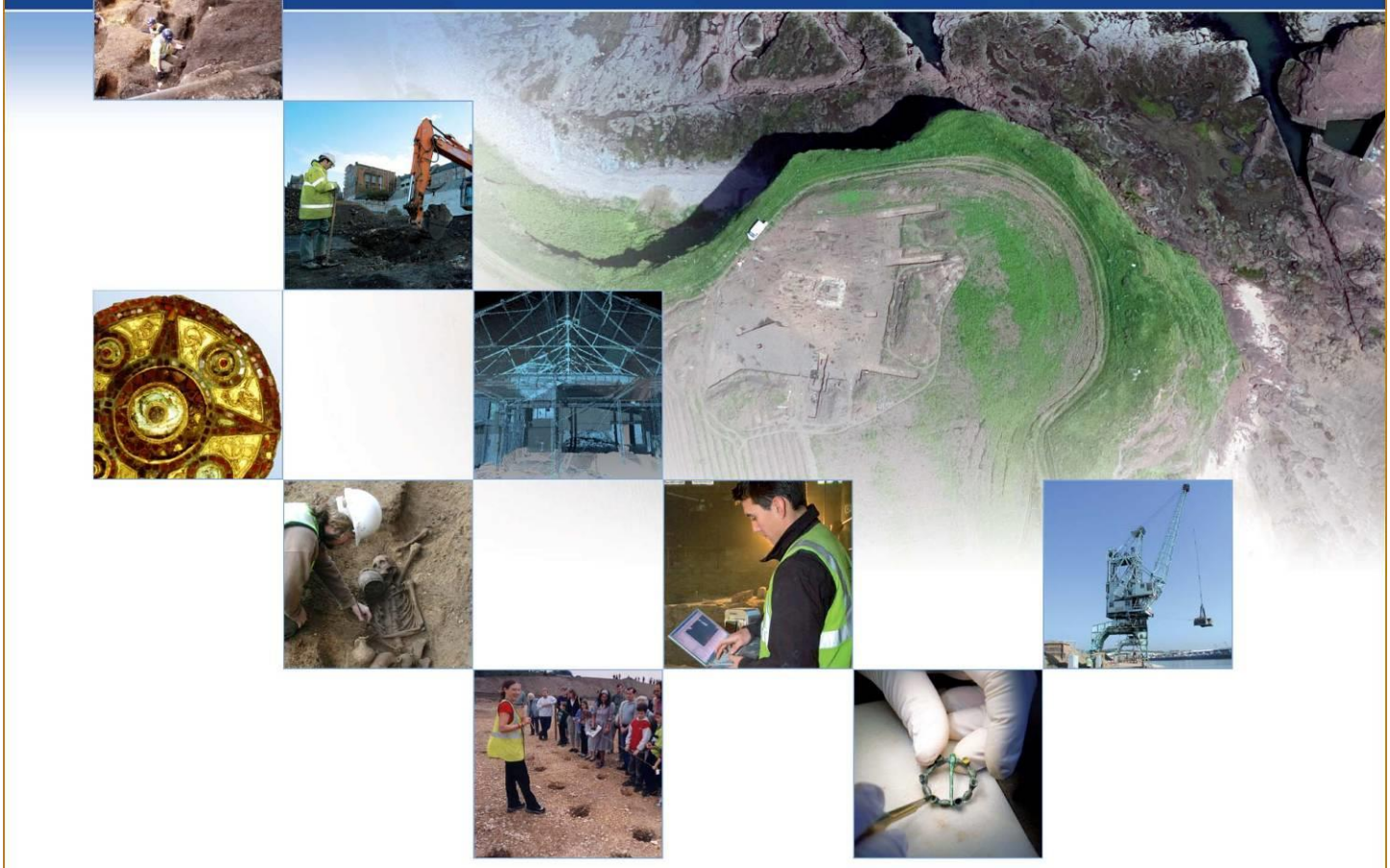
Cannock Road, Stafford, Staffordshire

Archaeological Geophysical Survey

National Grid Reference Number: SJ 9491 2016

AOC Project No: 51742

Date: May 2017



AOC Archaeology Group

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Cannock Road, Stafford, Staffordshire

Archaeological Geophysical Survey

On Behalf of:	**Simon McCudden** **WYG Arndale Court** **Headingley,** **Leeds,** **West Yorkshire,** **LS6 2UJ**
National Grid Reference (NGR):	**SJ 9491 2016**
AOC Project No:	**51742**
Prepared by:	**James Lawton**
Illustrations by:	**Kimberley Teale**
Date of survey:	**May 2017**

This document has been prepared in accordance with AOC standard operating procedures.

Author: James Lawton	**Date: 12th May 2017**
Approved by: Graeme Cavers	**Date: 24th May 2017**
Report Stage: Final Report	**Date: 24th May 2017**

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Non-Technical Summary

AOC Archaeology Group was commissioned by WYG Environment Planning Transport Ltd to undertake an archaeological geophysical (gradiometer) survey to investigate the potential for buried archaeological remains and the location of a culvert on a site off Cannock road, Stafford, Staffordshire (centred at SJ 9491 2016).

A total of 2 hectares were surveyed and the results have identified a number of anomalies.

The survey identified no definitive archaeological anomalies within the survey area.

A number of tentative discrete linear, curvilinear trends, possibly of an archaeological origin have been located within the data.

A number of agricultural anomalies have been observed in the data including ridge and furrow ploughing.

Several modern services were recorded which are most likely to be culverts or pipes. One of these falls along the line of the projected line of a culvert which was hoped to be located as part of the survey.

An area of magnetic disturbance, most likely the result of modern material was also recorded, at the edge of the field and survey area in the north.

Throughout the survey area isolated dipolar or ferrous (iron spikes) anomalies were also recorded; these are most likely the result of manuring and modern detritus.

