

BURB21B



BURBAGE FIELDS FARM, BURBAGE, LEICESTERSHIRE

GEOPHYSICAL SURVEY REPORT

PLANNING REF. PRE-APPLICATION

commissioned by Redrow Homes Ltd

March 2021

BURBAGE FIELDS FARM, BURBAGE, LEICESTERSHIRE

GEOPHYSICAL SURVEY REPORT

PLANNING REF. PRE-APPLICATION

commissioned by Redrow Homes Ltd

March 2021

© 2021 by Headland Archaeology (UK) Ltd
Contains OS data © Crown copyright and database right (2021).

This report adheres to the quality standard of ISO 9001:2015

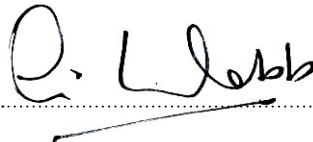
PROJECT INFO:

HA Project Code **BURB21b** / NGR **SP 443982 291586** / Parish **Burbage with Aston
Flamville** / Local Authority **Hinckley and Bosworth Borough Council** / Fieldwork Date **15/02/2021 –
17/02/2021** / OASIS Ref. **Headland5-417154**

PROJECT TEAM:

Project Manager **Alistair Webb** / Author **Matthew Berry** / Fieldwork **Michael Puntorno, Ross
Bishop** / Graphics **Beata Wieczorek-Oleksy, Matthew Berry**

Approved by **Alistair Webb**



Headland Archaeology Yorkshire & North
Units 23–25 & 15 | Acorn Business Centre | Balme Road | Cleckheaton BD19 4EZ
t 0127 493 8019
e yorkshireandnorth@headlandarchaeology.com
w www.headlandarchaeology.com



part of the **RSK** Group



PROJECT SUMMARY

Headland Archaeology (UK) Ltd undertook a geophysical (magnetometer) survey covering 22.5 hectares at Burbage, Leicestershire to support a planning application for a proposed residential development. The survey was undertaken to assess the impact of the proposed development on the historic environment and will inform future archaeological strategy at the site, if required.

The survey has successfully evaluated the PDA and has not identified any anomalies of definite or probable archaeological origin. Three separate clusters of discrete high magnitude anomalies have been interpreted as of possible archaeological in origin based on their grouping and magnitude of response although geological or modern causes are considered equally plausible.

Anomalies indicative of agricultural activity, including ridge and furrow cultivation (which is ubiquitous across most of the PDA), land drainage and boundary removal are identified. Other anomalies are due to modern activity such as the infilling of ponds or tipping and dumping or are caused by the sub-surface remains of former electricity pylons. Based on these results the PDA is assessed as having a low archaeological potential.

CONTENTS

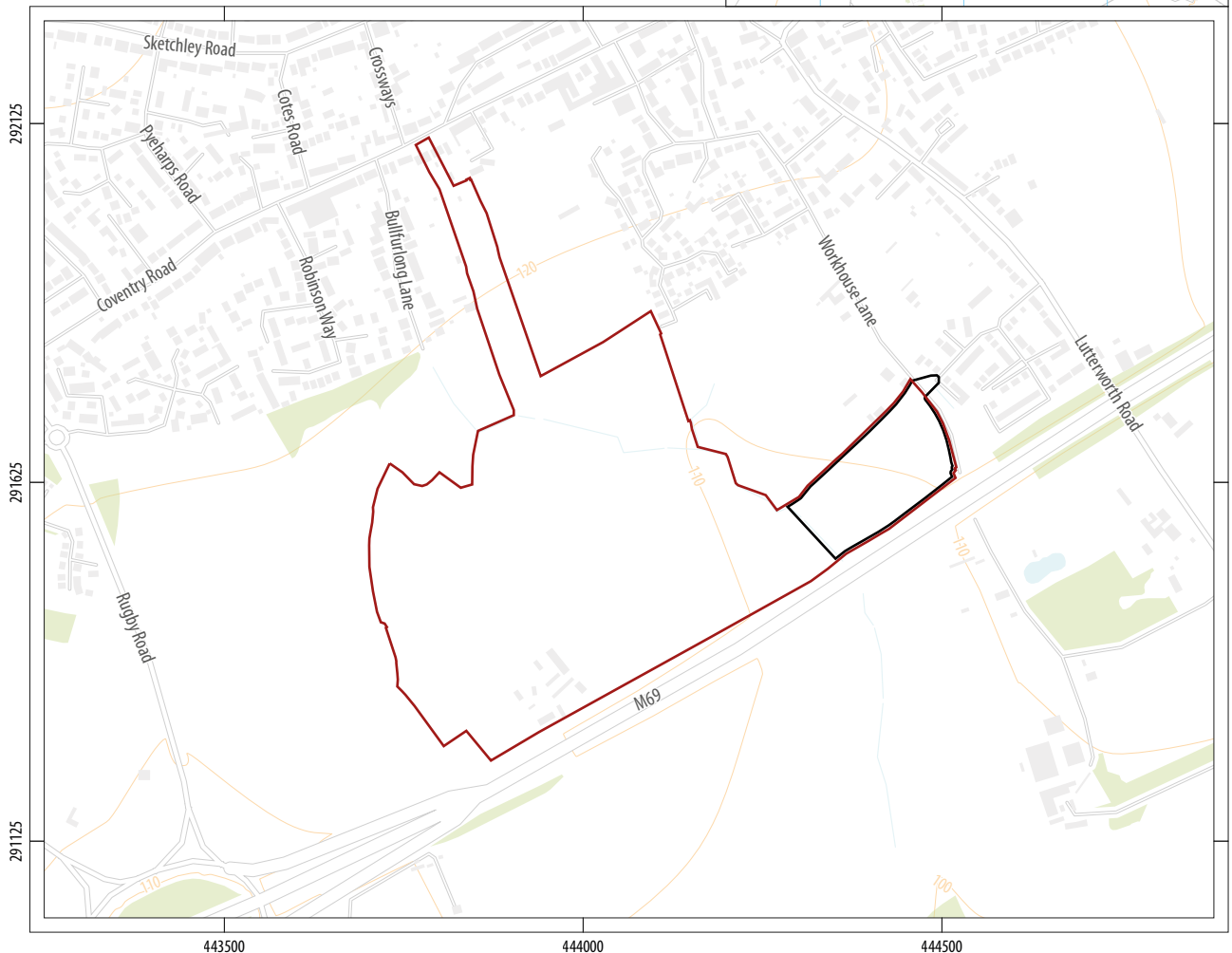
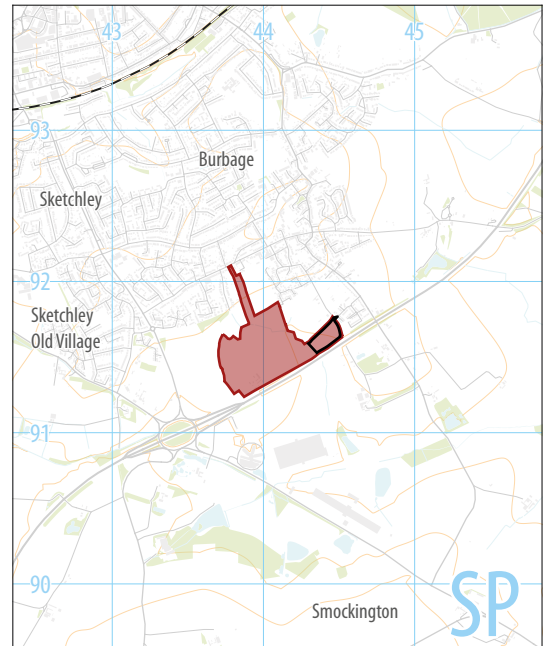
1	INTRODUCTION	1
1.1	SITE LOCATION, TOPOGRAPHY AND LAND-USE	1
1.2	GEOLOGY AND SOILS	1
2	ARCHAEOLOGICAL BACKGROUND	1
3	AIMS, METHODOLOGY AND PRESENTATION	2
3.1	MAGNETOMETER SURVEY	2
3.2	REPORTING	3
4	RESULTS AND DISCUSSION	3
4.1	FERROUS AND MODERN ANOMALIES	4
4.2	AGRICULTURAL ANOMALIES	4
4.3	GEOLOGICAL ANOMALIES	4
4.4	POSSIBLE ARCHAEOLOGICAL ANOMALIES	5
5	CONCLUSION	5
6	REFERENCES	5
7	APPENDICES	25
APPENDIX 1	MAGNETOMETER SURVEY	25
APPENDIX 2	SURVEY LOCATION INFORMATION	26
APPENDIX 3	GEOPHYSICAL SURVEY ARCHIVE	26
APPENDIX 4	DATA PROCESSING	26
APPENDIX 5	OASIS DATA COLLECTION FORM: ENGLAND	27

