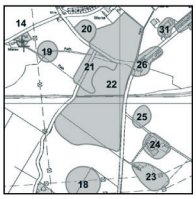
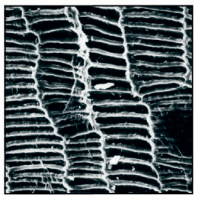
LIRC20










LLANDEILO INTERCONNECT, RHOSMAEN, CARMARTHENSHIRE

GEOPHYSICAL SURVEY REPORT

PLANNING REF. E/40566

commissioned by RSK Environment Ltd
on behalf of Western Power Distribution

August 2020

HEADLAND ARCHAEOLOGY

REGISTERED ORGANISATION CIfA

LLANDEILO INTERCONNECT, RHOSMAEN, CARMARTHENSHIRE

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

PROJECT INFO:

HA Project Code **LIRC20** / NGR **SN 6351 2315** / Parish **Llandeilo** / Local Authority **Carmarthenshire County Council** / Archive Repository **museum/archive**

PROJECT TEAM:

Project Manager **David Harrison** / Author **David Harrison** / Fieldwork **Matt Berry, Ross Bishop** / Graphics **David Harrison, Rafael Maya Torcelly**

Approved by **David Harrison** D Harrison .....

Headland Archaeology Yorkshire & North
Units 23–25 & 15 | Acorn Business Centre | Balme Road | Cleckheaton BD19 4EZ
t 0113 387 6430
e yorkshireandnorth@headlandarchaeology.com
w www.headlandarchaeology.com

HEADLAND ARCHAEOLOGY

part of the RSK Group

REGISTERED ORGANISATION CIfA

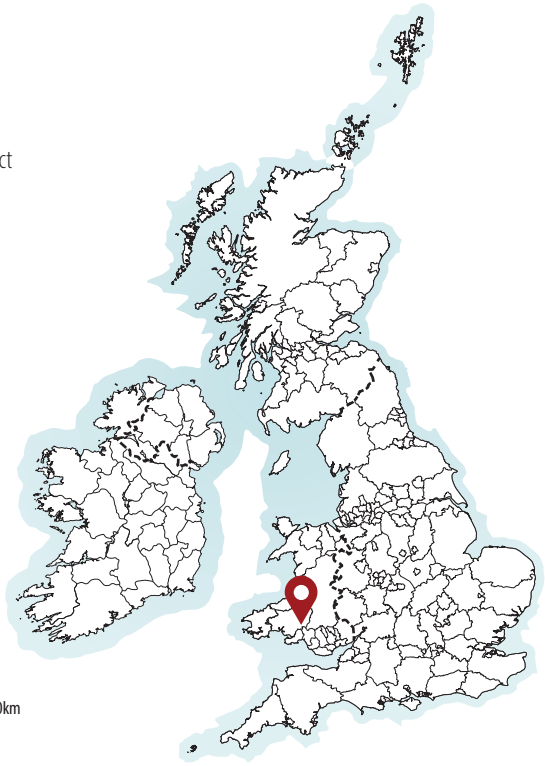
PROJECT SUMMARY

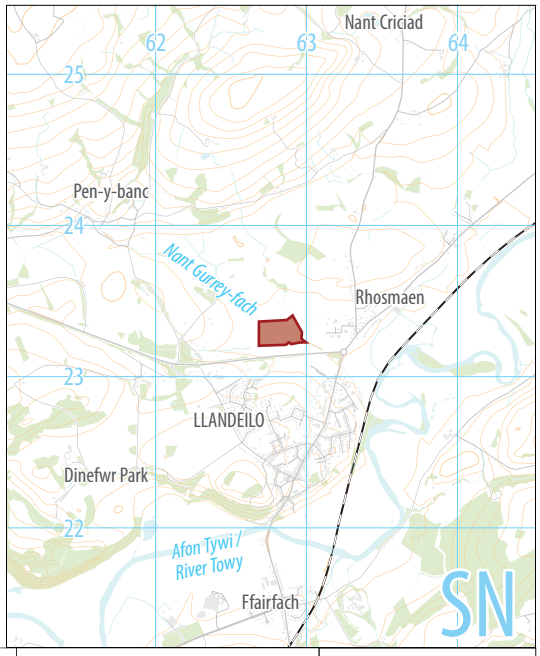
Headland Archaeology (UK) Ltd undertook a geophysical (magnetometer) survey of a 4.5ha field north of Llandeilo, Carmarthenshire, where a new 11kV powerline is proposed. The survey has identified a clear rectilinear anomaly corresponding to a possible prehistoric cropmark enclosure (PRN 11,815) which is recorded on the regional Historic Environment Record. However no other anomalies of any archaeological potential have been identified and the anomaly is thought likely to be due to post-medieval land division and/or water management. On the basis of the geophysical survey, the archaeological potential of the site is assessed as low.