1 Introduction

1.1 AOC Archaeology Group was commissioned by WYG Environment Planning Transport Ltd to undertake an archaeological geophysical survey at a site off Cannock road, Stafford, Staffordshire, as part of a wider scheme of archaeological assessments in advance of a proposed development of the site.

1.2 The survey was carried out to provide information on the extent and significance of potential buried archaeological remains within the proposed development site. The survey also aimed to determine the location of a known culvert that had been partially identified with a separate CCTV survey.

2 Site Location and Description

2.1 The proposed development site is located on the southern and western boundary of Weeping Cross, Staffordshire. It is located to the south and west of the A34 Cannock Road, centred at SJ 9491 2016 (see Figure 1).

2.2 The survey boundary covers an area of approximately 2 hectares (Ha) and the field itself consists of ridges of planted potatoes with significantly high ridges and furrows. The survey area is situated on sloping ground ranging between approximately 102m to 110m aOD (above Ordnance Datum).

2.3 The recorded bedrock geology within the survey area consists of Kidderminster Formation – Sandstone and Conglomerate, Interbedded (BGS 2017). No superficial deposits have been recorded on the site.

2.4 These are overlain by freely draining slightly acid sandy soils (Soilscapes 2017).

3 Archaeological Background

3.1 The archaeological background below is drawn from historic mapping (Old Maps 2017). A Desk-based assessment will be written in due course. A Desk-based assessment is currently been written by WYG Environment Planning Transport Ltd and will be available in due course.

Prehistoric period (up to AD 70)

3.2 There is no evidence of any prehistoric activity within the site.

Roman period (AD 70 to 5th century)

3.3 There is no evidence for archaeology of Roman date in the site.

Medieval period (5th century to 1540)

3.4 There is no evidence of early medieval or medieval settlement activity within the site boundary.

Post-medieval period (1541 to 1899)

3.5 The 2nd edition Ordnance Survey map records no field boundary on the southern extent of the field.

Modern period (1900 to present)

3.6 The Ordnance Survey map of 1959 records the installation of the modern field boundary to the south, but no other changes had occurred within the site itself.

4 Aims

4.1 The aim of the geophysical survey was to identify any potential archaeological anomalies that would enhance the current understanding of the archaeological resource within the proposed survey area.

4.2 Specifically, the aims of the gradiometer survey were;

- To locate, record and characterise any surviving sub-surface archaeological remains within the survey area
- To locate the possible route of a culvert across the site
- To help determine the next stage of works as per the client's instruction
- To provide an assessment of the potential significance of any identified archaeological remains in a local, regional and (if relevant) national context
- To produce a comprehensive site archive and report.

5 Methodology

5.1 All geophysical survey work was carried out in accordance with recommended good practice specified in guideline documents published by English Heritage – now Historic England (David *et al.* 2008) and the Chartered Institute for Archaeologists *Standard and Guidance for archaeological geophysical survey* (2014).

5.2 Parameters were selected that were suitable for the prospective aims of the survey and in accordance with recommended professional good practice (David *et al.* 2008, 8).

5.3 The gradiometer survey was carried out using Bartington Grad601-2 fluxgate gradiometers (see Appendices 2 and 3). Data was collected on an east-west alignment using zig-zag traverses, with a sample interval of 0.25m and a traverse interval of 1m. A total of 18 full or partial 30m by 30m grids were surveyed within the specified area, totalling an area of approximately 2ha.

5.4 Care was taken to avoid metal obstacles present within the survey area during data collection using gradiometers. Gradiometer survey is affected by 'above-ground noise' such as metal objects, and avoiding these improves the overall data quality and results obtained.

5.5 The gradiometer data were downloaded using Bartington Grad601 PC Software v313 and processed using Geoscan Geoplot v3.0 / v4.0. The details of these processes can be found in Appendices 4 and 5. Data processing, storage and documentation were carried out in accordance with the good practice specifications detailed in the guidelines issued by the Archaeology Data Service (Schmidt and Ernenwein, 2009).

5.6 Interpretations of the data were created as layers in AutoCAD LT 2009 / GIS and the technical terminology used to describe the identified features can be found in Appendix 6.

6 Results and Interpretation

6.1 The gradiometer survey results have been visualised as greyscale plots, with the minimally processed data plotted at -1nT to 2nT in Figure 3. The processed data is also plotted at -1nT to 2nT and can be seen in Figure 4. An interpretation of the data can be seen in Figure 5 and an individual characterisation of the identified anomalies follows this in Appendix 1.

Archaeology

6.2 No responses indicating definitive archaeological remains have been located in the survey area.

Discrete Archaeology

Discrete linear trends

6.3 Several discrete curvilinear / linear trends have been identified in the data in the west and east of the site (**S1**). These trends comprise increased signals compared to the background values, however poor patterning of these response values and weaker anomaly strength makes interpretation difficult and more tentative. An archaeological origin could be suggested, possibly relating to ditches. Equally they could also be related to geological variations across the area.

Discrete pits

6.4 Two anomalies typical of the response given for pits are observed in the centre-north of the dataset (**S2**). A pit is an anomaly composed of an increase in magnetic values with a patterning on the XY trace plot that is suggestive of buried remains, such as the infill of a pit, but is isolated in its location and association with other features. These could be archaeological in nature, however are also likely to be natural features.

Agricultural

Linear Trend (Ridge and Furrow / Rig and Furrow)

6.5 An area of former ridge and furrow ploughing trends have been recorded in the data in the eastern part of the site (**S3**).

Non-archaeology

Linear Trend (possible modern service)

6.6 A linear response in the eastern part of the survey area is likely to represent a service pipe and runs north-west south-east along the eastern field boundary (**S4**).

6.7 A negative linear trend runs north-west to south-east through the survey and would appear to fall within the line of a possible former/existing culvert (**S5**).

Disturbed Area (modern disturbance?)