LIST OF ILLUSTRATIONS

ILLUS 1 SITE LOCATION	VIII
ILLUS 2 PDA LOOKING SOUTH-WEST	2
ILLUS 3 PDA LOOKING NORTH	3
ILLUS 4 PDA LOOKING SOUTH	4
ILLUS 5 SURVEY LOCATION SHOWING GPS SWATHS AND PHOTO LOCATIONS (1:4,000)	7
ILLUS 6 OVERALL GREYSCALE PLOT OF MAGNETOMETER DATA (1:4,000)	9
ILLUS 7 OVERALL INTERPRETATION OF MAGNETOMETER DATA (1:4,000)	11
ILLUS 8 PROCESSED GREYSCALE MAGNETOMETER DATA; SECTOR 1 (1:2,500)	13
ILLUS 9 XY TRACE PLOT OF MINIMALLY PROCESSED MAGNETOMETER DATA; SECTOR 1 (1:2,500)	15
ILLUS 10 INTERPRETATION OF MAGNETOMETER DATA; SECTOR 1 (1:2,500)	17
ILLUS 11 PROCESSED GREYSCALE MAGNETOMETER DATA; SECTOR 2 (1:2,500)	19
ILLUS 12 XY TRACE PLOT OF MINIMALLY PROCESSED MAGNETOMETER DATA; SECTOR 2 (1:2,500)	21
ILLUS 13 INTERPRETATION OF MAGNETOMETER DATA; SECTOR 2 (1:2,500)	23

Burbage Fields Farm
Burbage
Leicestershire

0 200km
1:12,500,000 @ A4



0 200m
1:10,000 @ A4

geophysical survey area
phase 2 survey area

HEADLAND
ARCHAEOLOGY

Headland Archaeology Yorkshire & North
Units 23-25 & 15 | Acorn Business Centre | Cleckheaton BD19 4EZ
t 0127 493 8019
e yorkshireandnorth@headlandarchaeology.com
w www.headlandarchaeology.com

ILLUS 1 Site location

BURBAGE FIELDS FARM, BURBAGE, LEICESTERSHIRE

GEOPHYSICAL SURVEY REPORT

1 INTRODUCTION

Headland Archaeology (UK) Ltd was commissioned by RSK Environment Ltd (The Consultant), on behalf of Redrow Homes Ltd (The Client) to undertake a geophysical (magnetometer) survey on land south of Burbage, Leicestershire (Illus 1).

The survey extended across eight fields (F1 to F8 inclusive) covering approximately 22.5 hectares. The results will support a planning application for a residential development and inform future archaeological strategy at the site, if required. The data and interpretation from a separate application in an adjoining ninth field (F9) are also included within this report for completeness although there is no discussion of the results from this survey which are fully reported separately (Headland 2021a).

The survey was undertaken to assess the impact of the proposed development on the historic environment and was undertaken in accordance with an Archaeological Written Scheme of Investigation (WSI; Headland 2021), with guidance within the National Planning Policy Framework (MHCLG 2019) and in line with current best practice (Chartered Institute for Archaeologists 2014, Europae Archaeologia Consilium 2016).

The survey was carried out between February 15th and February 17th 2021.

1.1 SITE LOCATION, TOPOGRAPHY AND LAND-USE

The Proposed Development Area (PDA) comprises eight contiguous pasture fields covering approximately 22.5 hectares located south of Burbage, Leicestershire, centred at NGR SP 443982, 291586 (Illus 1). The PDA is bound by the M69 motorway to the south, Bullfurlong

Lane to the west and largely open pasture to the north and east. A ditch draining springs located to the north-west and east of the PDA demarcates most of the eastern limits of the survey.

Topographically, the PDA is generally flat gradually sloping down to the south and east. The northernmost field lies at 125m Above Ordnance Datum (AOD), the area around Burbage Fields Farm to the south-west at 115m AOD and land at the south-east extent of the PDA at 111m AOD.

1.2 GEOLOGY AND SOILS

The underlying bedrock geology comprises Mercia Mudstone Group and is predominantly overlain by Oadby Member Diamicton superficial deposits. Areas of Wolston Sand and Gravel and Dunsmore Sand and Gravel are recorded in the north-east corner and northernmost field of the PDA respectively. A band of Alluvium (Clay, Silt, Sand and Gravel) borders the line of the ditch which marks the eastern PDA boundary (UKRI 2021).

The soils are classified in the Soilscape 8 Association, being characterised as slightly acid loamy and clayey soils with impeded drainage (Cranfield University 2021).

2 ARCHAEOLOGICAL BACKGROUND

Detailed historic background information relating to the proposed development is contained within a Desk-Based Assessment (DBA; RSK 2019) with only a summary provided herein.

The DBA (RSK 2019) identifies there are no designated heritage assets and only one known non-designated heritage asset, Burbage Fields Farm (HER MLE24420) within the PDA.



ILLUS 2 PDA looking south-west

A further twenty-six non-designated heritage assets are recorded by Leicestershire Historic Environment Record (LHER) within a wider 500m study area. Of these, the most pertinent to this survey are located north of the PDA on the southern periphery of Burbage. Here, ten non-designated assets range in date from the prehistoric to medieval periods indicating a longstanding use of the surrounding landscape.

A Bronze Age cemetery (HER MLE23172), Iron Age enclosure (HER MLE21696) and Romano-British field systems and agricultural remains (HER MLE20670) have been identified through fieldwalking and archaeological excavations approximately 150m north-east of F3.

West of this location, in the vicinity of the present recreation ground, immediately east of F2 and north of F3, further records of Roman sites (HER MLE18736 and MLE2846) have been recorded in addition to a ring ditch (HER MLE20838) and prehistoric (HER MLE18737), Anglo-Saxon (HER MLE6181) and medieval findspots (HER MLE6788).

The presence of ridge and furrow cultivation of likely medieval or early post-medieval date within the PDA and neighbouring fields indicate the landscape was extensively agriculturally exploited during these periods. Ridge and furrow earthworks are recorded on a LHER plan transcribed from historical aerial photos in all but I1 and L2. Where ridge and furrow earthworks are extant, they are assessed as either poorly (in F3, F6 and F7) or very poorly (in F8) preserved based on LiDAR data (RSK 2019). The DBA (RSK 2019) suggests, given the predominantly agricultural setting of land within the PDA, that any surviving evidence of settlement is unlikely but that there remains a moderate potential for previously unknown medieval archaeology to be preserved.

