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Hilfield Solar Farm and Battery Storage

Geophysical Survey Report

on behalf of Elstree Green Limited

Prepared by Headland Archaeology| December 2020 |
Document Reference: R017

HSFH20

HILFIELD SOLAR FARM, HERTFORDSHIRE

GEOPHYSICAL SURVEY REPORT

commissioned by Elstree Green Limited

December 2020

HEADLAND ARCHAEOLOGY

REGISTERED ORGANISATION CIfA

HILFIELD SOLAR FARM, HERTFORDSHIRE

GEOPHYSICAL SURVEY REPORT

commissioned by Elstree Green Limited

December 2020

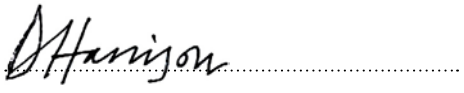
This report adheres to the quality standard of ISO 9001:2015

PROJECT INFO:

HA Project Code **HSFH20** / NGR **TQ 1499 9693 (west), TQ 1620 9802 (east)** / Parish **Elstree and Borehamwood Town Council** / Local Authority **Hertfordshire County Council** / OASIS Ref. **headland5-410836**

PROJECT TEAM:

Project Manager **David Harrison** / Author **Alistair Webb** / Fieldwork **Glyn Sheldrick, Michael Puntorno, Peter Heykoop, Richard McGregor-Edwards, Robbie House, Ross Bishop** / Graphics **Eleanor Winter, Olivier Vansassenbrouck**

Approved by **David Harrison** 

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HEADLAND ARCHAEOLOGY

part of the RSK Group

REGISTERED ORGANISATION CIfA

PROJECT SUMMARY

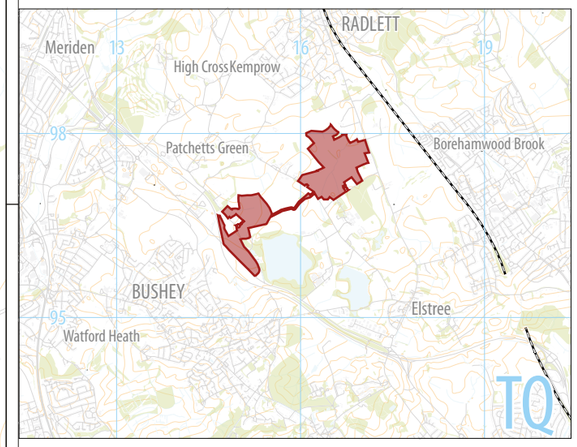
Headland Archaeology (UK) Ltd undertook a geophysical (magnetometer) survey at a 130-hectare site north-west of Elstree, Hertfordshire to inform a planning application for a proposed solar farm and battery storage. Several fields were surveyed across the full extent of the site. In all locations the data was extremely disturbed due to the presence of 'green waste' in the plough soil. No anomalies of archaeological potential were identified. The extent and magnitude of the disturbance was such that no archaeological anomalies, if present, could be identified against the perturbed magnetic background. Consequently, following consultation and review it was agreed that continuing the survey would not help inform the application and was so abandoned.

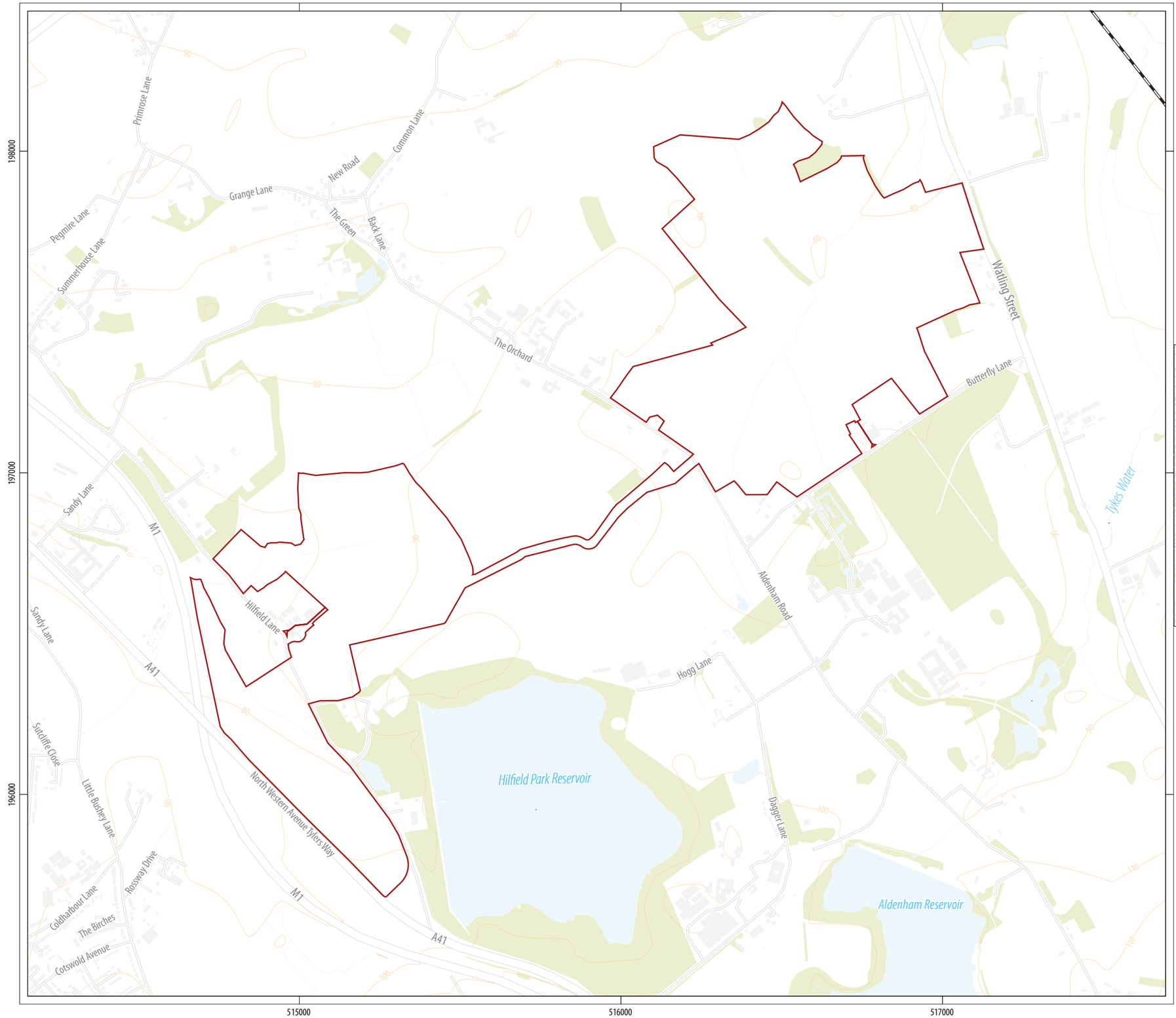
CONTENTS

LIST OF ILLUSTRATIONS

HEADLAND ARCHAEOLOGY (UK) LTD

Hilfield Solar Farm
Elstree
Hertfordshire





0
250m
1:12,500 @ A3

proposed development area

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ILLUS 1 Site location

HILFIELD SOLAR FARM, HERTFORDSHIRE

GEOPHYSICAL SURVEY REPORT

1 INTRODUCTION

Headland Archaeology (UK) Ltd was commissioned by Elstree Green Limited to undertake a geophysical (magnetometer) survey on land north-east and west of Elstree Aerodrome, an area of 130 hectares, the site of a proposed solar farm and battery storage.

The results of the survey will inform future archaeological strategy at the site. The survey was undertaken to assess the impact of the scheme on the historic environment. It was undertaken in accordance with an Archaeological Written Scheme of Investigation (WSI) (Headland 2020), 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 surveys were carried out between September 18th 2020 and October 2nd 2020.

1.1 SITE LOCATION, TOPOGRAPHY AND LAND-USE

The proposed development area (PDA) comprised two irregularly sized blocks of land north-east and west of Elstree Aerodrome and north of Hilfield Park Reservoir, linked by a new access track (Illus 1). The western block, centred on TQ 1499 9693, comprised five fields (F1–F5) which are bound to the west by the M1 motorway, to the south by London Elstree Aerodrome, to the north-west by an electricity sub-station and to the east and the north by arable fields. The eastern block is centred on TQ 1620 9802 and is bound to the west by Aldenham Road, to the south by Butterfly Lane, to the east by Watling Street and to the north by arable farmland.

1.2 GEOLOGY AND SOILS

The bedrock geology comprises London Clay Formation. No superficial deposits are recorded (NERC 2020).

The soils are classified in the Soilscape 18 Association, characterised as slowly permeable, seasonally wet loams and clays (Cranfield University 2020).

2 ARCHAEOLOGICAL BACKGROUND

A preliminary assessment of the historic environment resource of the application site and its surroundings has been undertaken (Headland Archaeology 2020). This assessment included gathering baseline data on known heritage assets from the Hertfordshire Historic Environment Record and the National Heritage List and a review of Ordnance Survey mapping, LiDAR data and a site visit.

This initial review of the Hertfordshire HER data indicated that a Roman road (Watling Street) borders the PDA along part of its easternmost edge. Two later, two post-medieval roads are also noted as is an 18th century park which also partially was located within the PDA. A medieval moated site at Little Kendals Wood may also extend into the PDA although no earthworks are visible.