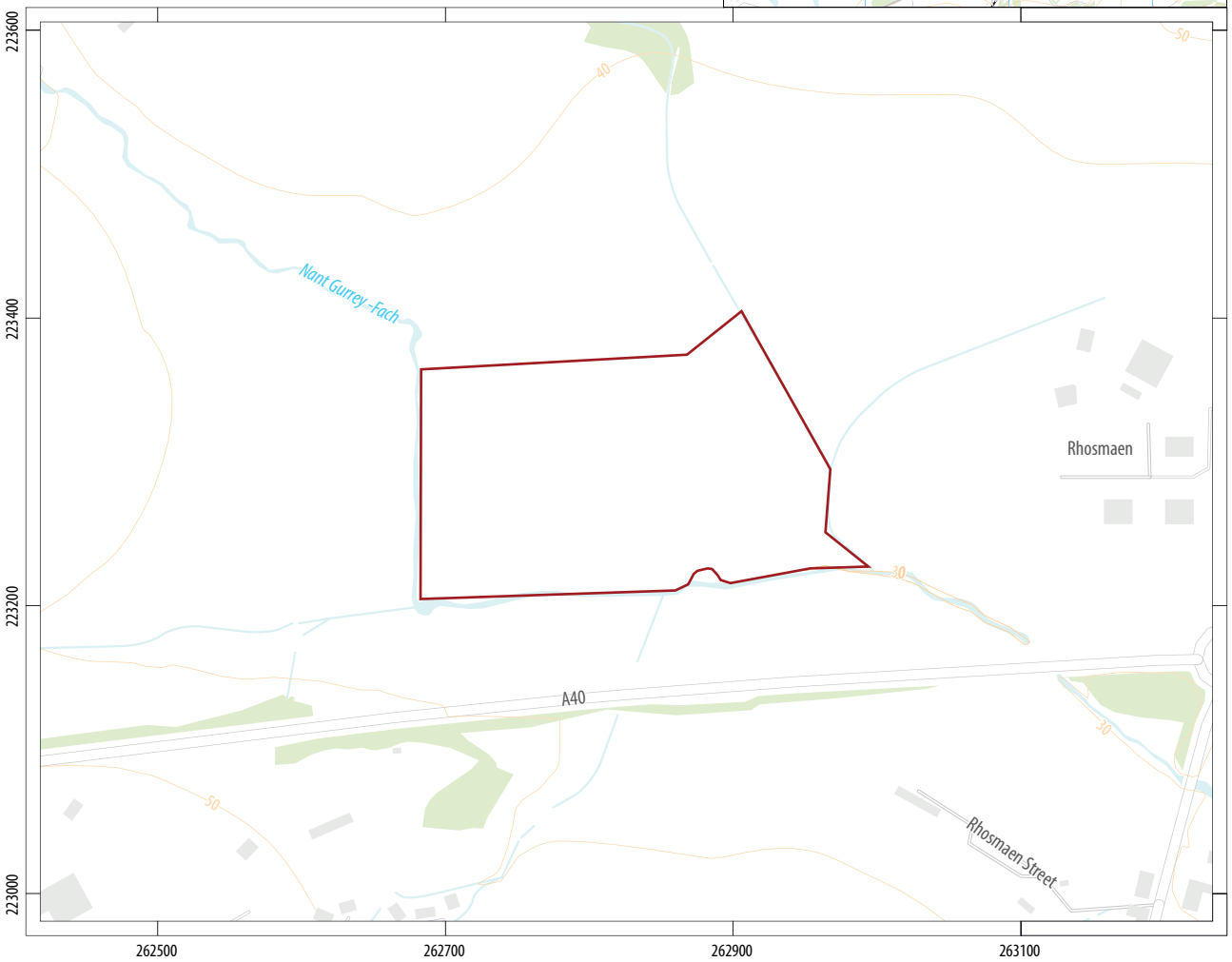
CONTENTS

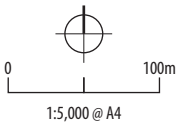
LIST OF ILLUSTRATIONS

Llandeilo Interconnect
Rhosmaen
Carmarthenshire









geophysical survey area

HEADLAND ARCHAEOLOGY
Headland Archaeology Yorkshire & North
Units 23–25 & 15 | Acorn Business Centre | Balme Road | Cleckheaton BD19 4EZ
t 0113 387 6430
e yorkshireandnorth@headlandarchaeology.com
w www.headlandarchaeology.com

ILLUS 1 Site location (1:5,000)

LLANDEILO INTERCONNECT, RHOSMAEN, CARMARTHENSHIRE

GEOPHYSICAL SURVEY REPORT

1 INTRODUCTION

Headland Archaeology (UK) Ltd was commissioned by Western Power Distribution (the Client), to undertake a geophysical (magnetometer) survey on land adjacent to Beechwood Industrial Estate, Llandeilo, where a new 11kV powerline is proposed. The survey has been requested by Dyfed Archaeological Trust in response to a planning application (E/40566) for the new powerline. The geophysical survey will form the first part of a staged archaeological evaluation and will inform future archaeological strategy at the site, if required.