Cartographic sources indicate the layout of the PDA has remained largely unchanged until the removal of internal field boundaries in the late 1980s. Between 1964 and 1979 the M69 motorway delineating the southern boundary of the PDA was constructed.

Based on the favourable geographic location close to two springs and the presence of multi-period archaeological activity in the surrounding landscape the DBA (RSK 2019) identifies the potential for the discovery of previously unrecorded archaeology as generally moderate to high.

3 AIMS, METHODOLOGY AND PRESENTATION

The general aim of the geophysical survey was to provide enough information to establish the presence/absence, character and extent of any archaeological remains within the PDA. This will therefore enable an assessment to be made of the impact of the proposed development on any sub-surface archaeological remains, if present.

The specific archaeological objectives of the geophysical survey were:

- › to gather enough information to inform the extent, condition, character and date (as far as circumstances permit) of any archaeological features and deposits within the PDA;
- › to obtain information that will contribute to an evaluation of the significance of the scheme upon cultural heritage assets; and
- › to prepare a report summarising the results of the survey.

3.1 MAGNETOMETER SURVEY

Magnetic survey methods rely on the ability of a variety of instruments to measure very small magnetic fields associated with buried archaeological remains. A feature such as a ditch, pit or kiln can act like a small magnet, or series of magnets, that produce distortions (anomalies) in the earth's magnetic field. In mapping these slight variations, detailed plans of sites can be obtained as buried features often produce reasonably characteristic anomaly

**ILLUS 3** PDA looking north

shapes and strengths (Gaffney & Gater 2003). Further information on soil magnetism and the interpretation of magnetic anomalies is provided in Appendix 1.

The survey was undertaken using four Bartington Grad601 sensors mounted at 1m intervals (1m traverse interval) onto a rigid carrying frame. The system was programmed to take readings at a frequency of 10Hz (allowing for a 10–15cm sample interval) on roaming traverses (swaths) 4m apart. These readings were stored on an external weatherproof laptop and later downloaded for processing and interpretation. The system was linked to a Trimble R8s Real Time Kinetic (RTK) differential Global Positioning System (dGPS) outputting in NMEA mode to ensure a high positional accuracy for each data point.

MLGrad601 and MultiGrad601 (Geomar Software Inc.) software was used to collect and export the data. Terrasurveyor V3.0.36.0 (DWConsulting) software was used to process and present the data.

3.2 REPORTING

A general site location plan is shown in Illus 1 at a scale of 1:10,000. Illus 2 to Illus 4 are site condition photographs. Illus 5 shows the GPS swaths and photo locations at 1:4,000. Overall data plots and interpretation are included as Illus 6 and Illus 7, also at a scale of 1:4,000. Fully processed (greyscale) data, minimally processed data (XY trace plot) and interpretative plots are presented at a scale of 1:2,500, by sector, in Illus 8 to Illus 13 inclusive.

Technical information on the equipment used, data processing and magnetic survey methodology is given in Appendix 1. Appendix 2 details the survey location information and Appendix 3 describes the composition and location of the site archive. Data processing details are presented in Appendix 4. A copy of the OASIS entry (Online Access to the Index of Archaeological Investigations) is reproduced in Appendix 5.

The survey methodology, report and any recommendations comply with the Written Scheme of Investigation (Headland 2021), guidelines outlined by Europae Archaeologia Consilium (EAC 2016) and by the Chartered Institute for Archaeologists (CIfA 2014). All illustrations from Ordnance Survey (OS) mapping are reproduced with the permission of the controller of Her Majesty's Stationery Office (© Crown copyright).

The illustrations 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 illustrations are presented to display and interpret the data to best effect. The interpretations are based on the experience and knowledge of management and reporting staff.

4 RESULTS AND DISCUSSION

Ground conditions at the time of survey were very good leading to a high standard of data acquisition requiring minimal processing. The PDA was surveyed in full except for a small area which was waterlogged in the location of a shallow gully in F3, a dumping ground associated with Burbage Fields Farm in F7 (Illus 2) and around an electricity pylon in F8.

Mixed superficial deposits of sand and gravel, alluvium and diamicton recorded across the PDA have generally proved adequate for magnetic prospection despite producing a variable magnetic background containing numerous discrete high magnitude anomalies. Possible anomalies of interest have generally provided a weak magnetic contrast against this natural background. However, several magnetically enhanced anomalies have been identified which are thought to provide a reliable indication of the extent of any sub-surface features. The anomalies can be classified into categories (see below).



ILLUS 4 PDA looking south

4.1 FERROUS AND MODERN ANOMALIES

Ferrous anomalies, characterised as individual 'spikes', are typically caused by ferrous (magnetic) material, either on the ground surface or in the plough-soil. Little importance is normally given to such anomalies, unless there is any supporting evidence for an archaeological interpretation, as modern ferrous debris is common on most sites, often being introduced into the topsoil as a result of manuring or tipping/infilling. There is no obvious clustering to these ferrous anomalies which might indicate an archaeological origin. Far more probable is that the 'spike' responses are likely caused by the random distribution of ferrous debris in the upper soil horizons.

Strongly magnetic responses covering an area of 30m x 13m in the north-east corner of F3 (MD1) are defined by the line of a former field boundary FB1 (Illus 8–10). This disturbance is likely associated with the former use of this area as allotments.

Concentrated areas of magnetic disturbance in the western half of F4 (MD2; Illus 8–10) and the north-east corner of F5 (MD3; Illus 8–10) correspond to infilled ponds recorded on historic OS mapping.

A large area of magnetic disturbance in the south-east corner of F7 (MD4; Illus 8–10) corresponds to a likely pit and dumping ground associated with Burbage Fields Farm identifiable from satellite imagery.

Strongly magnetic linear anomalies indicative of buried service pipes or cables are evident in F1 (SP1), F5 and F6 (SP2 and SP3; Illus 8–10).

Former electricity pylon bases are recorded along the current line of the overhead electricity cables as characteristic equidistantly spaced high magnitude 'spike' responses from the struts at each corner of the pylon. Five former pylons are identified; in the western half of F5 (PY1 and PY2), in F7 (PY3; Illus 8–10) and F8 (PY4 and PY5; Illus 11–13).

Magnetic disturbance around the periphery of most of the fields within the PDA is due to ferrous material within, or adjacent to, the boundaries and is of no archaeological interest.

4.2 AGRICULTURAL ANOMALIES

The most common anomalies detected across the PDA are the elongated, slightly curving and parallel, low magnitude anomalies, aligned parallel with the extant field boundaries. These anomalies are typical of ridge and furrow cultivation and are caused by the magnetic contrast between the soil infilling the furrows and former ridges and are recorded in all fields, with the exception of F1 and F2. These anomalies correlate with those transcribed from historic aerial photographs (RSK 2019, Figure 17).

Six field boundaries FB1–FB4 (Sector 1; Illus 8–10 and FB5–FB6 (Sector 2; Illus 11–13) have been removed since the publication of the first edition OS mapping of the area and these are identifiable as linear and curvilinear anomalies in the survey data. A weakly magnetic right angled linear anomaly (FB?1) in F3 is interpreted as a possible former boundary with its northern edge possibly a continuation of former boundary FB1 (Illus 8–10) although this boundary is not recorded on historic mapping.

Other high magnitude linear anomalies (FD1–FD5 in Sector 1; Illus 8–10 and FD6 and FD7 in Sector 2; Illus 11–13) in F3, F5 and F8 are interpreted as probable field drains.

4.3 GEOLOGICAL ANOMALIES

Occasional and sporadic discrete low magnitude anomalies visible throughout the PDA are due to localised variations in the depth and composition of the topsoil and superficial deposits and are not thought to be of any archaeological potential. Only the most conspicuous of these anomalies have been shown on the interpretation graphic.