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 would 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 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 site location plan is included as Illus 1 with the greyscale data and interpretation graphically displayed in Illus 2 and Illus 3 at a scale of 1:10,000. The PDA is split into two sectors and the data displayed and interpreted at 1:5,000 in Illus 4 to Illus 7 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 included as 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 (Jacobs 2019), guidelines outlined by Europae Archaeologia Consilium (EAC 2016) and by the Chartered Institute for Archaeologists (ClfA 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 were very good throughout the PDA. However, the data is extremely magnetically perturbed throughout. This is due to the use of 'green waste' as a soil improver. Magnetic material within the green waste and the strongly magnetic compounds created during the decomposition process have led to a highly elevated magnetic background against which the much weaker responses from archaeological features, if present, have effectively been masked.

Anomalies or areas of anomalous response can still be identified against this magnetic background. However, these are all non-archaeological. These include high magnitude linear anomalies due to sub-surface pipes or overhead cables leading to/from the Electricity Distribution Station adjacent to the north-western corner of the PDA (F2, F14 and F15), the magnetic halo caused by the electricity pylons (F4 and F20) and the sub-surface footings of former pylons (adjacent to the current pylon in F4).

In the eastern half of F20 the massive magnetic disturbance is due to material used to infill a former quarry.

In F1 the area of elevated magnetic response on the southern side of Hilfield Brook is due to the deposition of alluvial material during episodes of flooding.

Two vague linear trends, also in F1, to the southern end locate former field boundaries.

5 CONCLUSION

In this instance the survey has not been able to successfully evaluate the site due to the presence of 'green waste' across the PDA. Consequently, no anomalies of possible or probable archaeological origin have been identified and hence the archaeological potential of the PDA remains unknown.

6 REFERENCES

Chartered Institute for Archaeologists (ClfA) 2014 ***Standard and guidance for archaeological geophysical survey*** (Reading) https://www.archaeologists.net/sites/default/files/ClfAS%26GGeophysics_3.pdf accessed 23 November 2020

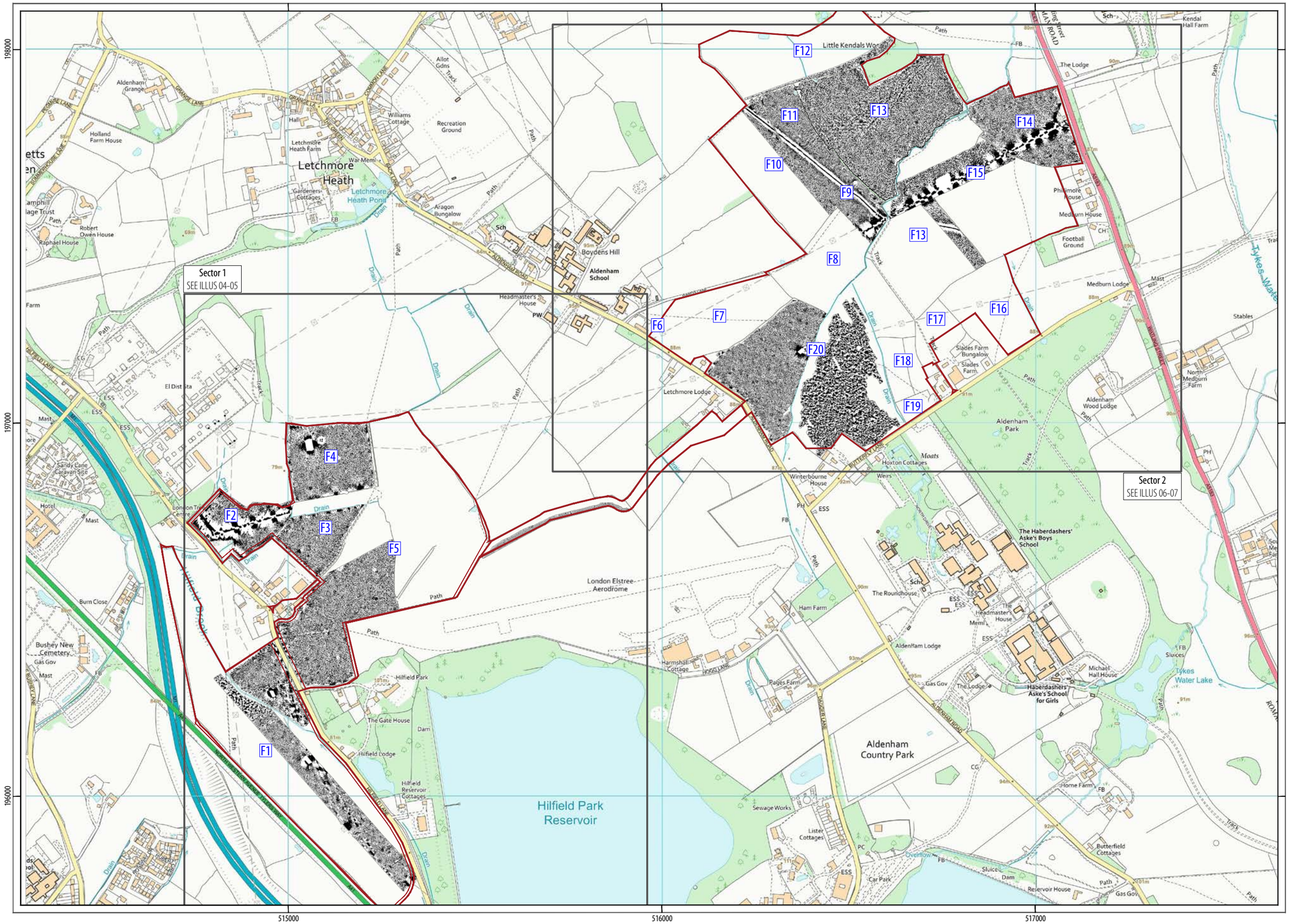
Natural Environment Research Council (NERC) 2018 ***British Geological Survey*** http://www.bgs.ac.uk/ accessed 23 November 2020

Europae Archaeologia Consillium (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-guidlines accessed 23 November 2020

Gaffney C & Gater J 2003 ***Revealing the Buried Past: Geophysics for Archaeologists*** Stroud

Headland Archaeology 2020 ***Hilfield Solar Farm, Hertfordshire: Written Scheme of Investigation for Geophysical Survey*** [unpublished client report]

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 23 November 2020



PROJECT HSFH20
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CLIENT Aardvark EM Limited

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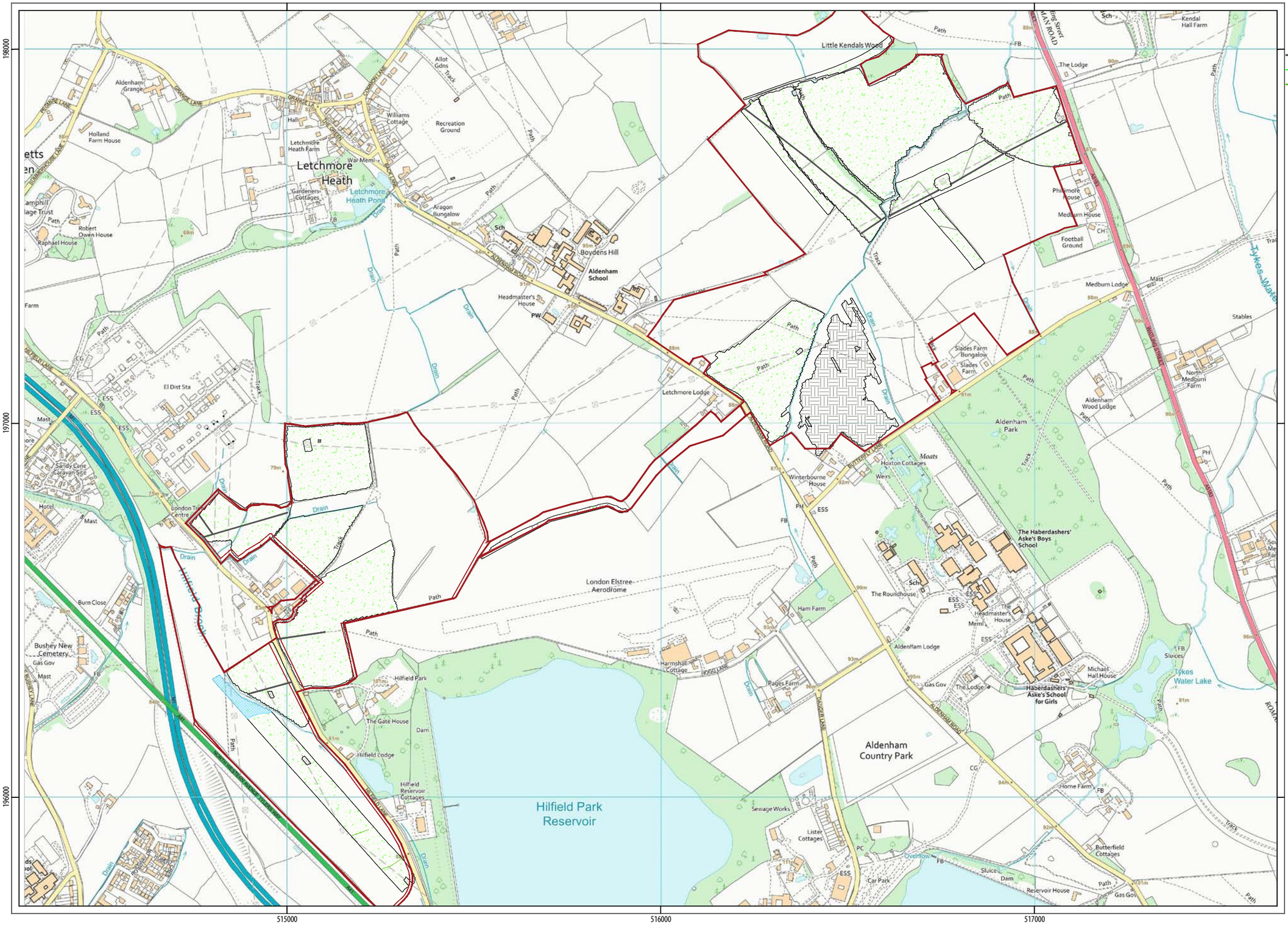
ILLUS 2 Greyscale plot of processed magnetometer data