The survey was undertaken in order to assess the impact of the proposed development on the historic environment. It was undertaken in accordance with an Archaeological Written Scheme of Investigation (WSI) (Harrison 2020) and with the requirements of Planning Policy Wales (Edition 10 2018) and Technical Advice Note (TAN 24). Current best practice was adhered to throughout the survey (Chartered Institute for Archaeologists 2014, Europae Archaeologia Consilium 2016).

1.1 SITE LOCATION, TOPOGRAPHY AND LAND-USE

The proposed scheme comprises the erection of eight poles to carry power lines over five fields west of Rhosmaen. The Geophysical Survey Area (GSA) comprises a single irregularly-shaped field centred on SN 6351 2315. The field is bound to the west and south by the Nant Gurrey-fach watercourse, a clear rectilinear deviation from its natural course, and by fields which contain permanent pasture on all sides.

Topographically, the site slopes gently towards from south-east from the north-western corner between 36m Above Ordnance Datum (AOD) and 32m AOD.

The fieldwork was carried out on the 27 July 2020.

1.2 GEOLOGY AND SOILS

The bedrock geology comprises Nantmel Mudstone and is overlain by glacial till (NERC 2020).

The soils are classified in the Soilscape 17 Association, characterised as slowly permeable, seasonally wet loams and clays (Cranfield University 2020).

2 ARCHAEOLOGICAL BACKGROUND

Dyfed Archaeological Trust, archaeological advisors to Carmarthenshire County Council, have advised that

> *'The proposed power line runs across a field where a cropmark (PRN 11,815) has been recorded that indicates the possible presence of a prehistoric enclosure and associated features. Although this is not currently confirmed, it potentially represents a site of archaeological significance.'*

ILLUS 2 GSA, looking north-west

Analysis of modern satellite imagery (Google Earth) has identified the cropmark as a clear rectilinear ditch in the centre of the GSA extending from the north-west before turning southwards (Getmapping plc 2020; Illus 3). The feature is not depicted on any historic Ordnance Survey mapping nor on the Rhosmaen Tithe map (1838–1850).

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 GSA. 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 GSA;
- to obtain information that will contribute to an evaluation of the significance of the proposals 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 V3.0.35.1 (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 1:5,000. Illus 2 is a site condition photograph and Illus 3 is a 2005 satellite image. Illus 4 shows the survey location and GPS swaths at a scale of 1:3,000 with large-scale, fully processed (greyscale) data, minimally processed data (XY trace plot) and an interpretative plot presented at a scale of 1:2,500 in Illus 5 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 presented in Appendix 4.

ILLUS 3 Modern satellite image showing rectilinear cropmark (Getmapping Plc 2020)

The survey methodology, report and any recommendations comply with the Written Scheme of Investigation (Harrison 2020), with 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 data are presented at a range determined by the Headland staff to best present the data from this site based on the experience and knowledge of Headland management and staff.

4 RESULTS AND DISCUSSION

Ground conditions were good and the data collected is of a high standard throughout. The survey has detected a variable magnetic background with several low-level sinuous bands of magnetic enhancement probably locating the original course(s) of the Nant Gurrey-fach river. Against this background several anomalies have been identified and cross-referenced to specific examples on the interpretation illustration, where appropriate.

4.1 FERROUS 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 present 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.

The localised area of magnetic disturbance in the south-east of the field is caused by temporary fencing around an open drain (Illus 2).

Magnetic disturbance around the field edges is due to ferrous material within, or adjacent to the boundaries, and is of no archaeological interest.

4.2 AGRICULTURAL ANOMALIES

Analysis of historical mapping indicates that the division and layout of land within the GSA has remained largely unchanged since the publication of the Rhosmaen Tithe Map (1838–1850), albeit with the canalisation of the Nant Gurrey-fach watercourse along the southern boundary of the field.

The survey has detected a clear negative rectilinear anomaly within the centre of the field which corresponds to cropmarks shown on modern satellite images (Google Earth). The anomaly is caused by a soil-filled ditch, probably for land division and/or water management. Several narrower linear trends on varying alignments are typical of land drains

4.3 GEOLOGICAL ANOMALIES

Occasional and sporadic discrete low magnitude anomalies throughout the GSA are probably due to localised variation in the depth and composition of the topsoil and are not thought to be of any archaeological potential.