6.8 An area of modern disturbance is located along the western boundary of the survey area (**S6**). It is likely that this is related to modern debris which has found its way in to the field from previous activity.

Isolated Dipolar Anomalies / Ferrous (iron spikes)

6.9 Across the data set there are a quantity of isolated dipolar anomalies (iron spikes). These are commonly caused by ferrous or high magnetically susceptible material on the surface or within the topsoil of the site, and it is likely that modern agricultural activity such as manuring has changed the magnetic properties of the top soil and created a high level of background ‘noise’ within the data set.

7 Conclusion

7.1 The gradiometer survey has not identified any anomalies or features of a definitive archaeological nature.

7.2 Across the survey area a number of discrete curvilinear / linear trends were identified but due to their poor strength and patterning only a tentative interpretation can be formed as to their origin, and therefore and archaeological origin can neither be dismissed or agreed.

7.3 A number of agricultural anomalies relating to former ridge and furrow ploughing trends can be seen in the data, as well as more conventional modern ploughing trends.

7.4 Non archaeological anomalies were also detected in the results: these reflect areas of likely modern disturbance. In particular, two linear responses both of which are most likely pipes or culverts. One of these is a pipe anomaly running north south and the second is a negative trend along the line of a former water culvert which was meant to be located in the area.

7.5 Several ferrous spikes most likely related to modern manuring have been located throughout the data.

8 Statement of Indemnity

8.1 Although the results and interpretation detailed in this report have been produced as accurately as possible, it should be noted that the conclusions offered are a subjective assessment of collected data sets.

8.2 The success of a geophysical survey in identifying archaeological remains can be heavily influenced by several factors, including geology, seasonality, field conditions and the properties of the features being detected. Therefore, the geophysical interpretation may only reveal certain archaeological features and not produce a complete plan of all of the archaeological remains within a survey area.

9 Bibliography

Bartington Instruments, 2007 *Operation Manual for Grad601 Single Axis Magnetic Field Gradiometer System*

Bartington Instruments, 2016 *Operation Manual for Non-Magnetic Cart*

British Geological Survey, Geology of Britain Viewer, h*ttp://www.bgs.ac.uk/data/mapViewers/home* (last accessed 12.5.2017)

CIfA, 2014 *Standards and Guidance for Archaeological Geophysical Survey*

Clark, A., 1996 *Seeing Beneath the Soil: Prospecting Methods in Archaeology*, Second Edition. London

David, A. Linford, N. Linford, P., 2008, English Heritage (Historic England): *Geophysical Survey in Archaeological Field Evaluation*, Swindon

Gaffney, C. and Gater, J., 2003 *Revealing the Buried Past Geophysics for Archaeologists*. Stroud: Tempus Publishing Ltd.

Geoscan Research, 2005 *Geoplot – Instruction Manual,* Version 1.97

Heron, C. and Gaffney, C., 1987 'Archaeogeophysics and the site: ohm sweet ohm? in C. Gaffney and V. Gaffney (eds.) *Pragmatic Archaeology: Theory in crisis?* British Archaeological Report, British Series 167:71-81.

Old-Maps, *https://www.old-maps.co.uk/* (last accessed 12.05.2017)

Schmidt, A. and Ernenwein, E., 2009 *Archaeology Data Service: Geophysical Data in Archaeology: A Guide to Good Practice*

Sharma, P.V., 1997 *Environmental and Engineering Geophysics*

Soilscapes, *http://www.landis.org.uk/soilscapes2* (last accessed 12.05.2017)

Plate 1. Survey area looking west from the east of the site.

Plate 2. Survey area looking south east from the northern boundary of the site.

Plate 3. Survey area looking south west from the eastern corner of the site.

Plate 4. Survey area looking north highlighting the marker post for the culvert.

CANNOCK ROAD, STAFFORD
(AOC PROJECT NO. 51742)