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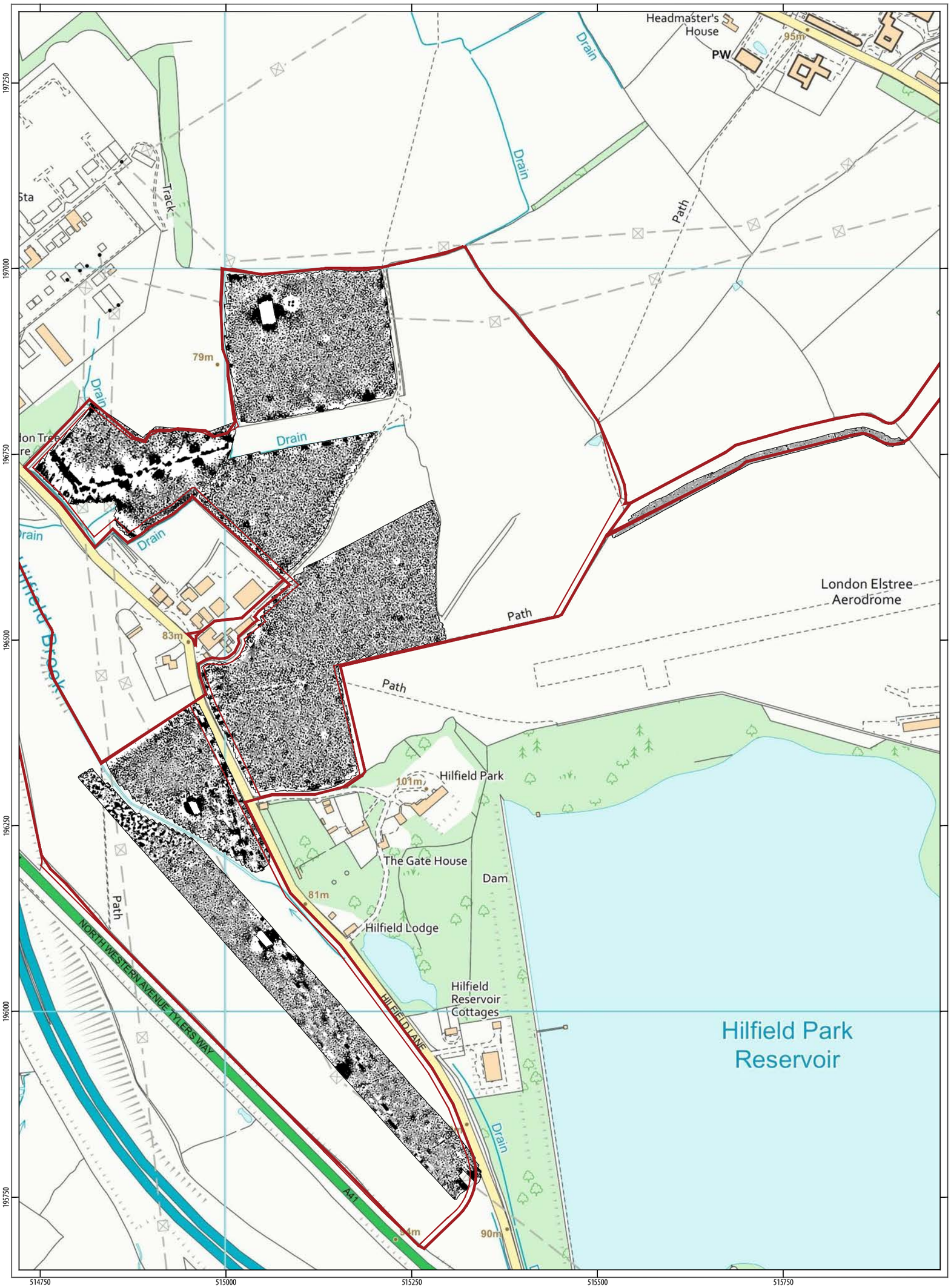
ILLUS 3 Interpretation of magnetometer data



Proposed development area

nT
-1.0 2.0

0 100m
1:5,000 @ A3

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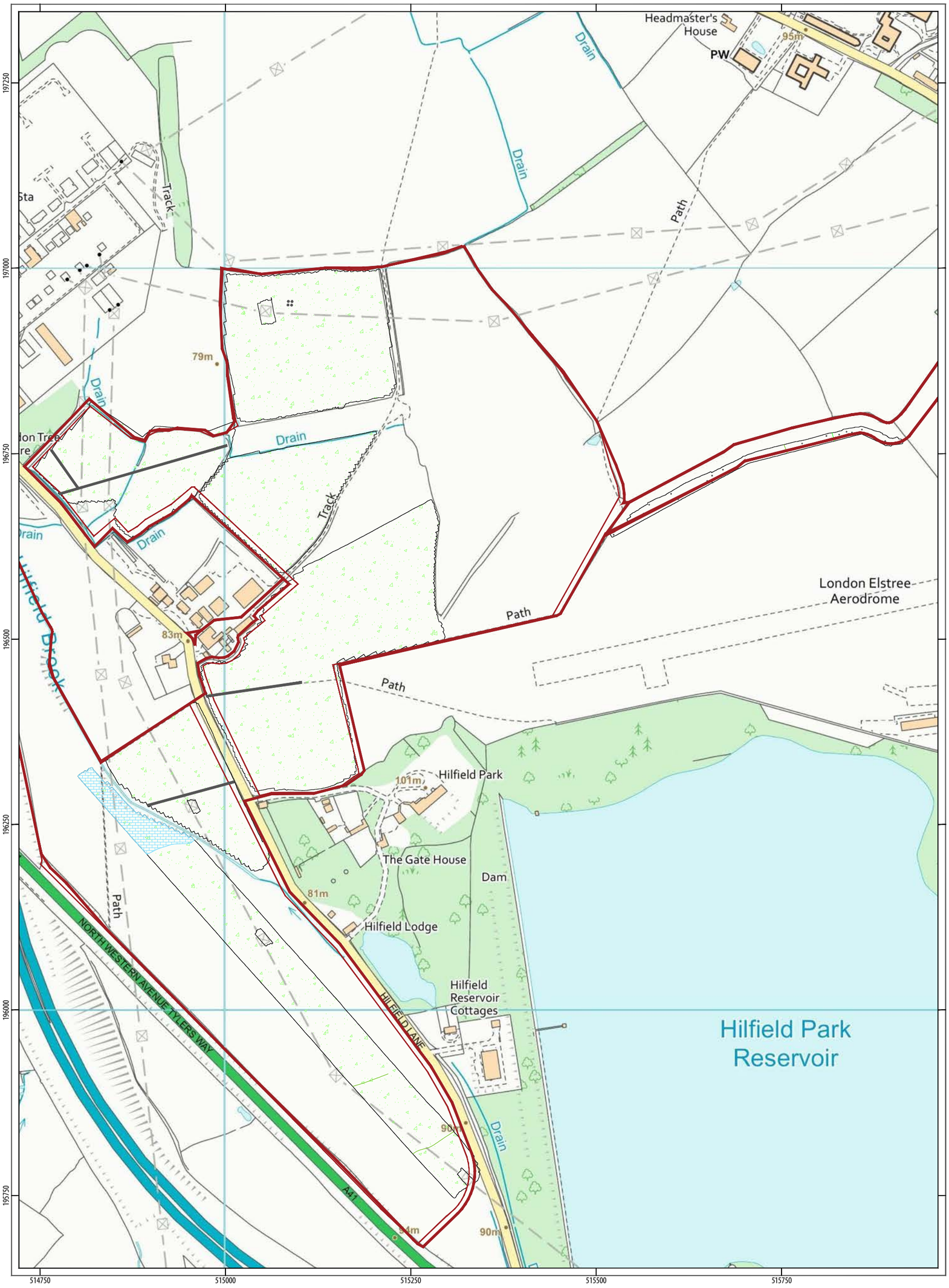
ILLUS 4 Greyscale plot of processed magnetometer data; Sector 1



Proposed development area

TYPE OF ANOMALY	INTERPRETATION
dipolar isolated	ferrous material
dipolar linear	service pipe
linear	former field boundary
linear trend	agricultural
magnetic enhancement	green waste
magnetic enhancement	geology