4.4 POSSIBLE ARCHAEOLOGICAL ANOMALIES

Three clusters of discrete high magnitude anomalies have been interpreted as possibly archaeological in origin. Discrete high magnitude anomalies at P1 and P2 in F3 (Illus 8–10) occur either side of the weak linear anomaly interpreted as a possible former boundary (FB?1). These pit-like anomalies have been interpreted as possibly archaeological in origin due to their grouping and elevated strength of response compared to the other discrete geological anomalies caused by variations in the superficial deposits. These anomalies are also located in the adjacent field south of previously identified non-designated heritage assets relating to Roman sites (HER MLE18736 and MLE2846), a ring ditch (HER MLE20838) and prehistoric (HER MLE18737), Anglo-Saxon (HER MLE6181) and medieval findspots (HER MLE6788). Anomalies at P3 (Illus 11–13) in F8 have also been highlighted as possibly archaeological for similar reasons.

No anomalies of probable or definite archaeological origin have been identified within the PDA.

5 CONCLUSION

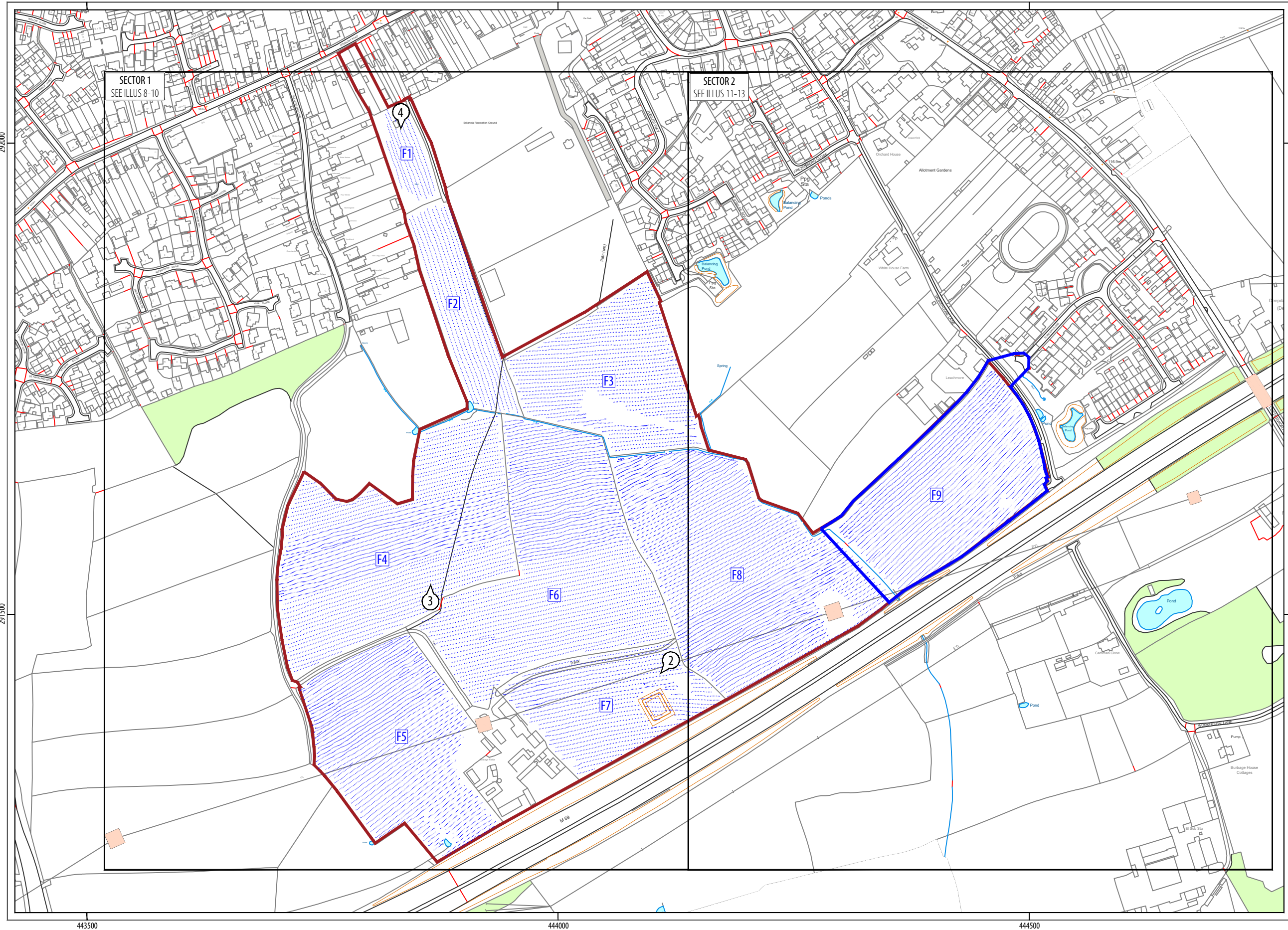
The survey has successfully evaluated the PDA and has not identified any anomalies of definite or probable archaeological origin.

Three separate clusters of discrete high magnitude anomalies have been interpreted as possibly archaeological in origin based on their grouping and magnitude of response although geological or modern causes are considered equally plausible.

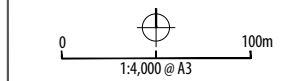
Anomalies indicative of agricultural activity, including ridge and furrow cultivation which is ubiquitous across most of the PDA, land drainage and boundary removal are identified as are anomalies due to modern activity such as the infilling of ponds, tipping and dumping or which locate the below ground remains of electricity pylon bases. Based on these results the PDA is assessed as having a low archaeological potential.

6 REFERENCES

- Chartered Institute for Archaeologists (CIfA) 2014 *Standard and guidance for archaeological geophysical survey* (Reading) https://www.archaeologists.net/sites/default/files/CIfAS%26GGeophysics_3.pdf accessed 3rd March 2021
- Cranfield University 2021 *Cranfield Soil and Agrifood Institute Soilscales* <http://www.landis.org.uk/soilscales/> accessed 3rd March 2021
- Headland Archaeology 2021a *Burbage Fields Farm, Burbage, Leicestershire: Written Scheme of Investigation for Geophysical Survey* [unpublished client document] Ref BURB21
- Headland Archaeology 2021b *Land South-West of Lutterworth Road, Burbage (Phase 2), Leicestershire: Geophysical Survey* [unpublished client document] Ref BURB21a
- Natural Environment Research Council (UKRI) 2021 *British Geological Survey* <http://www.bgs.ac.uk/> accessed 3rd March 2021
- Europae Archaeologia Consilium (EAC) 2016 *EAC Guidelines for the Use of Geophysics in Archaeology: Question to Ask and Points to Consider* (Namur, Belgium) <https://www.europae-archaeologiae-consilium.org/eac-guidelines> accessed 12th February 2021
- Gaffney C & Gater J 2003 *Revealing the Buried Past: Geophysics for Archaeologists* Stroud
- Ministry of Housing, Communities and Local Government (MHCLG) 2019 *National Planning Policy Framework* https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/810197/NPPF_Feb_2019_revised.pdf accessed 12th February 2020
- RSK Environment Ltd 2019 *Burbage Fields Farm, Burbage, Leicestershire Archaeological Desk-Based Assessment* [unpublished client document] Project No. 19–324



- geophysical survey area
- phase 2 survey area
- GPS swaths
- location and direction of ILLUS 2-4