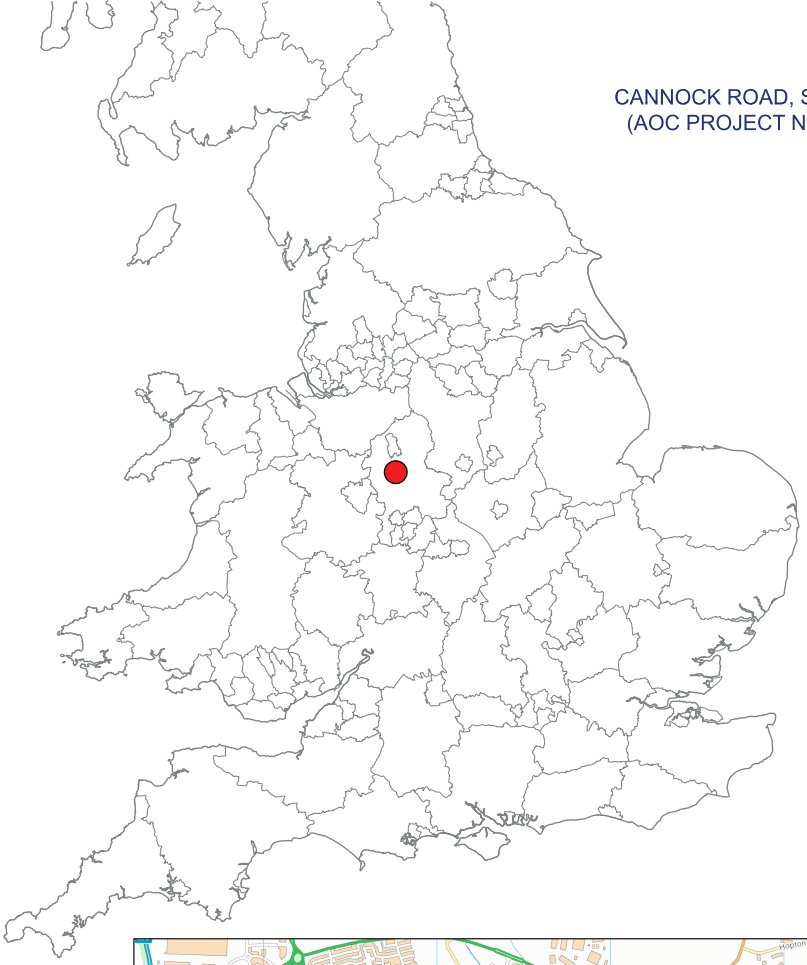

Figure
1

N

Site location

0 1000m

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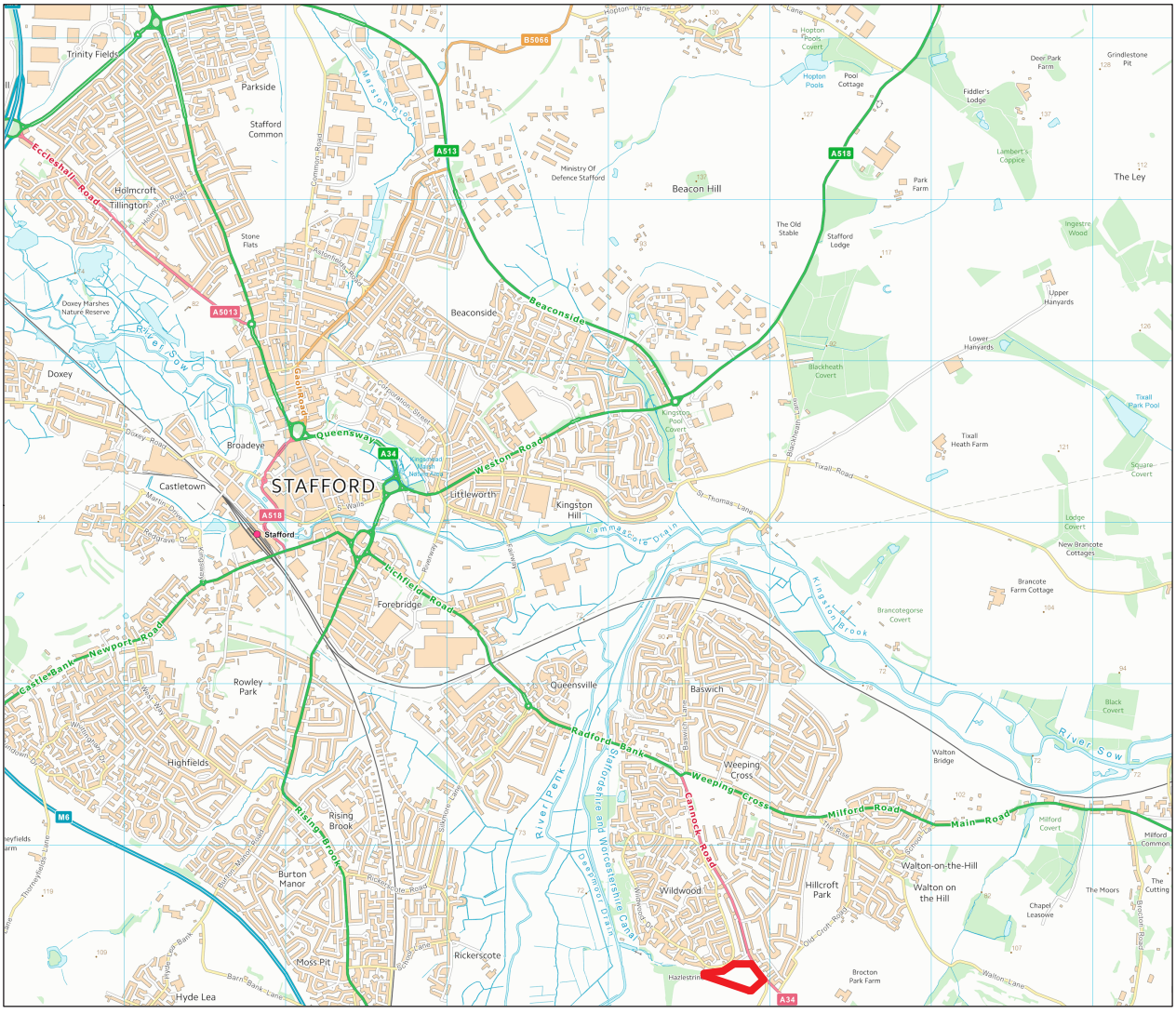