0 100m
1:5,000 @ A3

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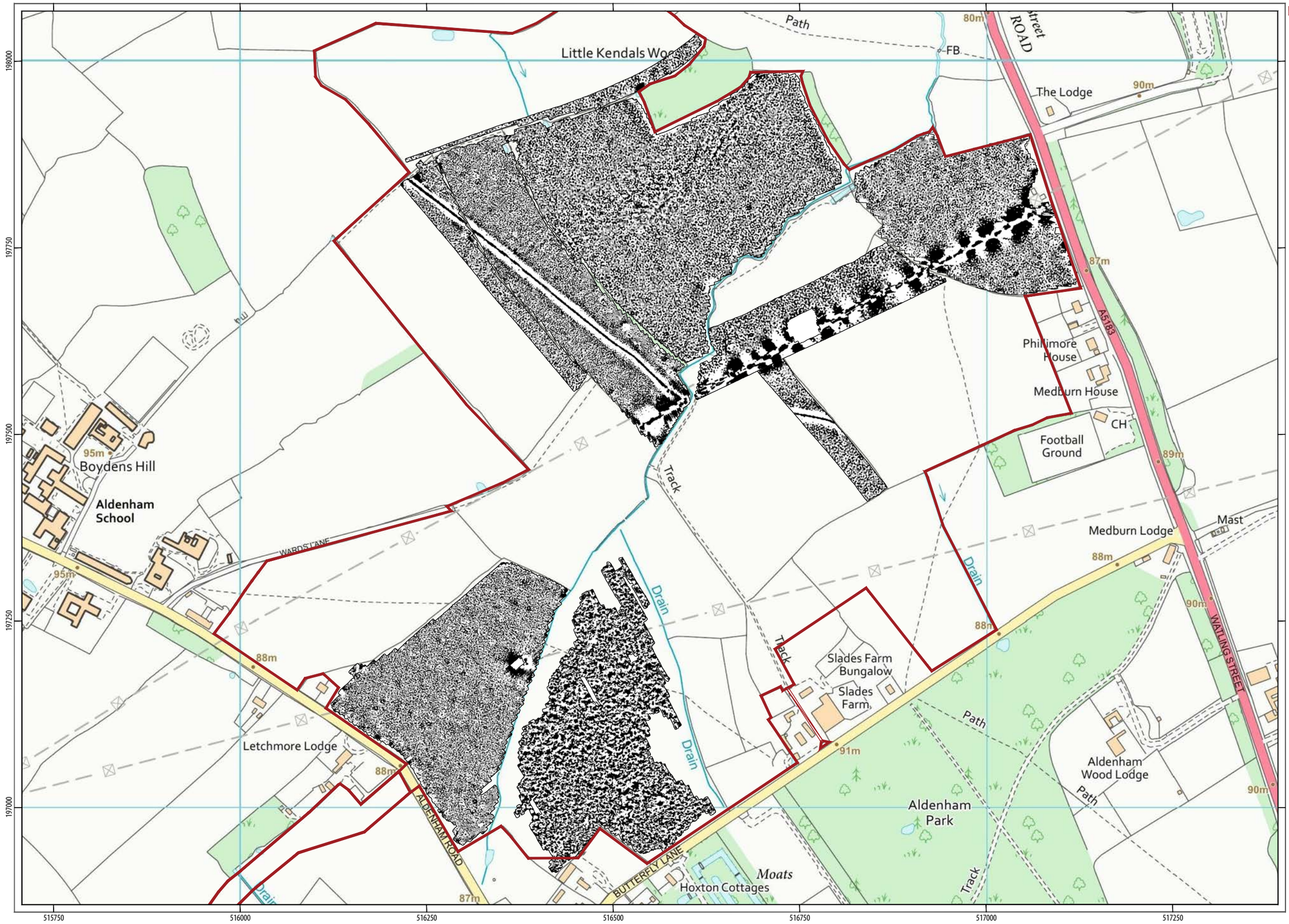
ILLUS 5 Interpretation of magnetometer data; Sector 1



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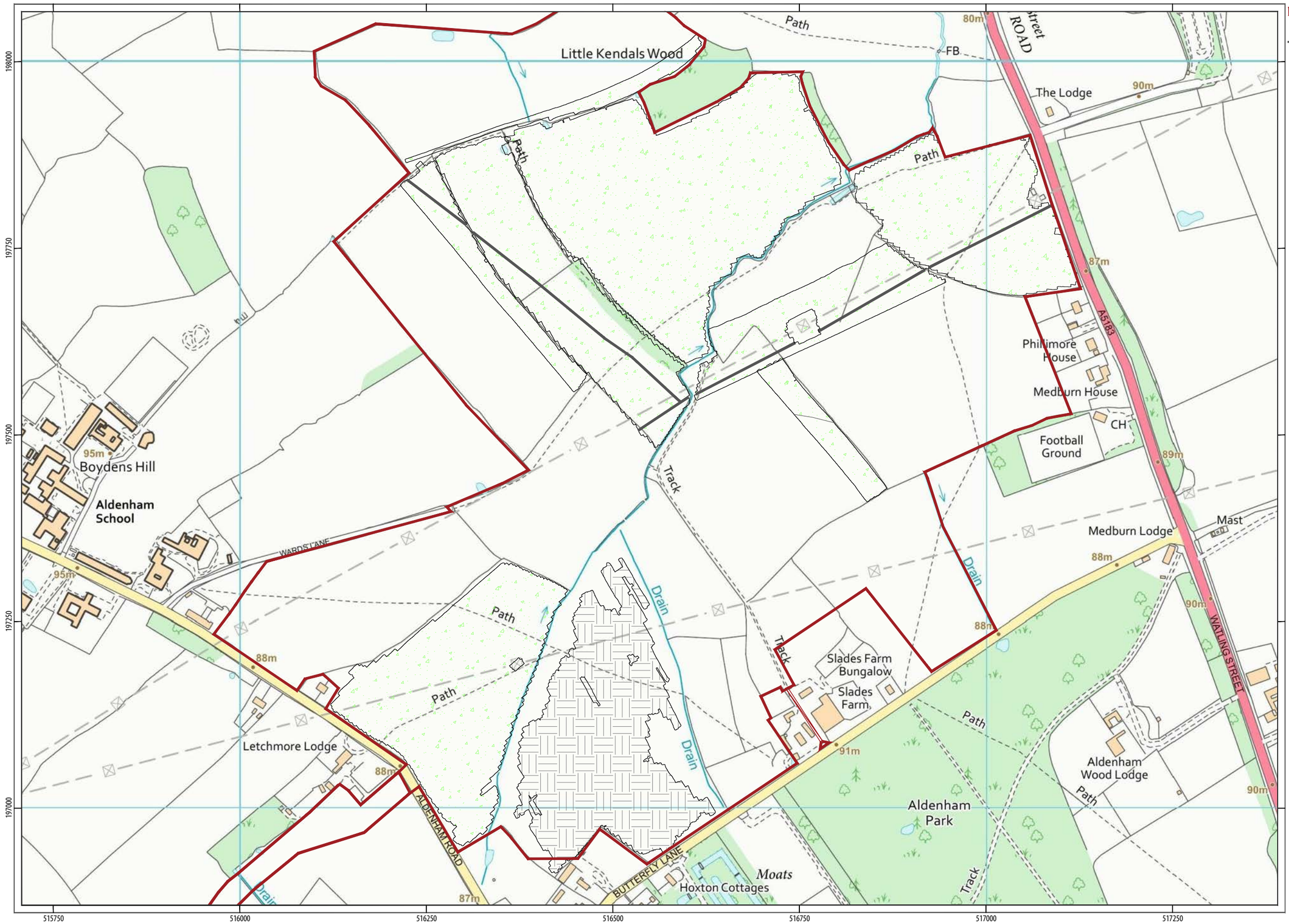
ILLUS 6 Greyscale plot of processed magnetometer data; Sector 2



Proposed development area

TYPE OF ANOMALY	INTERPRETATION
dipolar linear	service pipe
magnetic enhancement	green waste
magnetic enhancement	landfill

0 25m
1:1,000 @ A3

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Elstree
Hertfordshire

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ILLUS 7 Interpretation of magnetometer data; Sector 2

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 associate 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) in order 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: headland5-410836

PROJECT DETAILS	
Project name	410836Hilfield Solar Farm, Hertfordshire
Short description of the project	Headland Archaeology (UK) Ltd undertook a geophysical (magnetometer) survey at a 123-hectare site north-west of Elstree, Hertfordshire to inform a planning application for a proposed solar farm. Several fields were surveyed across the full extent of the site. In all locations the data was extremely disturbed due to the presence of 'green waste' in the plough soil. No anomalies of archaeological potential were identified. The extent and magnitude of the disturbance was such that no archaeological anomalies, if present, could be identified against the perturbed magnetic background. Consequently, following consultation and review it was agreed that continuing the survey would not help inform the application and was so abandoned.
Project dates	Start: 18-09-2020 End: 02-10-2020
Previous/future work	Not known / Not known
Any associated project reference codes	HSFH20 – Sitecode
Type of project	Field evaluation
Site status	None
Current Land use	Cultivated Land 4 – Character Undetermined
Monument type	N/A
Monument type	N/A
Significant Finds	N/A
Significant Finds	N/A
Methods & techniques	"Geophysical Survey"
Development type	Solar Farm
Prompt	National Planning Policy Framework – NPPF
Position in the planning process	Pre-application
Solid geology	London Clay
Drift geology	Unknown
Techniques	Magnetometry
PROJECT LOCATION	
Country	England
Site location	Hertfordshire, Hertsmere, Elstree And Borehamwood, Hilfield Solar Farm, Hertfordshire
Study area	123 Hectares
Site coordinates	TQ 1620 9802 51.668450071495 -0.319536772123 51 40 06 N 000 19 10 W Point
Site coordinates	TQ 1499 9693 51.658902039787 -0.337386331576 51 39 32 N 000 20 14 W Point
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