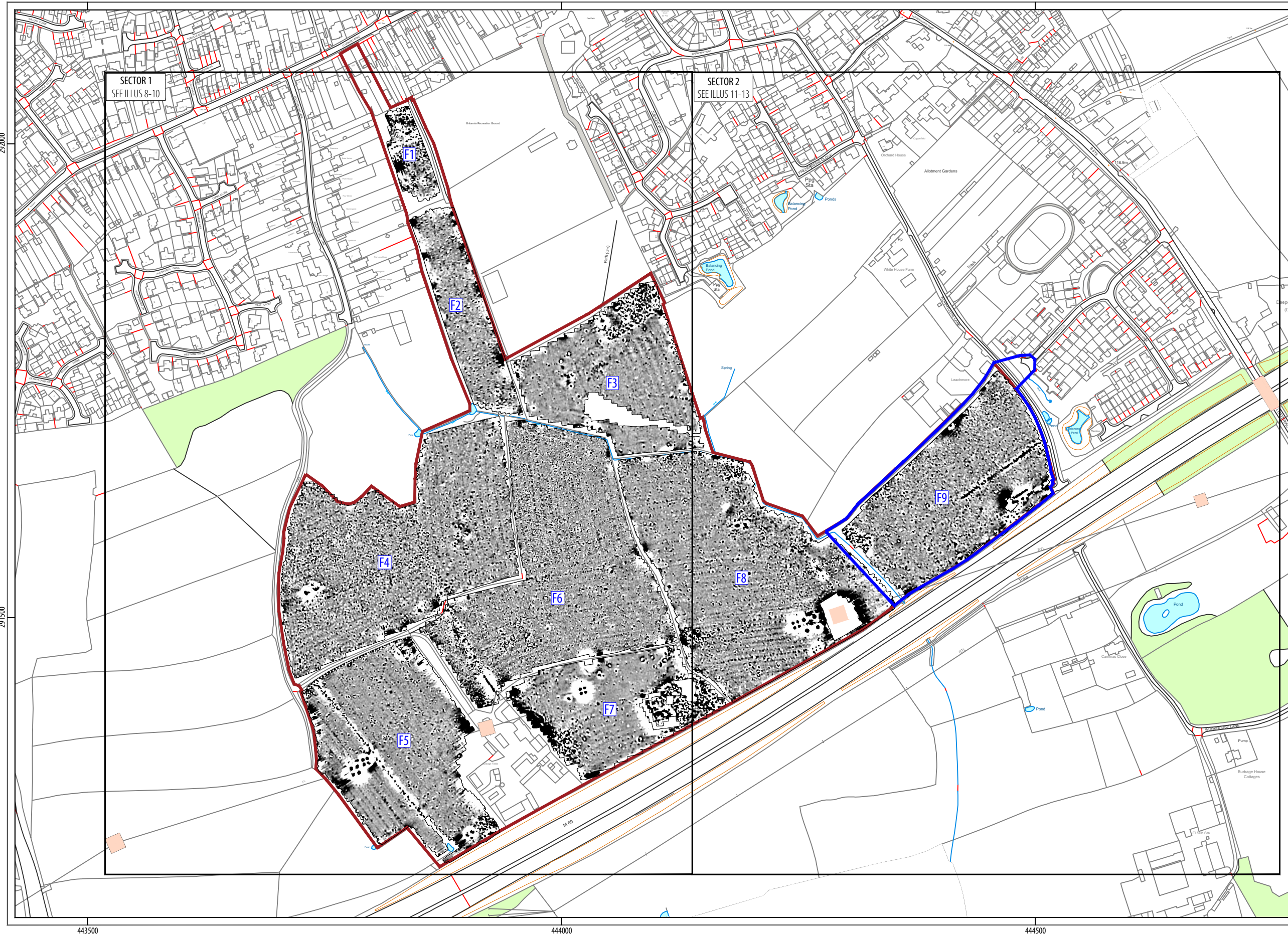
PROJECT BURB21
Burbage Fields Farm
Burbage
Leicestershire

CLIENT Redrow Homes Ltd

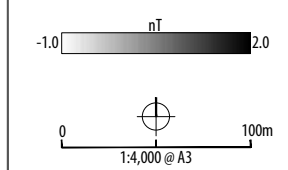


Headland Archaeology Yorkshire & North
Units 23-25 | Acorn Business Centre | Balme Road
Cleckheaton | BD19 4EZ
t0127 493 8019
w www.headlandarchaeology.com

ILLUS 5 Geophysical survey location showing GPS swaths and photo locations



▬ geophysical survey area
▬ phase 2 survey area

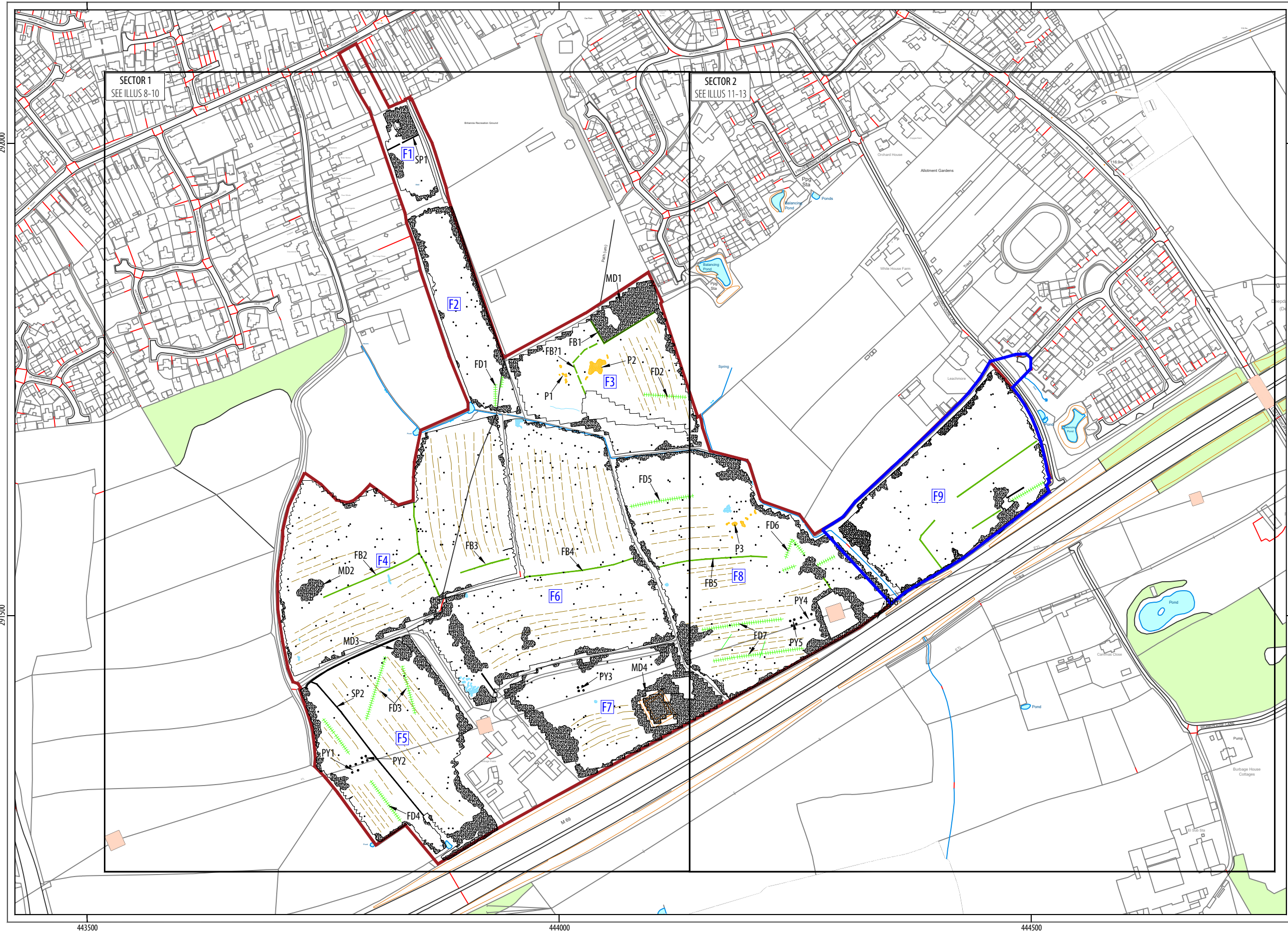


PROJECT BURB21
 Burbage Fields Farm
 Burbage
 Leicestershire
CLIENT Redrow Homes Ltd