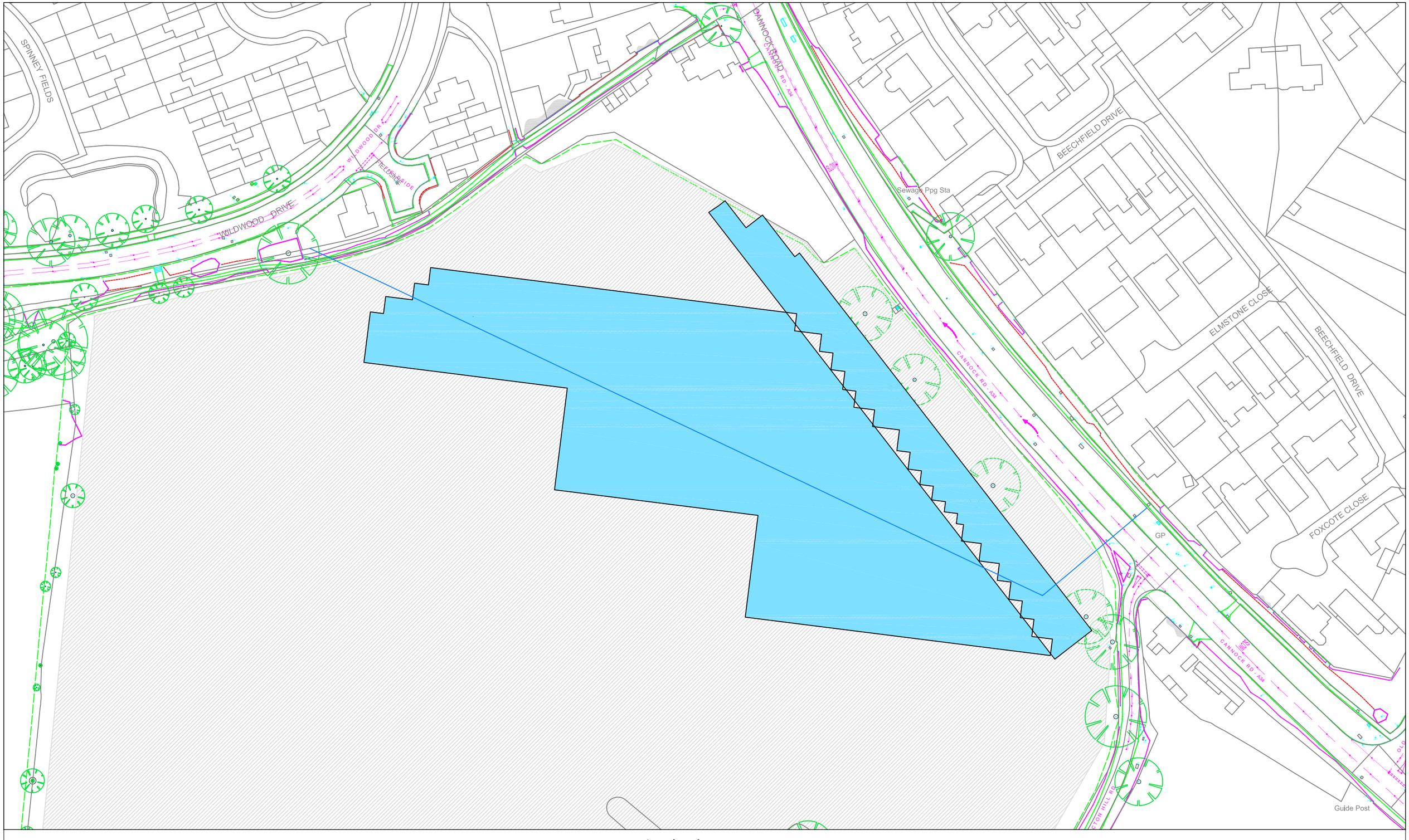

Location of survey area

Figure 2

Area surveyed

Area not surveyed

Proposed path of culvert

N

0 40m

1:1000 at A3

Project Title: Cannock Road, Stafford Project No: 51742		
Drawing Title: Figure 2 Location of Survey Area		
V1/51742/GEO/F2/23.05.17		
Drawn by: KT	Checked by: JL	Approved by: JL
23/05/2017	23/05/2017	23/05/2017

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Minimally processed gradiometer survey results - greyscale plot

Figure 3	Scale: 2nT / -1nT		N; 0 – 40m; 1:1000 at A3	Project Title: Cannock Road, Stafford Project No: 51742 Drawing Title: Figure 3 Minimally processed gradiometer survey results V1/51742/GEO/F3/23.05.17	AOC Archaeology Group

Drawn by: KT	Checked by: JL	Approved by: JL
23/05/2017	23/05/2017	23/05/2017

Processed gradiometer survey results - greyscale plot

Figure 4	Scale 2nT / -1nT		N; 0 40m; 1:1000 at A3	Project Title: Cannock Road, Stafford Project No: 51742		
				Drawing Title: Figure 4 Processed gradiometer survey results		
				V1/51742/GEO/F4/23.05.17		
				Drawn by: KT	Checked by: JL	Approved by: JL
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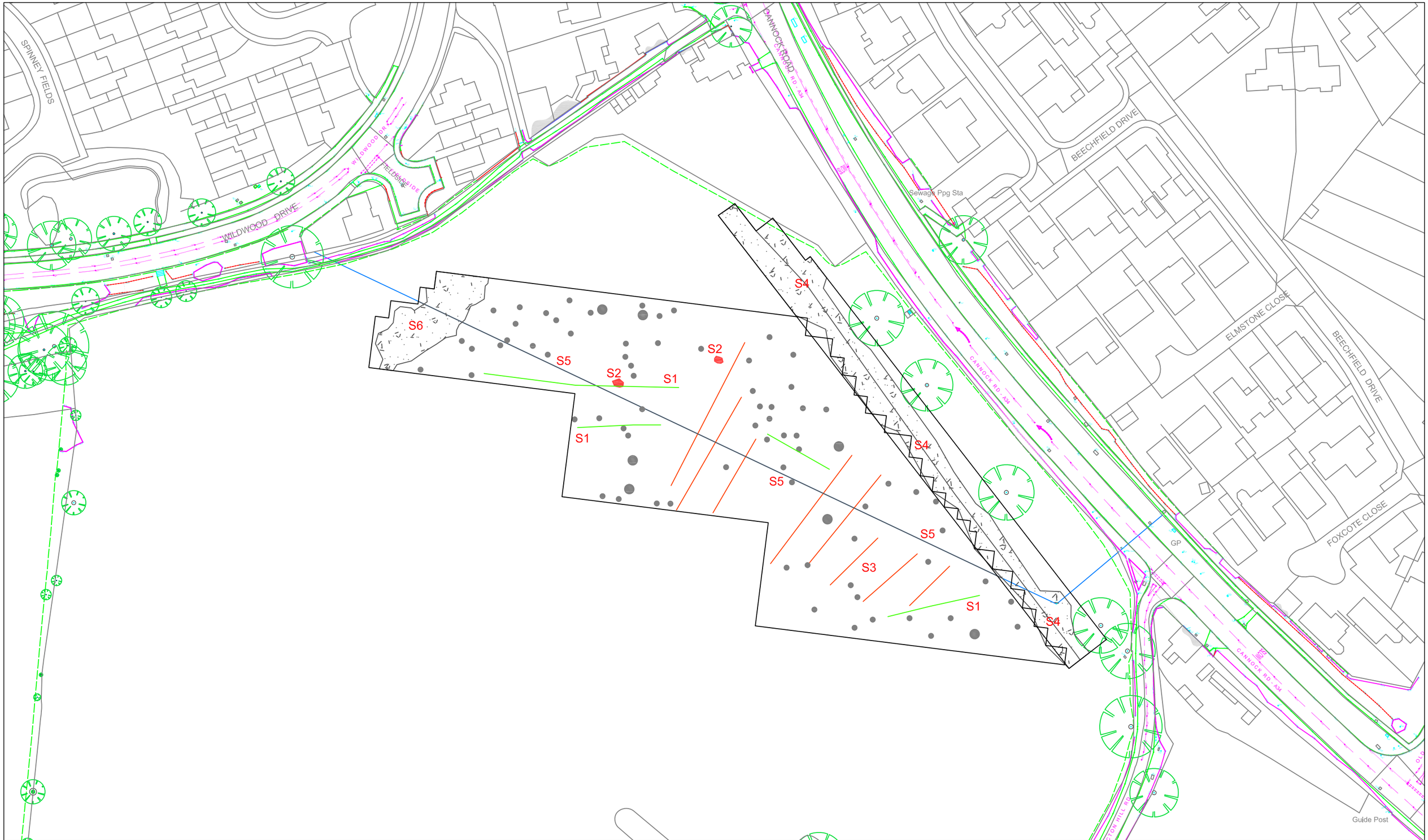