PROJECT ARCHIVES	
Physical Archive Exists?	No
Digital Archive recipient	Headland Archaeology
Digital Contents	"other"
Digital Media available	"Geophysics", "Images raster / digital photography", "Images vector"
Paper Archive Exists?	No

PROJECT BIBLIOGRAPHY 1	
Publication type	Grey literature (unpublished document/manuscript)
Title	Hilfield Solar Farm, Hertfordshire: Geophysical Survey
Author(s)/Editor(s)	Alistair Webb
Other bibliographic details	HSFH20
Date	2020
Issuer or publisher	Headland Archaeology
Place of issue or publication	Edinburgh
Description	A4 Glue bound report
Entered by	Sam Harrison (sam.harrison@headlandarchaeology.com)
Entered on	15 December 2020

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APPENDIX 4: INTERIM REPORT ON TRIAL TRENCH EVALUATION

Hilfield Solar Farm and Battery Storage

Interim Report

INTRODUCTION

Headland Archaeology was commissioned by Elstree Green Limited (the client) to carry out the required archaeological works on land at Hilfield Lane, Elstree, Hertfordshire. The evaluation, in advance of work related to a solar farm development, was required by the client to provide further information about the archaeological resource, to enable appropriate decisions to be reached regarding the planning submission. The trial trenching, conducted between 30th November to 4th December 2020, was comprised of the excavation of twenty trenches, across three areas. The nature of the evaluation and area of investigation was agreed between the client and Hertfordshire Historic Environment Advisory Service (HA 2020).

RESULTS

In total twenty trenches were excavated, across three fields (Fig 1). Field 3 contained trenches 1-5 each measuring 25m x 2.2m, and Field 17 contained trenches 6-10 also measuring 25m x 2.2m. Field 14 contained trenches 11-20, measuring 50m x 2.2m. Trench 20 was reduced in length to 32m due to constraints after a change in alignment. The locations of the trenches in Field 14 were moved onsite, due to the presence of public footpaths, Overhead Electricity cables and a High Pressure Gas main. These trenches represent a 4% sample of the area under evaluation, minus appropriate buffer zones for electrical and gas services.

The natural stratigraphy across Fields 2 and 3 comprised a single layer of topsoil (plough-soil) with no observable subsoil interface.

Topsoil in Field 3 comprised a mid-grey brown silty clay with an average depth of 0.30m overlying a light-yellow orange silty clay natural with patches of course gravel. The arable field was relatively level. Field 3 was located behind Hilfield Farm.

Topsoil in Fields 14 and 17 comprised topsoil of dark grey brown loamy clay with occasional small stones and flint nodules, with an average depth of 0.20m in Field 17 and 0.30 in Field 14. The natural was similarly a mid-yellowish red clay with chalk fleck inclusions and occasional patches of angular stone and flint. Both fields were arable, recently ploughed and fairly level and were located between Slade Farm and Watling Street.

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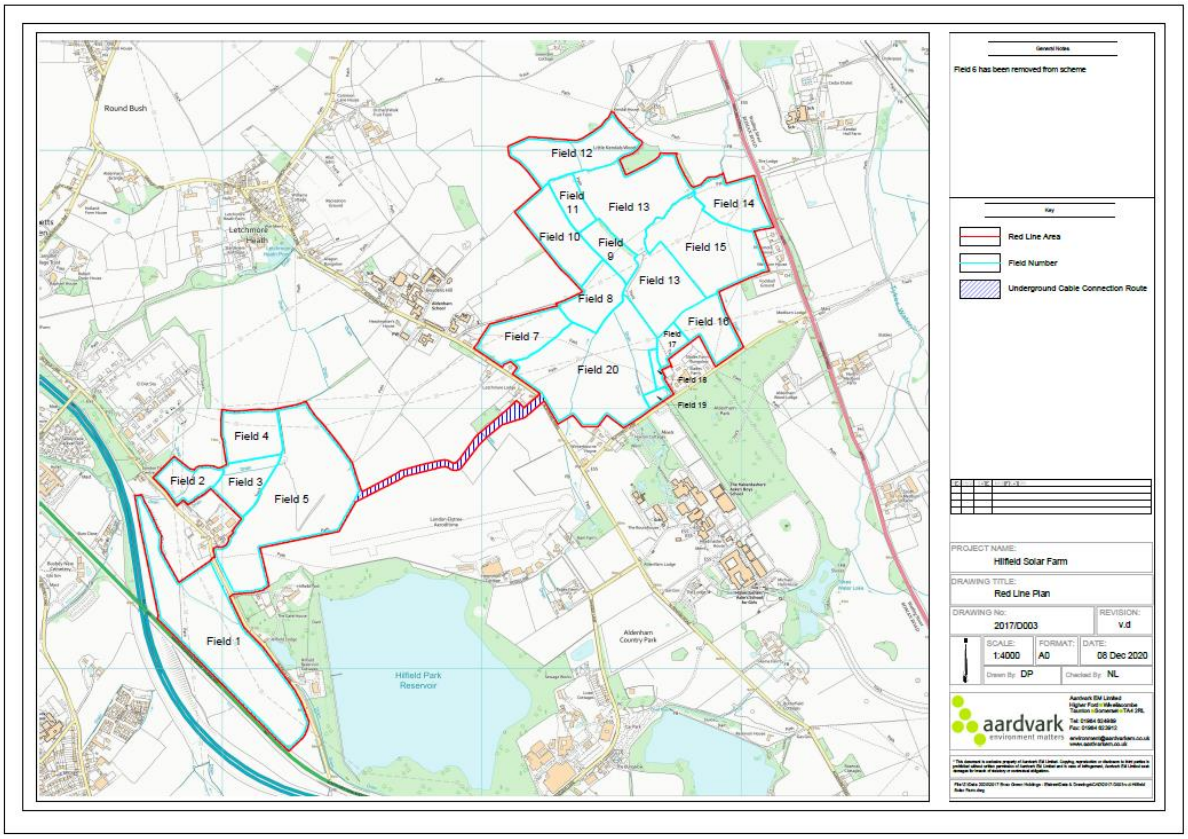


Fig 1. Field locations

1.1. FIELD 3

Trenches 1-5 were excavated down, on average to a depth of 0.20m, to the natural substrate. The trenches which contained no archaeology were 1,2, 3 and 5. Trench 4, orientated NW/SE with an average depth of 0.37m, contained a ditch and a possible pit both of which area detailed below.

Ditch [0403], the more northerly of the features, was orientated approximately NW/SE and had a V-shaped profile. It spanned the width of the trench, measuring 1m wide and 0.58m deep. It contained a firm dark grey brown silty clay fill (0604) with frequent angular stones and produced no dateable evidence.

Pit [0405] was located to the south of [0403]. It was 0.43m in diameter and 0.19m deep and contained a single, mid grey brown, silty clay fill (0406) with a moderate amount of charcoal. The feature was extending from the eastern baulk of Trench 4. No finds were retrieved from the fill, it can most likely be interpreted as a tree-bole.

1.2. FIELD 17

Trenches 6-10 were excavated down, on average to a depth of 0.30m, to the natural substrate (Illus. 8, 9 and 10). There were no archaeological features recorded within these trenches. Suggesting that this area has always been in agricultural use.

1.3. FIELD 14

Trenches 11-20 were excavated down, on average to a depth of 0.30m, to the natural substrate. Trench 12 contained a tree bole which is detailed below. The remaining nine trenches were archaeologically sterile.

Tree bole [1203] was 1.9m in diameter and 0.33m deep and contained a single, mid-brownish yellow silty clay fill (1204). The feature was extending from the northerly baulk of the trench. No finds were produced, and the feature has been judged to be a tree-bole.

2. DISCUSSION AND CONCLUSION

The archaeological evaluation uncovered a single undated archaeological feature within Trench 4. The ditch, likely functioning as agricultural drainage, does not match any alignments visible on the Ordnance Survey maps for the locality and is undated. The lack of archaeology and the presence of tree boles would suggest that the areas evaluated have always had an agricultural land use.