Headland Archaeology Yorkshire & North
 Units 23-25 | Acorn Business Centre | Balme Road
 Cleckheaton | BD19 4EZ
 t0127 493 8019
 w www.headlandarchaeology.com

ILLUS 6 Overall greyscale plot of magnetometer data



geophysical survey area
phase 2 survey area

TYPE OF ANOMALY	INTERPRETATION
dipolar isolated	ferrous material
magnetic disturbance	ferrous material
dipolar linear	service pipe
linear trend	ridge and furrow
linear trend	agricultural
linear trend	field drain
linear	former field boundary
linear trend	geological variation
magnetic enhancement	geology
magnetic enhancement	archaeology?

ABBREVIATIONS

FB	former boundary
FD	field drain
MD	magnetic disturbance
P	pit
PY	pylon base
SP	service pipe

0 100m
1:4,000 @ A3

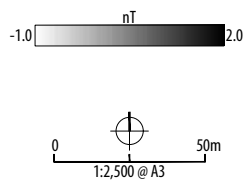
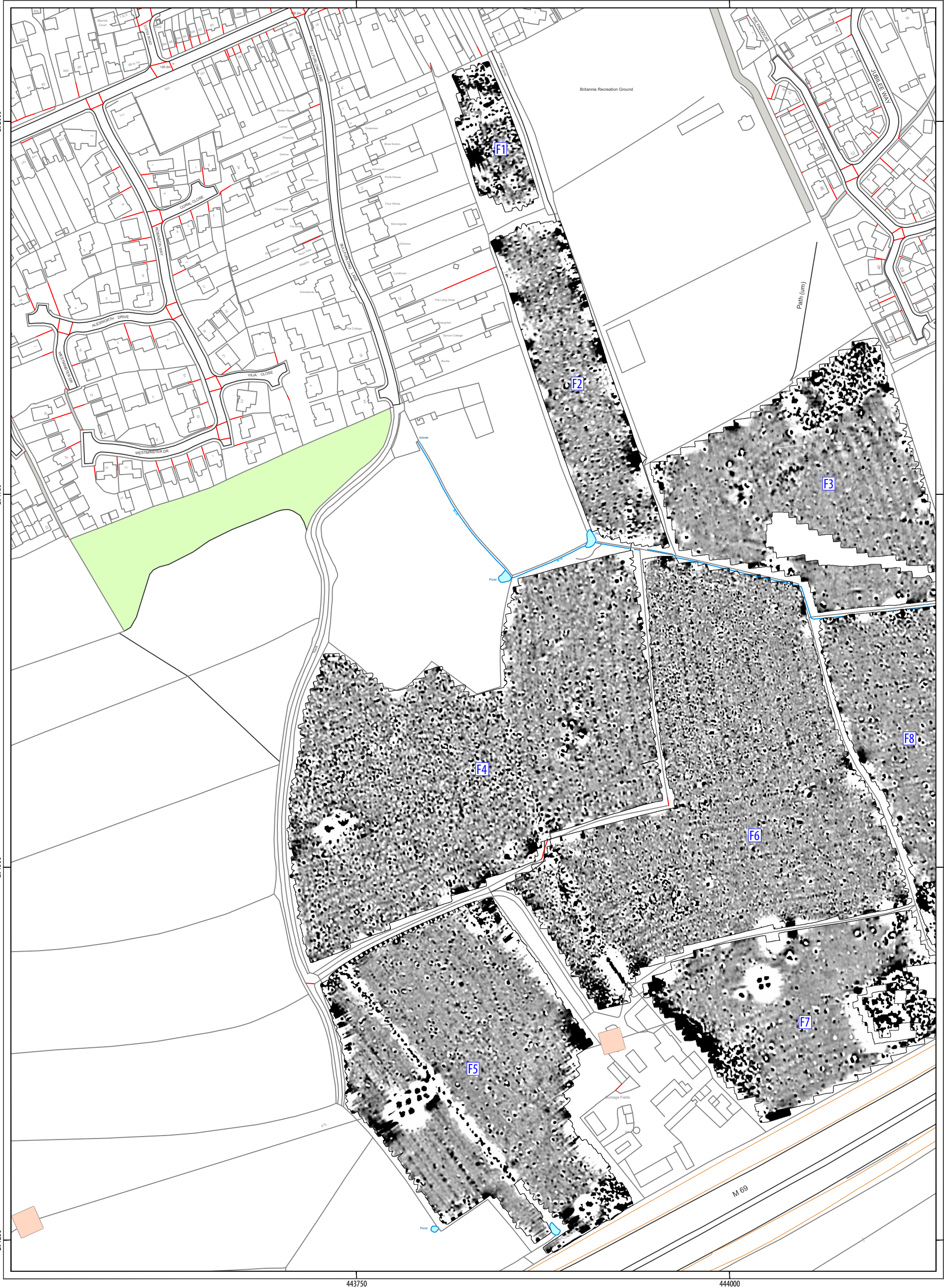
PROJECT BURB21
Burbage Fields Farm
Burbage
Leicestershire

CLIENT Redrow Homes Ltd

HEADLAND
ARCHAEOLOGY

Headland Archaeology Yorkshire & North
Units 23-25 | Acorn Business Centre | Balme Road
Cleckheaton | BD19 4EZ
t0127 493 8019
w www.headlandarchaeology.com

ILLUS 7 Overall interpretation of magnetometer data



PROJECT BURB21
Burbage Fields Farm
Burbage
Leicestershire
Redrow Homes Ltd

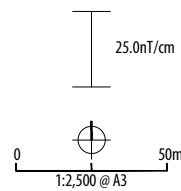
CLIENT

**HEADLAND
ARCHAEOLOGY**

Headland Archaeology Yorkshire & North
Units 23-25 | Acorn Business Centre | Balme Road
Cleckheaton | BD19 4EZ
t 0127 493 8019
w www.headlandarchaeology.com