Interpretation of gradiometer survey results

Figure 5

- Discrete Trend (Archaeology?)
- Pit (Archaeology?)
- Linear Trend (Ridge and Furrow)
- Linear Trend (Modern Service)
- Area of Disturbance (Modern)
- Ferrous / Iron Spikes
- Path of culvert

N

0 40m

1:1000 at A3

Project Title: Cannock Road, Stafford Project No: 51742		
Drawing Title: Figure 5 Interpretation of gradiometer survey results		
V1/51742/GEO/F5/23.05.17		
Drawn by: KT	Checked by: JL	Approved by: JL
23/05/2017	23/05/2017	23/05/2017

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Appendix 1: Characterisation of Identified Anomalies

Gradiometer survey

Site Specific Anomaly Code: **S**

Anomaly	Type of Archaeology
S1	Discrete linear trends
S2	Discrete pit – Archaeology?
S3	Linear Trend (Ridge and Furrow / Rig and Furrow)
S4	Linear Trend (possible modern service)
S5	Linear Trend (possible modern service)
S6	Disturbed Area (modern disturbance?)

Appendix 2: Survey Metadata

Field	Description
Surveying Company	AOC Archaeology
Data collection staff	James Lawton, Kimberley Teale, Alistair Galt
Client	WYG Environment Planning Transport Ltd
Site name	Cannock Road, Stafford
County	Staffordshire
NGR	SJ 9491 2016
Land use/ field condition	Potatoes
Duration	8/5/17
Weather	Overcast/Sunny
Survey type	Gradiometer Survey
Instrumentation	Trimble GXOR system Bartington Grad 601-2
Area covered	Approx. 2 ha (18 full and partial grids)
Download software	Grad601 PC Software v313
Processing software	Geoplot v3.0 and v4.0
Visualisation software	AutoCAD LT 2009
Geology	The recorded bedrock geology within the survey area consists of Kidderminster Formation – Sandstone and Conglomerate, Interbedded (BGS 2017).
Soils	These are overlain by freely draining slightly acid sandy soils (Soilscapes 2017)
Scheduled Ancient Monument	No
Known archaeology on site	None
Historical documentation/ mapping on site	None
Report title	Cannock Road, Stafford, Staffordshire
Project number	51742
Report Author	James Lawton
Report approved by	Graeme Cavers

Appendix 3: Archaeological Prospection Techniques, Instrumentation and Software Utilised

Gradiometer survey

Gradiometer surveys measure small changes in the earth's magnetic field. Archaeological materials and activity can be detected by identifying changes to the magnetic values caused by the presence of weakly magnetised iron oxides in the soil (Aspinall *et al.*, 2008, 23; Sharma, 1997, 105). Human inhabitation often causes alterations to the magnetic properties of the ground (Aspinall et al, 2008, 21). There are two physical transformations that produce a significant contrast between the magnetic properties of archaeological features and the surrounding soil: the enhancement of magnetic susceptibility and thermoremnant magnetization (Aspinall *et al.*, 2008, 21; Heron and Gaffney 1987, 72).

Ditches and pits can be easily detected through gradiometer survey as the top soil is generally suggested to have a greater magnetisation than the subsoil caused by human habitation. Also areas of burning or materials which have been subjected to heat commonly have high magnetic signatures, examples include: hearths, kilns, fired clay and mudbricks (Clark 1996, 65; Lowe and Fogel 2010, 24). It should be noted that negative anomalies can also be useful for characterising archaeological features. If the buried remains are composed of a material with a lower magnetisation compared with the surrounding soil, the surrounding soil will consequently have a greater magnetisation resulting in the feature displaying a negative signature. For example stone materials of a structural nature that are composed of sedimentary rocks are considered non-magnetic and so will appear a negative features within the data set.

Ferrous objects- i.e. iron and its alloys- are strongly magnetic and are typically detected as high-value peaks in gradiometer survey data, though it is not usually possible to determine whether these relate to archaeological or modern objects.