APPENDICES

APPENDIX 1 TRENCH REGISTERS

Trench 1			
L (m)	**W (m)**	**Min. D (m)**	**Max. D (m)**
25	2.2	0.35	0.45

Context	**Description**	***D BGL (m)**
0101	Mid greyish brown silty clay with stones	0.3
0102	Light yellow orange silty clay with rounded gravels	

Summary
Archaeologically sterile

Trench 2			
L (m)	**W (m)**	**Min. D (m)**	**Max. D (m)**
25	2.2	0.35	0.45

Context	**Description**	***D BGL (m)**
0201	Mid greyish brown silty clay with stones	0.3
0202	Light yellow orange silty clay with rounded gravels	

Summary
Archaeologically sterile

Trench 3			
L (m)	**W (m)**	**Min. D (m)**	**Max. D (m)**
25	2.2	0.35	0.45

Context	**Description**	***D BGL (m)**
0301	Mid greyish brown silty clay with stones	0.3
0302	Light yellow orange silty clay with rounded gravels	

Summary
Archaeologically sterile

Trench 4			
L (m)	**W (m)**	**Min. D (m)**	**Max. D (m)**
25	2.2	0.3	0.45

Context	**Description**	***D BGL (m)**
0401	Mid greyish brown silty clay with stones	0.3
0402	Light yellow orange silty clay with rounded gravels	
0403	Cut of ditch, NW/SE aligned. V-shaped profile	0.58
0404	Dark greyish brown silty clay with freq angular stones	0.58
0405	Cut of tree bole, concave sides and rounded base	0.19
0406	Mid greyish brown silty clay with moderate charcoal	0.19

Summary
NW/SE aligned ditch and Tree bole

Trench 5			
L (m)	**W (m)**	**Min. D (m)**	**Max. D (m)**
25	2.2	0.3	0.45

Context	**Description**	***D BGL (m)**
0501	Mid greyish brown silty clay with stones	0.3
0502	Light yellow orange silty clay with rounded gravels	

Summary
Archaeologically sterile

Trench 6			
L (m)	**W (m)**	**Min. D (m)**	**Max. D (m)**
25	2.2	0.2	0.35

Context	Description	*D BGL (m)
0601	Dark grey brown loamy clay with occ. rounded stones	0.2
0602	Yellow orange clay with mod rounded stones	

Summary
Archaeologically sterile

Trench 7			
L (m)	**W (m)**	**Min. D (m)**	**Max. D (m)**
25	2.2	0.2	0.35

Context	**Description**	***D BGL (m)**
0701	Dark grey brown loamy clay with occ. rounded stones	0.2
0702	Yellow orange clay with mod rounded stones	

Summary
Archaeologically sterile

Trench 8			
L (m)	**W (m)**	**Min. D (m)**	**Max. D (m)**
25	2.2	0.2	0.35

Context	**Description**	***D BGL (m)**
0801	Dark grey brown loamy clay with occ. rounded stones	0.2
0802	Yellow orange clay with mod rounded stones	

Summary
Archaeologically sterile

Trench 9			
L (m)	**W (m)**	**Min. D (m)**	**Max. D (m)**
25	2.2	0.2	0.35

Context	**Description**	***D BGL (m)**
0901	Dark grey brown loamy clay with occ. rounded stones	0.2
0902	Yellow orange clay with mod rounded stones	

Summary
Archaeologically sterile

Trench 10			
L (m)	**W (m)**	**Min. D (m)**	**Max. D (m)**
25	2.2	0.2	0.35

Context	**Description**	***D BGL (m)**
1001	Dark grey brown loamy clay with occ. rounded stones	0.2
1002	Yellow orange clay with mod rounded stones	

Summary
Archaeologically sterile

Trench 11			
L (m)	**W (m)**	**Min. D (m)**	**Max. D (m)**
50	2.2	0.5	0.55

Context	**Description**	***D BGL (m)**
1101	Dark grey brown loamy clay with rounded stones and medium flint nodules	0.3
1102	Dark yellow orange with mottled grey patches of rounded stones	

Summary
Archaeologically sterile

Trench 12			
L (m)	**W (m)**	**Min. D (m)**	**Max. D (m)**
50	2.2	0.3	0.4

Context	**Description**	***D BGL (m)**
1201	Dark grey brown loamy clay with rounded stones and medium flint nodules	0.25
1202	Dark yellow orange with mottled grey patches of rounded stones	
1203	Cut of Tree bole	0.33
1204	Mid brown yellow silty clay fill	0.33

Summary
Tree bole

Trench 13			
L (m)	**W (m)**	**Min. D (m)**	**Max. D (m)**
50	2.2	0.3	0.45

Context	**Description**	***D BGL (m)**
1301	Dark grey brown loamy clay with rounded stones and medium flint nodules	0.3
1302	Dark yellow orange with mottled grey patches of rounded stones	

Summary
Archaeologically sterile

Trench 14			
L (m)	**W (m)**	**Min. D (m)**	**Max. D (m)**
50	2.2	0.3	0.45

Context	**Description**	***D BGL (m)**
1401	Dark grey brown loamy clay with rounded stones and medium flint nodules	0.3
1402	Dark yellow orange with mottled grey patches of rounded stones	

Summary
Archaeologically sterile

Trench 15			
L (m)	**W (m)**	**Min. D (m)**	**Max. D (m)**
50	2.2	0.3	0.45

Context	**Description**	***D BGL (m)**
1501	Dark grey brown loamy clay with rounded stones and medium flint nodules	0.3
1502	Dark yellow orange with mottled grey patches of rounded stones	

Summary
Archaeologically sterile

Trench 16			
L (m)	**W (m)**	**Min. D (m)**	**Max. D (m)**
50	2.2	0.3	0.45

Context	**Description**	***D BGL (m)**
1601	Dark grey brown loamy clay with rounded stones and medium flint nodules	0.3
1602	Dark yellow orange with mottled grey patches of rounded stones	

Summary
Archaeologically sterile

Trench 17			
L (m)	**W (m)**	**Min. D (m)**	**Max. D (m)**
50	2.2	0.3	0.45

Context	**Description**	***D BGL (m)**
1701	Dark grey brown loamy clay with rounded stones and medium flint nodules	0.3
1702	Dark yellow orange with mottled grey patches of rounded stones	

Summary
Archaeologically sterile

Trench 18			
L (m)	**W (m)**	**Min. D (m)**	**Max. D (m)**
50	2.2	0.3	0.45

Context	**Description**	***D BGL (m)**
1801	Dark grey brown loamy clay with rounded stones and medium flint nodules	0.3
1802	Dark yellow orange with mottled grey patches of rounded stones	

Summary
Archaeologically sterile

Trench 19			
L (m)	**W (m)**	**Min. D (m)**	**Max. D (m)**
50	2.2	0.3	0.45

Context	**Description**	***D BGL (m)**
1901	Dark grey brown loamy clay with rounded stones and medium flint nodules	0.3
1902	Dark yellow orange with mottled grey patches of rounded stones	

Summary
Archaeologically sterile

Trench 20			
L (m)	**W (m)**	**Min. D (m)**	**Max. D (m)**
32	2.2	0.3	0.45

Context	**Description**	***D BGL (m)**
2001	Dark grey brown loamy clay with rounded stones and medium flint nodules	0.3
2002	Dark yellow orange with mottled grey patches of rounded stones	

Summary
Archaeologically sterile

APPENDIX 2 OASIS

Project details	headland4-410138
Project name	Hilfield Solar Farm and Battery Storage.
Short description of the project	Headland Archaeology (UK) Ltd conducted a trial trench evaluation on land at Hilfield Lane, Elstree, Hertfordshire. This evaluation, conducted between 30th November to 4th December 2020, was commissioned by Aardvark Em Ltd in advance of work related to a solar farm development. The work comprised of the excavation of twenty trenches, across three areas. The majority of the trenches were archaeologically sterile, with one trench containing a ditch.
Project dates	Start: 30-11-2020 End: 04-12-2020
Previous/future work	No / No
Type of project	Field evaluation
Site status	None
Current Land use	Cultivated Land 2 - Operations to a depth less than 0.25m
Monument type	N/A None
Significant Finds	N/A None
Methods & techniques	"Targeted Trenches"
Development type	Solar Farm
Prompt	Planning agreement (Section 106 or 52)
Position in the planning process	Between deposition of an application and determination

Project location	
Country	England
Site location	HERTFORDSHIRE WATFORD WATFORD Elstree Solar Farm, Elstree
Postcode	WD25 8DA
Study area	130 Hectares
Site coordinates	TQ 1661 9732 51.662061 -0.31383 51 39 43 N 000 18 49 W Point