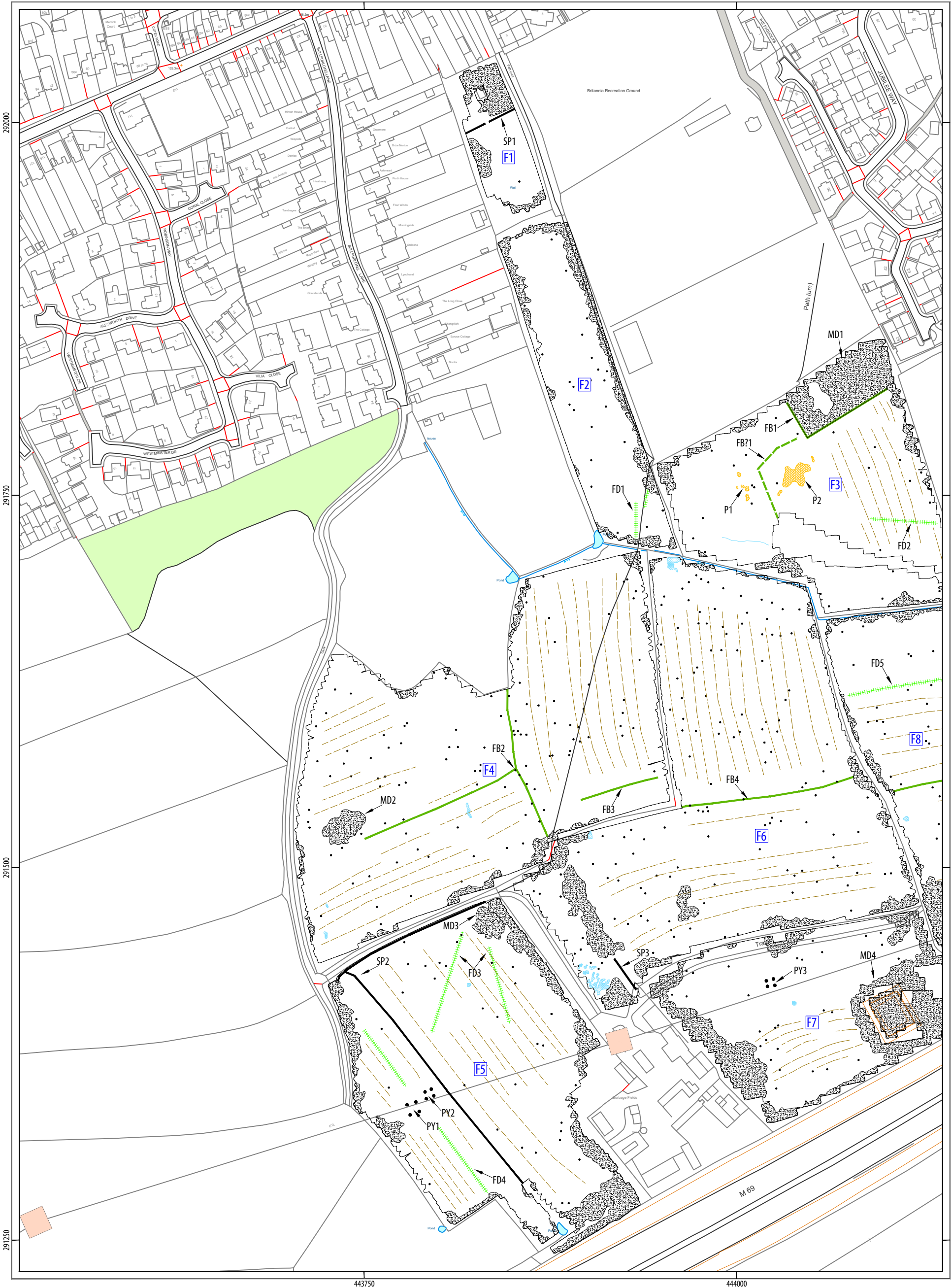


ILLUS 9 XY trace plot of minimally processed magnetometer data; Sector1



PROJECT BURB21
Burbage Fields Farm
Burbage
Leicestershire
CLIENT Redrow Homes Ltd

HEADLAND
ARCHAEOLOGY
Headland Archaeology Yorkshire & North
Units 23-25 | Acorn Business Centre | Balme Road
Cleckheaton | BD19 4EZ
t 0127 493 8019
w www.headlandarchaeology.com

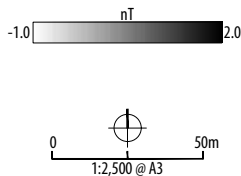


TYPE OF ANOMALY	INTERPRETATION	TYPE OF ANOMALY	INTERPRETATION	ABBREVIATIONS	PROJECT	HEADLAND ARCHAEOLOGY Headland Archaeology Yorkshire & North Units 23-25 Acorn Business Centre Balme Road Cleckheaton BD19 4EZ t 0127 493 8019 www.headlandarchaeology.com
• dipolar isolated	ferrous material	— linear	former field boundary	FB former boundary	BURB21	
• magnetic disturbance	ferrous material	— linear	former field boundary?	FD field drain	Burbage Fields Farm	
— dipolar linear	service pipe	— linear trend	geological variation	MD magnetic disturbance	Burbage	
— linear trend	ridge and furrow	• magnetic enhancement	geology	P pit	Leicestershire	
— linear trend	agricultural	• magnetic enhancement	archaeology?	PY pylon base	Redrow Homes Ltd	
— linear trend	field drain			SP service pipe		

ILLUS 10 Interpretation of magnetometer data; Sector 1



ILLUS 11 Greyscale magnetometer data; Sector2

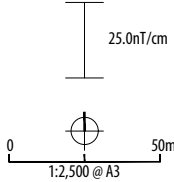


PROJECT BURB21
Burbage Fields Farm
Burbage
Leicestershire
Redrow Homes Ltd

CLIENT

HEADLAND
ARCHAEOLOGY

Headland Archaeology Yorkshire & North
Units 23-25 | Acorn Business Centre | Balme Road
Cleckheaton | BD19 4EZ
t 0127 493 8019
w www.headlandarchaeology.com