Although gradiometer surveys have been successfully carried out in all areas of the United Kingdom, the effectiveness of the technique is lessened in areas with complex geology, particularly where igneous and metamorphic bedrock is present. All magnetic geophysical surveys must therefore take the effects of background geological and geomorphological conditions into account.

Gradiometer survey instrumentation

AOC Archaeology's gradiometer surveys are carried out using Bartington Grad601-2 magnetic gradiometers. The Grad601-2 is a high-stability fluxgate magnetic gradient sensor, which uses a 1m sensor separation. The detection resolution is from 0.03 nT/m to 0.1nT/m, depending on the sensor parameters selected, making the Grad601-2 an ideal instrument for prospective survey of large areas as well as detailed surveys of known archaeology. The instrument stores the data collected on an on-board data-logger, which is then downloaded as a series of survey grids for processing.

Gradiometer survey software

Following the survey, gradiometer data is downloaded from the instrument using Grad601 PC Software v313. Survey grids are then assembled into composites and enhanced using a range of processing techniques using Geoscan Geoplot v3.0 / v4.0 (see Appendix 4 for a summary of the processes used in Geoplot and Appendix 5 for a list of processes used to create final data plots).

Appendix 4: Summary of Processes used in Geoplot

Process	Effect
Clip	Limits data values to within a specified range
De-spike	Removes exceptionally high readings in the data that can obscure the visibility of archaeological features. In resistivity survey, these can be caused by poor contact of the mobile probes with the ground. In gradiometer survey, these can be caused by highly magnetic items such as buried ferrous objects.
De-stagger	Corrects a misalignment of data when the survey is conducted in a zig-zag traverse pattern.
Edge Match	Counteracts edge effects in grid composites by subtracting the difference between mean values in the two lines either side of the grid edge.
High pass filter	Removes low-frequency, large scale detail in order to remove background trends in the data, such as variations in geology.
Interpolate	Increases the resolution of a survey by interpolating new values between surveyed data points, creating a smoother overall effect.
Low Pass filter	Uses a Gaussian filter to remove high-frequency, small scale detail, typically for smoothing the data.
Periodic Filter	Used to either remove or reduce the appearance of constant and reoccurring features that distort other anomalies, such as plough lines.
Wallis filter	Applies a locally adaptive contrast enhancement filter.
Zero Mean Grid	Resets the mean value of each grid to zero, in order to counteract grid edge discontinuities in composite assemblies.
Zero Mean Traverse	Resets the mean value of each traverse to zero, in order to address the effect of striping in the data and counteract edge effects.