Site coordinates	TQ 1497 9668 51.656696 -0.33774 51 39 24 N 000 20 15 W Point

Project creators

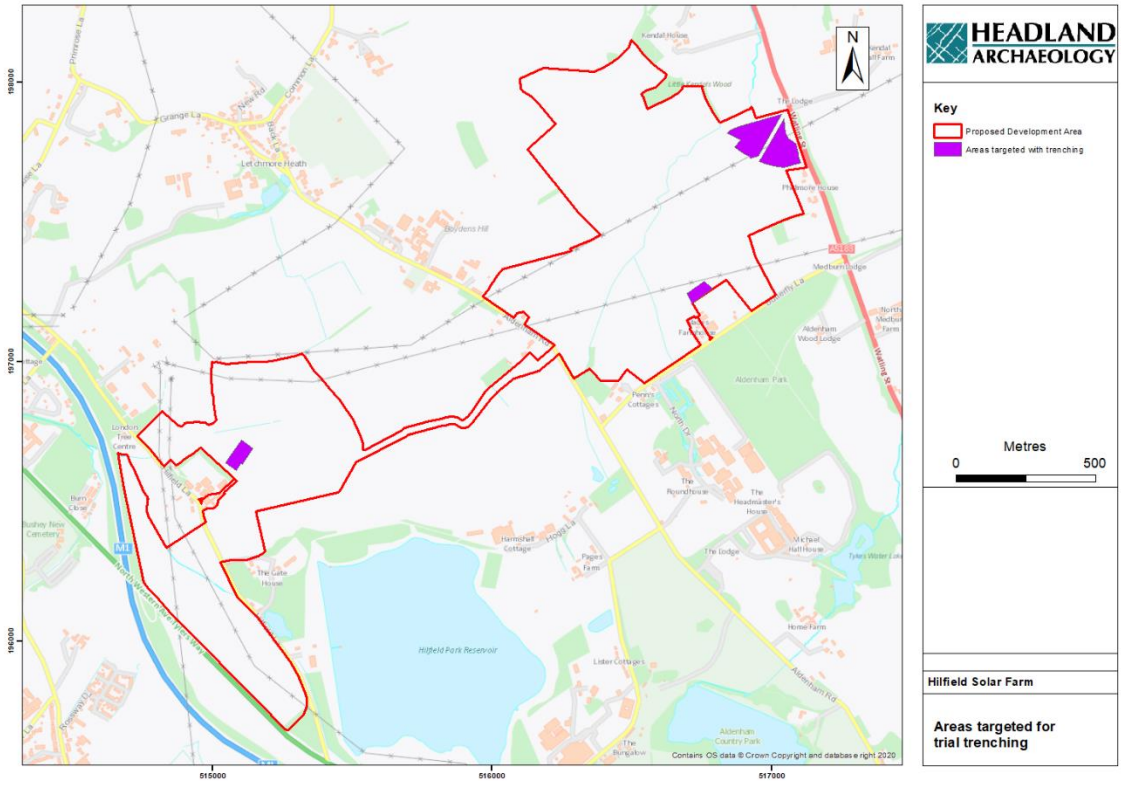
Name of Organisation	Headland Archaeology Ltd
Project brief originator	Aardvark Em Ltd
Project design originator	Consultant
Project director/manager	Ailsa Westgarth
Project supervisor	Beth Doyle
Type of sponsor/funding body	Developer

Project archives

Physical Archive Exists?	No
Physical Archive recipient	To Be Confirmed
Digital Archive recipient	Archaeology Data Service
Digital Contents	"other"
Digital Media available	"Survey","Images raster / digital photography"
Paper Archive recipient	North Hertfordshire Museum Service
Paper Contents	"other"
Paper Media available	"Context sheet","Notebook - Excavation',' Research',' General Notes","Survey "

APPENDIX 3 PHOTOS

APPENDIX 4 AREAS TARGETED FOR TRENCHING



Elstree Solar Farm Elstree

Written Scheme of Investigation for Archaeological Evaluation

Client: AARDVARK EM Ltd

v1.1

18/11/2020

Ailsa Westgarth MCIfA
Headland Archaeology (UK) Ltd
Unit 1 Clearview Court
Twyford Road
Hereford HR2 6JR

1 INTRODUCTION

1.1 This document is submitted by Headland Archaeology (UK) Ltd as the Written Scheme of Investigation (WSI) for a programme of archaeological evaluation related to Solar Farm development on land at Hilfield Lane, Elstree, Hertfordshire.

1.2 This WSI defines the scope of the investigation and is submitted for agreement from the archaeological advisor to the planning authority.

1.3 The evaluation will provide further information about the archaeological resource, to enable appropriate decisions to be reached regarding the planning submission. This WSI takes into account relevant CIfA and regional Standards and Guidance.

SITE LOCATION AND DESCRIPTION

1.4 The Proposed Development Area (PDA) covers a total of 20 fields. Five are located in the west of the PDA, Field 1 is bounded by the M1 motorway and A41 to the west and by Hilfield Lane to the east, east of Hilfield Lane are Fields 2—5, with the buildings of Hilfield farm between Hilfield Lane and Field 3, the Elstree Aerodrome to the south east of Field 5 and fields to the north-east and north of these fields (with an electricity substation to the north-west beyond a further field and small area of woodland). The western parcel is bounded by Aldenham Road to the west, Butterfly Lane with Aldenham Park beyond to the south, by the A5183 Watling Street to the east and by hedgerows to the north with further fields beyond. In total the site covers c.120ha.

1.5 The PDA is mainly in arable use, but Fields 18, 19 and 20 are pasture. The site varies in elevation at around 90mOD in the eastern parcels and between 75 and 90m in the western parcels (rising to towards the south). A grid connection route is proposed between these two main areas, this runs through the northern edge of the Elstree Aerodrome.

1.6 This WSI covers evaluation trenches in fields 3, 14 and 17.

1.7 The solid geology of the application site is recorded as being London Clay Formation across most of the site although the northern edges are of Lambeth Group - Clay, Silt and Sand. No superficial deposits are recorded by the British Geological Survey. ARCHAEOLOGICAL BACKGROUND

1.8 A desk based assessment was undertaken in 2020. A study of the proposed development area and its surroundings was undertaken, looking at Historic Environment Records, previous evaluations and old maps (Richards, 2020).

1.9 There is little evidence for prehistoric activity within the development area. Three stray findspots of lithics have been recorded across the wider area. A single sherd of Iron Age pottery was recorded and six undated cropmarks within the wider study area.

1.10 The site is bounded to the East by Watling Street. During the Roman period this was the main road from Verulanium (Modern St Albans). Crop marks and local find spots suggest that the landscape has remained largely unchanged since the Iron Age. A possible Roman road has been recorded within the eastern part of the development area.

1.11 The HER contains thirty-eight records attributed to the medieval period within the Study Area. The closest of these records is for the moated site of Little Kendalls (MHT927) which is located adjacent to Field 13. The HER describes this monument as rectangular in shape but with no apparent northern arm. The western side has possibly two banks with the outer bank being the more prominent. The site measures approximately 67m NE-WS by 45m (Hertfordshire HER 2020).

1.12 The moated site is associated with an Area of Archaeological Sensitivity (AAS) which is shown extending into the northern part of Field 13. However, no earthworks are visible on LiDAR data within Field 13 itself indicating that the moat does not encroach into the PDA.

1.13 A geophysical survey of the proposed development area was begun in October 2020. The survey was initiated in Field 13 adjacent to the recorded Scheduled Monument of Pennes Place in order to identify any buried archaeological remains with Field 13 associated with this monument. However, the survey was soon abandoned due to poor ground conditions.

1.14 The proximity of the Roman road Watling Street to the east of the PDA, the supposed Roman road within the PDA and the quantity of Roman material found in the study area indicates that there is a strong likelihood of the PDA containing currently unrecorded remains of Roman date. The proximity of two medieval moated sites also indicates that there may be associated archaeological remains (most likely evidence of field systems relating to these settlements) within the PDA.

1.15 However, the archaeological advisor to Hertsmere council has advised that the London Clay soils of this area have "been shown to be unfavourable for archaeological remains" (Simon Wood, pers comm). The overall archaeological potential of the PDA is therefore assessed as low, archaeological remains may be present but are unlikely to be numerous or of high importance. This potential is assessed as being slightly higher in the far east of the PDA closest to the Roman road.

2 SCHEDULE

2.1 The works are planned to commence in November 2020 and are expected to take 6 days to complete.

2.2 A draft report will then be delivered to the client and, on approval, to the planning authority within four weeks of the completion of fieldwork.

3 PROJECT TEAM

3.1 The project will be managed for Headland Archaeology by Ailsa Westgarth; the field team will consist of a Project Officer, Project Supervisor and two field assistants, and an additional sub-contracted excavator driver. *Curricula vitae* of key personnel can be supplied on request. The project team will familiarise themselves with the background to the site and will be aware of the project's aims and methodologies.

3.2 Specialist artefact analyses will be managed by Julie Franklin who is Headland's Finds Manager. Julie will undertake finds assessment within her areas of competence (medieval and post-medieval metalwork, glassware, clay pipes, ceramic building material and other small finds). Further consultation will be sub-contracted to recognised period specialists familiar with finds from this geographical area as appropriate, notably David Mullin (Neolithic – Bronze-Age pottery) and Jane Timby (Romano-British pottery).

3.3 Environmental analysis will be managed by Dr Alex Smith. Headland has in-house specialists who can undertake analysis of plant macrofossils, faunal remains and human remains (although it is not anticipated that the latter will be removed during an evaluation project).

3.4 Headland Archaeology (UK) Ltd is a Registered Organisation and abides by the Codes of Conduct and Approved Practice and Standards of the Chartered Institute for Archaeologists. The company has all the necessary technical and personnel resources for the satisfactory completion of the evaluation.

4 INSURANCE & COPYRIGHT

4.1 Headland Archaeology (UK) Ltd is fully indemnified and all necessary insurances can be presented on request.

4.2 Copyright will be retained by Headland Archaeology (UK) Ltd. Headland will licence the client and other bodies as necessary for use in matters relating to the project and for use of the project archive by the relevant museum. This licence will also extend to non-commercial use.

5 HEALTH & SAFETY

5.1 All of Headland's work is undertaken in accordance with current H&S legislation. A risk assessment and method statement will be prepared prior to the commencement of fieldwork. All staff will wear appropriate PPE and this will include high-visibility clothing, hard hats and safety footwear. Suitable site welfare facilities will be located at an appropriate location after consultation with the landowner.

6 ACCESS & SERVICES

6.1 This WSI is submitted on the understanding that there will be unhindered access (including machine-access) to all areas of the site. A plan of any services within the proposed development area will also be provided by the client or their agents. Any livestock/cars/spoil heaps etc. will be removed by the client prior to the archaeological works taking place.