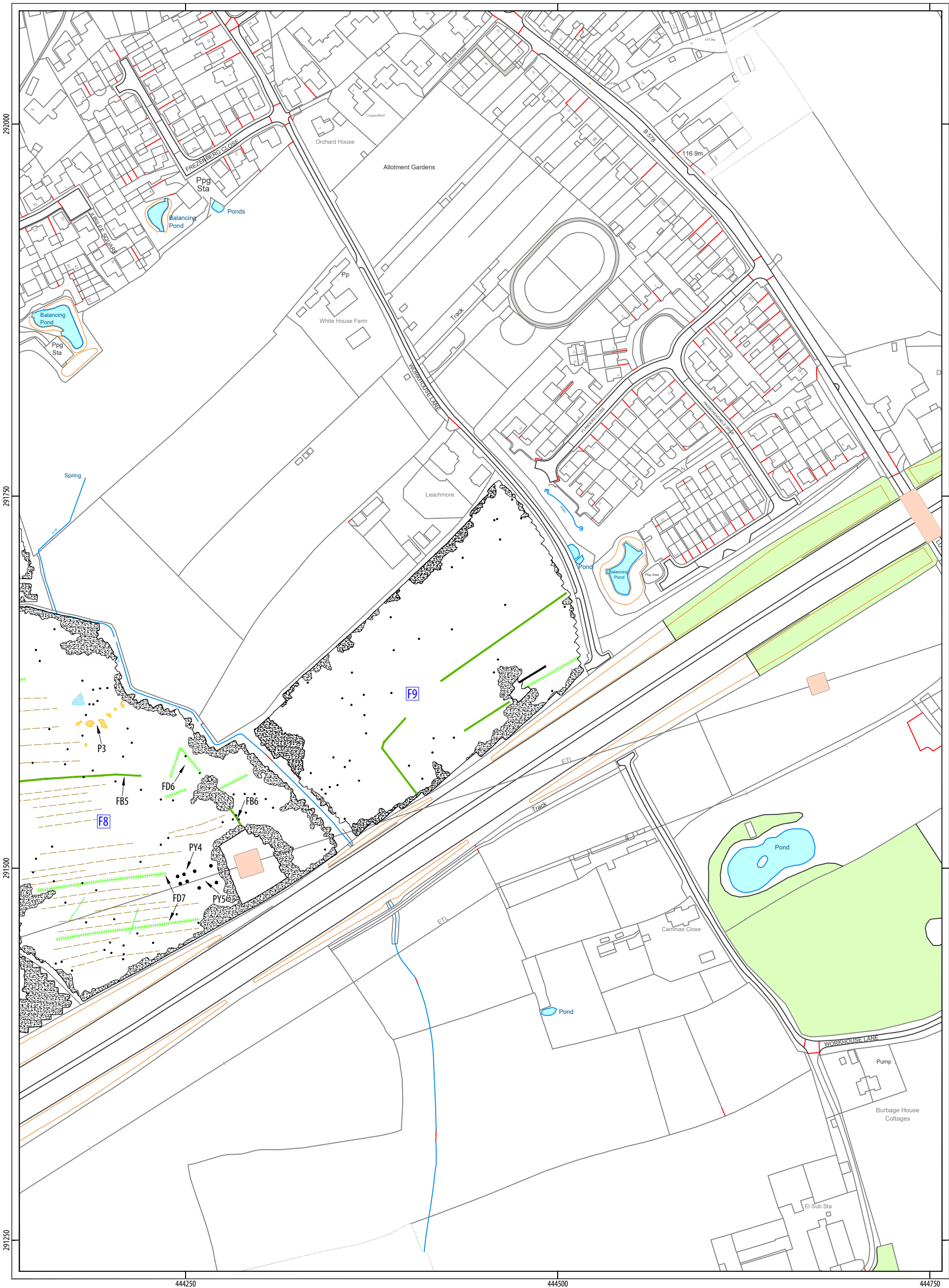


PROJECT BURB21
Burbage Fields Farm
Burbage
Leicestershire
CLIENT Redrow Homes Ltd



Headland Archaeology Yorkshire & North
Units 23-25 | Acorn Business Centre | Balme Road
Cleckheaton | BD19 4EZ
t 0127 493 8019
w www.headlandarchaeology.com

ILLUS 12 XY trace plot of minimally processed magnetometer data; Sector2



TYPE OF ANOMALY - dipolar isolated - magnetic disturbance - dipolar linear - linear trend - linear trend - linear trend	INTERPRETATION - ferrous material - ferrous material - service pipe - ridge and furrow - agricultural - field drain	TYPE OF ANOMALY - linear - magnetic enhancement - magnetic enhancement	INTERPRETATION - former field boundary - geology - archaeology?	ABBREVIATIONS - FB former boundary - FD field drain - P pit - PY pylon base	PROJECT - BURB21 - Burbage Fields Farm - Burbage - Leicestershire - Redrow Homes Ltd	CLIENT Redrow Homes Ltd	HEADLAND ARCHAEOLOGY Headland Archaeology Yorkshire & North Units 23-25 Acorn Business Centre Balme Road Cleckheaton BD19 4EZ t 0127 493 8019 w www.headlandarchaeology.com
--	--	---	--	--	---	--	---

ILLUS 13 Interpretation of magnetometer data; Sector2

7 APPENDICES

APPENDIX 1 MAGNETOMETER SURVEY

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 haematite. 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 so that by measuring the magnetic susceptibility of the topsoil, areas where human occupation or settlement has occurred can be identified by virtue 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. This effect can lead to the detection of features such as hearths, kilns or areas of burning.

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.

Where it is not possible to give a probable cause of an observed anomaly a '?' is appended.

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.

Lightning-induced remnant magnetisation (LIRM) LIRM anomalies are thought to be caused in the near surface soil horizons by the flow of an electrical current associated with lightning strikes. These observed anomalies have a strong bipolar signal which decreases with distance from the spike point and often appear as linear or radial in shape.

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 (sometimes only visible on an XY trace plot) 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.

APPENDIX 2 SURVEY LOCATION INFORMATION

An initial survey base station was established using a Trimble VRS differential Global Positioning System (dGPS). The magnetometer data was georeferenced using a Trimble RTK differential Global Positioning System (Trimble R8s model).

Temporary sight markers were laid out using a Trimble VRS differential Global Positioning System (Trimble R8s model) to guide the operator and ensure full coverage. The accuracy of this dGPS equipment is better than 0.01m.

The survey data 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 coordinates are measured off hard copies of the mapping rather than using the digital coordinates.

Headland Archaeology cannot accept responsibility for errors of fact or opinion resulting from data supplied by a third party.

APPENDIX 3 GEOPHYSICAL SURVEY ARCHIVE

The geophysical archive comprises an archive disk containing the raw data in XYZ format, a raster image of each greyscale plot with associated world file, and a PDF of the report.

The project will be archived in-house in accordance with recent good practice guidelines (http://guides.archaeologydataservice.ac.uk/g2gp/Geophysics_3). The data will be stored in an indexed archive and migrated to new formats when necessary.

APPENDIX 4 DATA PROCESSING

The gradiometer data has been presented in this report in processed greyscale and minimally processed XY trace plot format.

Data collected using RTK GPS-based methods cannot be produced without minimal processing of the data. The minimally processed data has been interpolated to project the data onto a regular grid and de-striped to correct for slight variations in instrument calibration drift and any other artificial data.

A high pass filter has been applied to the greyscale plots to remove low frequency anomalies (relating to survey tracks and modern agricultural features) to maximise the clarity and interpretability of the archaeological anomalies.

The data has also been clipped to remove extreme values and to improve data contrast.

APPENDIX 5 OASIS DATA COLLECTION FORM: ENGLAND

OASIS ID: *headland5-417154***PROJECT DETAILS**

Project name	Burbage Fields Farm
Short description of the project	Headland Archaeology (UK) Ltd undertook a geophysical (magnetometer) survey covering 22.5 hectares at Burbage, Leicestershire to support a planning application for a proposed residential development. The survey was undertaken to assess the impact of the proposed development on the historic environment and will inform future archaeological strategy at the site, if required. The survey has successfully evaluated the PDA and has not identified any anomalies of definite or probable archaeological origin. Three separate clusters of discrete high magnitude anomalies have been interpreted as of possible archaeological in origin based on their grouping and magnitude of response although geological or modern causes are considered equally plausible. Anomalies indicative of agricultural activity, including ridge and furrow cultivation (which is ubiquitous across most of the PDA), land drainage and boundary removal are identified. Other anomalies are due to modern activity such as the infilling of ponds or tipping and dumping or are caused by the sub-surface remains of former electricity pylons. Based on these results the PDA is assessed as having a low archaeological potential.
Project dates	Start: 15-02-2021 End: 17-02-2021
Previous/future work	Not known / Not known
Any associated project reference codes	BURB21b - Contracting Unit No.
Type of project	Field evaluation
Site status	None
Current Land use	Cultivated Land 1 - Minimal cultivation
Monument type	None
Monument type	None
Significant Finds	None
Significant Finds	None
Methods & techniques	'Geophysical Survey'
Development type	Housing estate
Prompt	National Planning Policy Framework - NPPF
Position in the planning process	Pre-application
Solid geology (other)	Mercia Mudstone
Drift geology (other)	Diamicton
Techniques	Magnetometry

PROJECT LOCATION

Country	England
Site location	Leicestershire Hinckley And Bosworth Burbage, Burbage Fields Farm, Burbage
Postcode	LE10 3ES
Study area	22.5 Hectares
Site coordinates	SP 439820 915860 52.520012445918 -1.351731433064 52 31 12 N 001 21 06 W Point
Height OD / Depth	Min: 111m Max: 125m

PROJECT CREATORS

Name of Organisation	Headland Archaeology
Project brief originator	Headland Archaeology
Project design originator	Headland Archaeology
Project director/manager	Alistair Webb
Project supervisor	Peter Heykoop

Type of sponsor/funding body	Developer
Name of sponsor/funding body	Redrow Homes

PROJECT ARCHIVES

Physical Archive Exists?	None
Digital Archive recipient	Headland Archaeology
Digital Contents	'None'
Digital Media available	'Geophysics'
Paper Archive Exists?	None

Entered by	Alistair Webb (alistair.webb@headlandarchaeology.com)
Entered on	11 March 2021