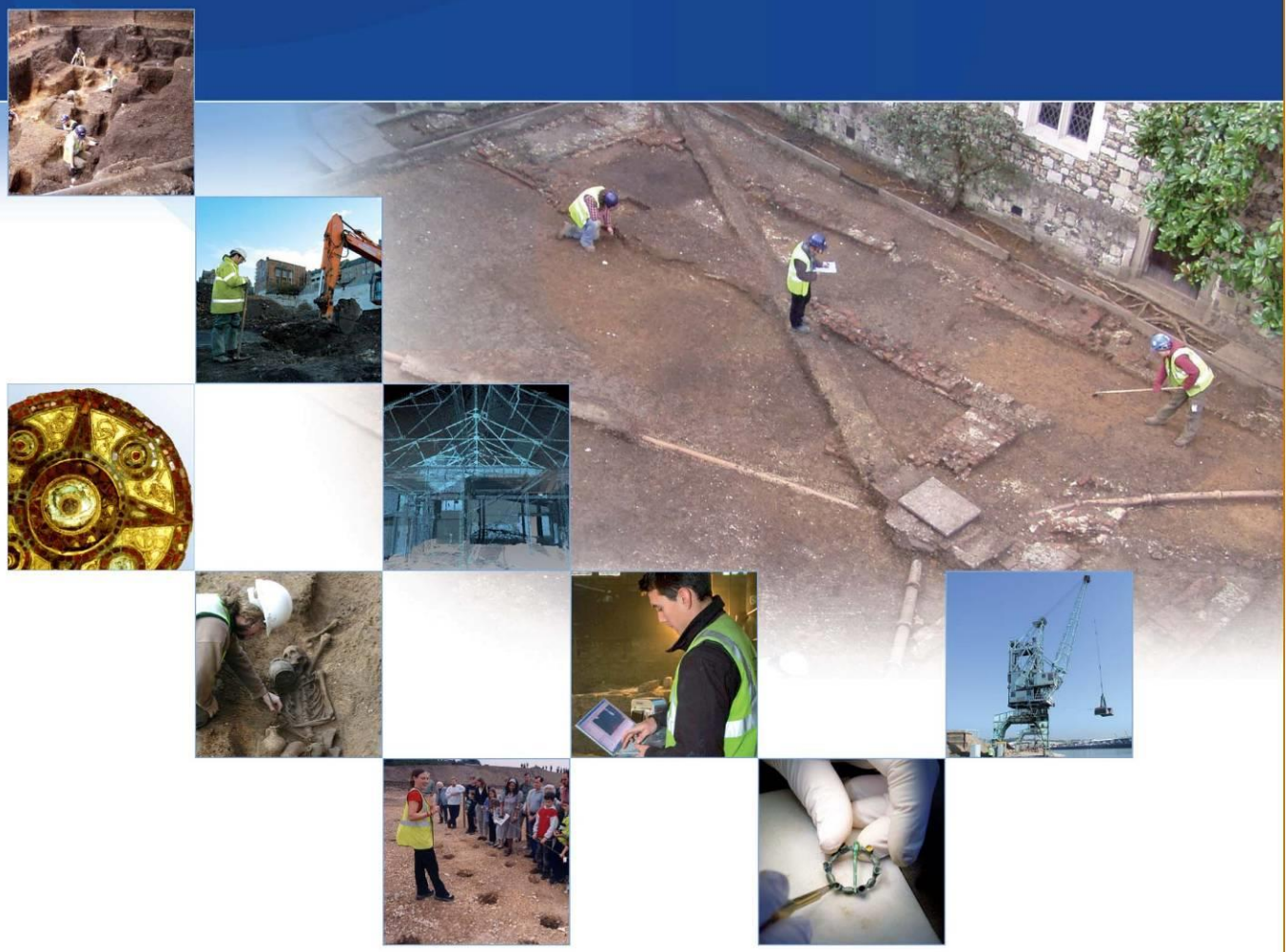
Appendix 5: Survey Processing Steps

Gradiometer survey	
Process	**Extent**
Zero Mean Traverse	All LMS =on, threshold -5 to 5
Despike	X=1 Y=1 Thr = 3 Repl = Mean
Clip	Min =-5 Max = 5
Destagger	All grids dir Shift = 2 Line Pattern 34-78 Dual-DS
Low Pass filter	X=1 Y=1 Wt=G
Interpolate	Y, Expand – Expand –SinX/X x2
Raw Palette Scale	Grey55 – Grey08 Min= -1nT Max= 2nT
Palette Scale	Grey55 – Grey08 Min= -1nT Max= 2nT

Appendix 6: Technical Terminology

Type of Anomaly	Description
Archaeology	
Archaeology - Trend	These are made up of linear / curvilinear / rectilinear anomalies and are either characterised by an increase or decrease in values compared to the magnetic background. This evidence is normally supported by the presence of archaeological remains and is confirmed by other forms of evidence such as HER records and aerial photography.
Archaeology - Area of Disturbance	This is characterised by a general increase and decrease of magnetic responses over a localised area and does not appear as having a linear form. These anomalies do not have the high dipolar response which are manifested in an 'iron spike' anomaly. This anomaly may be supported by the known location of a former building, or other forms of evidence such as HER records and aerial photography.
Archaeology - Pit	An anomaly composed of an increase in magnetic values with a patterning on the XY trace plot that is suggestive of buried remains, such as the infill of a pit. This evidence is normally supported by the presence of archaeological remains and is confirmed by other forms of evidence such as HER records and aerial photography.
Discrete Archaeology	
Archaeology? – Trend	Anomalies of a linear / curvilinear / rectilinear form either composed of an increased or decreased signal compared to magnetic background values. It is possible these anomalies belong to archaeological remains, but poor patterning or weaker response values makes interpretation difficult. Where historical records are present, the anomalies would appear to be weak or inconclusive.
Archaeology? - Area of Disturbance	Anomalies with an increase or decrease in magnetic values compared with the magnetic background over a localised area. Poor patterning or weak signal changes creates difficulty in defining the origin of the anomaly and so interpretation is only tentative. The anomaly lacks definitive records to confirm its origin as being archaeological. Disturbed areas could indicate the presence of buried rubble relating to fallen structures, or instead denote modern material from either quarrying or agricultural activity. On certain geologies these anomalies could be caused by in-filled natural features.
Archaeology? – Pit	An anomaly composed of an increase in magnetic values with a patterning on the XY trace plot that is suggestive of buried remains, such as the infill of a pit, but is isolated in its location and association with other features.
Unclear Origin	
Linear Trend	Anomalies of a linear / curvilinear form which are composed of a weak or different change in magnetic values. Coupled with poor patterning, the anomaly is difficult to interpret and it is unclear whether it has an archaeological origin.
Area of Disturbance	An area of magnetic disturbance which consists of a variety of increased and decreased magnetic values compared with background readings, but lacks sufficient patterning or context for a conclusive interpretation. It is likely that these readings are caused by modern disturbances, but interpretation is tentative.

Agricultural	
Linear Trend (Old Field Boundary)	These isolated long linear anomalies, most often represented as a negative magnetic trend, are likely to relate to former field boundaries. The magnetic signal may appear inconsistent but when the positioning is cross referenced with historic mapping, it is confirmed as a former field boundary.
Linear Trend (Old Field Boundary?)	These isolated long linear anomalies, most often represented as a negative magnetic trend, are likely to relate to former field boundaries. The positioning is not supported by historic mapping, but is often confirmed with adjacent ploughing patterns.
Linear Trend (Ridge and Furrow / Rig and Furrow)	A series of regular linear anomalies either composed of an increased or decreased magnetic response compared to background values. The width between the anomalies is consistent with that of a Ridge and Furrow ploughing regime, which is normally wider than conventional ploughing methods.
Linear Trend (Conventional ploughing)	A series of regular linear anomalies either composed of an increased or decreased magnetic response compared to background values. The regular patterning is likely to denote the presence of ploughing, however isolated trends can occasionally be observed that follow the orientation of ploughing trends seen elsewhere in the area. Anomalies seen adjacent to field edges are representative of headlands caused by ploughing.
Linear Trend (field drainage)	A series of linear anomalies of an indeterminate date, usually with a regular or herringbone patterning and regular spacing. These are likely to represent agricultural activity such as land drainage.
Non- Archaeology	
Geology / Natural	An area of disturbance that is composed of irregular significant increases or decreases in magnetic values compared with background readings and is likely to indicate natural variations in soil composition or geology.
Linear Trend (possible modern service)	Anomalies of a linear form often composed of contrasting high positive and negative values. Such anomalies usually signify a feature with a high level of magnetisation and are likely to belong to modern activity such as pipe lines or modern services.
Disturbed Area (modern disturbance?)	An area of disturbance that is likely to be caused by modern activity and is characterised by significant increases or decreases in magnetic values compared with background readings.
Isolated Dipolar Anomalies / Ferrous (iron spikes)	A response normally caused by ferrous materials on the ground surface or within the top soil, which causes a 'spike' representing a rapid variation in the magnetic response. These are generally not assessed to be archaeological when surveying on rural sites, and generally represent modern material often re-deposited during manuring.



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