6.2 Trenches will be laid out to the agreed plan so as to avoid any services and their associated exclusion zones.

6.3 Trenches will be scanned with a cable locator tool prior to excavation.

7 OBJECTIVES

7.1 The objectives of the evaluation are as follows:

- To establish the location, extent, nature and date of archaeological features or deposits that may be present within the areas proposed to be disturbed during the development;
- To establish the integrity and state of preservation of archaeological features or deposits that may be present within the areas proposed to be disturbed during the development;
- To inform the planning authority;
- To assist in developing a mitigation strategy should remains of significance be present on the site; and
- To produce and deposit a satisfactory archive and disseminate the results of the work via grey-literature reporting and publication as appropriate.
-

8 STRATEGY

8.1 Initial discussions with the Hertfordshire Historic Environment Advisory Service have resulted in agreement on the overall trenching strategy.

8.2 A total of 15 50m trenches and 10 25m trenches within fields 3, 14 and 17 will be excavated, totally 4% of the proposed excavation area for construction compounds and the battery array.

8.3 Trenches have been positioned to achieve sufficient coverage of the site and to provide an assessment of archaeological potential.

9 METHOD

FIELDWORK

9.1 All trenches will be set-out using differential GPS, which will also be used to provide absolute heights above OD. Service plans will be consulted in advance of excavation and safe digging techniques will be observed.

9.2 All trenches will be opened by a 14tonne tracked excavator. All trenches will be excavated by machine under direct archaeological supervision and will be excavated in controlled spits. Machine excavation will terminate at the top of the natural geology or the first significant archaeological horizon, whichever is encountered first. Spoil will be stored beside the trench; topsoil/tarmac and hardcore and subsoil will be kept separate by putting topsoil on one side of the trench and subsoil on the other.

9.3 Excavation of archaeological deposits and features required to satisfy the objectives of the evaluation will continue by hand (except where agreed otherwise with the archaeological advisor). On completion of machine excavation, all faces of the trench that require examination or recording will be cleaned using appropriate hand tools where required. The stratigraphic sequence will be recorded in full in each of the trenches, even where no archaeological deposits have been identified.

9.4 A sufficient quantity (to adequately evaluate the site) of identified features will be investigated and recorded. This will typically involve excavation of 50% of discrete features, and a 1m slot of linear features. Where features form a definite arrangement a sample of features within the arrangement will be sample excavated. Features not suited to excavation in evaluation trenches will be investigated in plan only. This would typically apply to areas of complex, intercutting features such as structures with *in-situ* floor surfaces, kilns and other 'special' features, all of which benefit from open area investigation and suffer when excavated during trial trench evaluations. No features will be wholly excavated; similarly, structures and features worthy of preservation will not be unduly excavated.

9.5 Due to Health and Safety considerations, excavations will normally be limited to a maximum depth of 1m below existing ground level. Test pits may be machine-excavated to greater depths; any such test pits will be located within blank areas of existing trenches, will not be entered by site staff, and will be backfilled immediately after excavation. Where required any trench exceeding 1m deep will be stepped for safety.

9.6 Trenches will be backfilled by replacing excavated materials back in the hole in reverse order of excavation; and by tamping down with the excavator as tidily as practicable.

9.7 No backfilling of trenches is to take place without prior agreement by the archaeological advisor to the planning authority.

RECORDING

9.8 All recording will follow the Headland manual and CIfA Standards and Guidance. All contexts, small finds and environmental samples will be given unique numbers. All recording will be undertaken on *pro forma* record cards. In the event that stratified deposits are encountered, a 'Harris' matrix will be compiled. Digital photographs on a minimum 10mp camera will be taken as the site photographic archive.

9.9 A site plan including all identified features, areas of excavation and other pertinent information will be recorded digitally. The site plan will be accurately linked to the National Grid and heights to OD. Where appropriate, sections and stratigraphic sequences will be recorded digitally. Digital recording will be undertaken using a differential GPS. If additional detailed recording of features and sections is required (i.e.. where their complexity means that archaeological information could be lost if recorded digitally) then plans and sections will be hand-drawn on permatrace at an appropriate scale (normally 1:20 or 1:50 for plans and 1:10 for sections).

SAMPLES AND ARTEFACTS

9.10 Finds will be routinely recorded by context and recorded 3-dimensionally where appropriate (i.e. where their position within a context can provide further significant information or the find is of particular significance). Any artefacts retrieved during the evaluation will be cleaned using appropriate techniques and packaged and stored in accordance with *First Aid for Finds* (Watkinson & Neal 1998). All artefacts recovered during the evaluation will be cleaned,

marked and catalogued. Headland's in-house finds specialists will be available to provide advice remotely or on site if necessary.

9.11 The terms of the Treasure Act 1996 will be followed with regards to any finds which might fall within its scope. Any finds will be removed to a safe place and reported to the local coroner as required by the procedures laid down in the "Code of Practice". Where removal cannot be effected on the same working day as the discovery, suitable security measures will be taken to protect the finds from theft. The find will also be reported to the Portable Antiquities Scheme Finds Liaison Officer.

9.12 A bulk sample will typically be 40 litres. However, where large deposits are encountered more than one bulk sample may be taken. Similarly, small deposits such as the fills of postholes may contain less than 40 litres of sediment and will be fully sampled from the excavated section. All samples collected on site will be processed and assessed, unless the stratigraphic assessment demonstrates that they derive from features with no archaeological significance, or unless they would provide duplicate information (e.g. multiple samples from the same phase of a ditch). A statement will be given on any discarded samples. The results and recommendations for any further work will be included in the evaluation report.

9.13 Where waterlogged deposits are encountered (such as peat) appropriate sampling techniques will be employed so as to maximise the environmental information gained from such deposits. This may include the taking of monolith or core samples for pollen and non-pollen palynomorphs (e.g. testates and fungal spores) and large specialist samples for plant macrofossil, wood (including waterlogged wood) and insect analyses.

9.14 The environmental sampling strategy will be in line with Historic England guidelines on environmental archaeology (English Heritage 2011).

10 MONITORING

10.1 Access to the site will be afforded to the archaeological advisor for monitoring purposes.

11 REPORTING AND ARCHIVE

11.1 All aspects of reporting and archive will be undertaken in accordance with guidelines published by the CIfA on behalf of the Archaeological Archives Forum (July 2007). On completion of the evaluation Headland will produce a site archive and, if appropriate, an Updated Project Design in line with the MAP2 specification and MoRPHE Guide. This will include all relevant specialist assessments of excavated material.

11.2 Final report contents and format will be in line with CIfA and Hertfordshire Historic Environment Advisory Service requirements. Copies of the report will be sent to the client for onward transmission to the local planning authority; copies (paper & electronic) will also be submitted to the HER Manager, to be uploaded to OASIS. All reports will be submitted within two months of the completion of fieldwork.

11.3 The final report will include:

- Background information including an overview of the Desk-based assessment and Historic Environment Record search (with reference number)
- Aims and Objective as outlined in this document
- Methodology of the trial evaluation
- Results of each trench, detail of general stratigraphy, modern disturbance and any archaeological features, including sample photos of trench overviews, sample section photos and archaeological features

- Assessment of any finds or environmental evidence
- Conclusion to results of evaluation

11.4 Headland Archaeology (UK) Ltd actively seeks to encourage land-owners to deposit artefacts with an appropriate museum, and agreement will be sought to this effect. Where permission is forthcoming the finds and archive will be deposited with the appropriate museum in line with its deposition guidelines. Deposition will be undertaken within one year of the completion of fieldwork.

11.5 A digital copy of the archive including photographs will be sent to Archaeology Data Service as per its guidelines.

11.6 If further publication of the results of the evaluation is required then a specification will be agreed with Hertfordshire Historic Environment Advisory Service and costs will be provided for agreement by the client.

12 PUBLIC ENGAGEMENT

12.1 The potential for the archaeological works to contribute to the advancement of educational or community benefits through public engagement has been considered. This potential is currently assessed to be low because of the limited duration and extent of the works and the low archaeological potential of the area.

12.2 Headland proposes no further additional public engagement beyond dissemination of the results as described above. This position will be kept under review as the works progress and the results become known. If circumstances change then potential public engagement activities – for example, press releases or other publicity - will be discussed with the client.

13 HUMAN REMAINS

13.1 All finds of human remains will be reported to the consultant/client/coroner/curator. Ordinarily none will be excavated during the course of the present program of work. However, if at the discretion of the archaeological advisor remains are considered to be at risk of harm from reinstatement of trenches, or required for understanding of the evaluation, excavation may be appropriate. If human remains are to be excavated during subsequent work, a license will be gained from the Ministry of Justice in accordance with Section 25 of the 1857 Burial Act. All excavation and treatment of cremated and inhumed human remains will be undertaken in cognisance of CIfA Technical Paper Number 13 (Brickley & McKinley & 2004) and relevant English Heritage guidelines (2005).

14 COPYRIGHT

14.1 Copyright will be retained by Headland Archaeology (UK) Ltd. Headland will licence the client, HHEAS and other bodies as necessary for use in matters relating to the project and for use of the project archive by the relevant museum. This licence will also extend to non-commercial use by the HHEAS HER.

15 PUBLICITY

15.1 No press releases or publicity material will be issued without prior approval of the client.

16 BIBLIOGRAPHY

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