Sinuous and weakly magnetic linear trends are thought to be due to silt-filled former water channels, probably the original course of the Nant Gurrey-fach river, and episodes of seasonal waterlogging.

5 CONCLUSION

The survey has successfully evaluated the geophysical survey area and has identified a clear rectilinear anomaly corresponding to a possible prehistoric cropmark enclosure (PRN 11,815) which is recorded on the regional Historic Environment Record. However no other anomalies of any archaeological potential have been identified and the anomaly is thought likely to be due to post-medieval land division and/or water management. On the basis of the geophysical survey, the archaeological potential of the site is assessed as low.

6 REFERENCES

Chartered Institute for Archaeologists (ClfA) 2014 ***Standard and guidance for archaeological geophysical survey*** (Reading) http://www.archaeologists.net/sites/default/files/ClfAS%26GGeophysics_2.pdf accessed 7 August 2020

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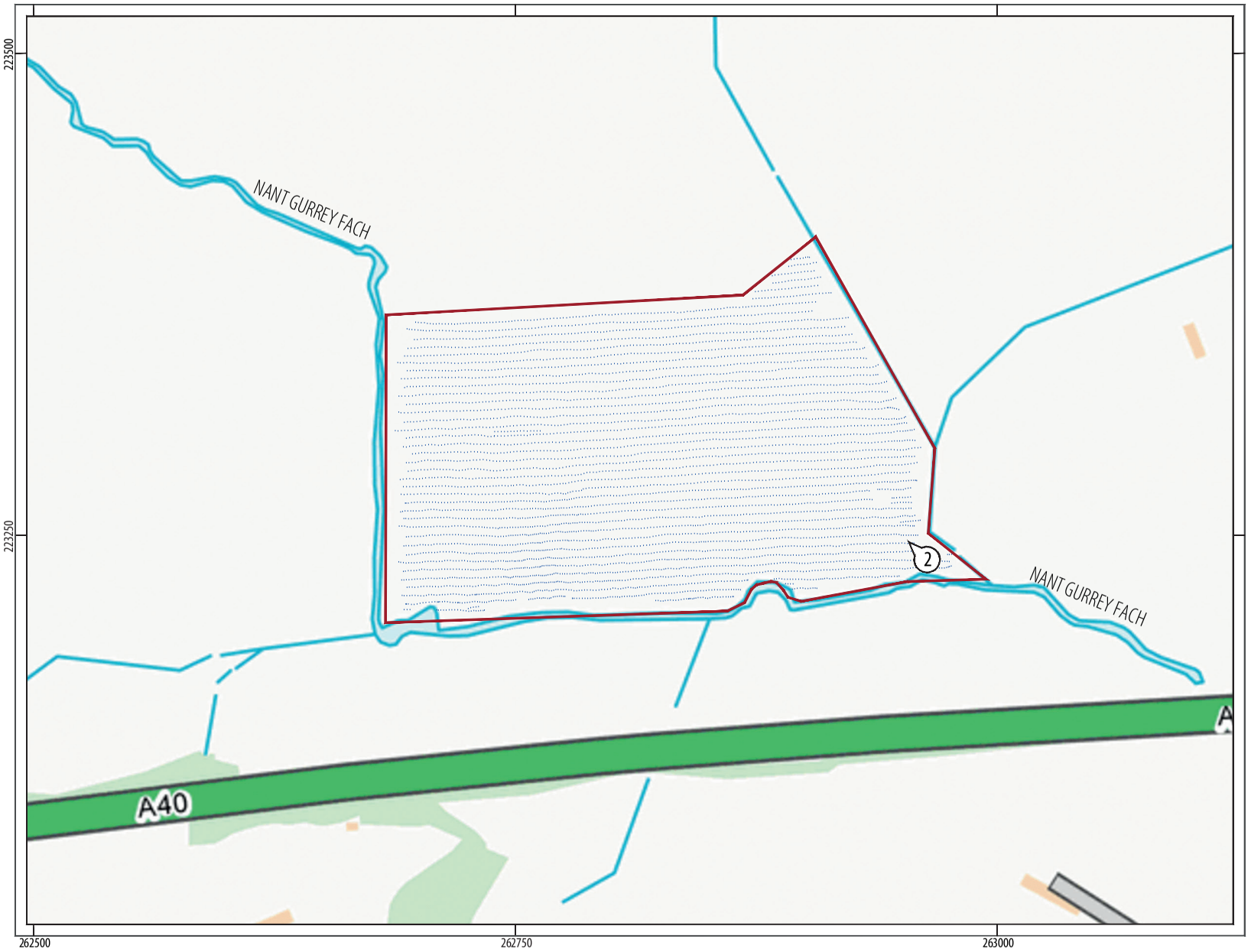


geophysical survey area
GPS swaths
location and direction of ILLUS 2

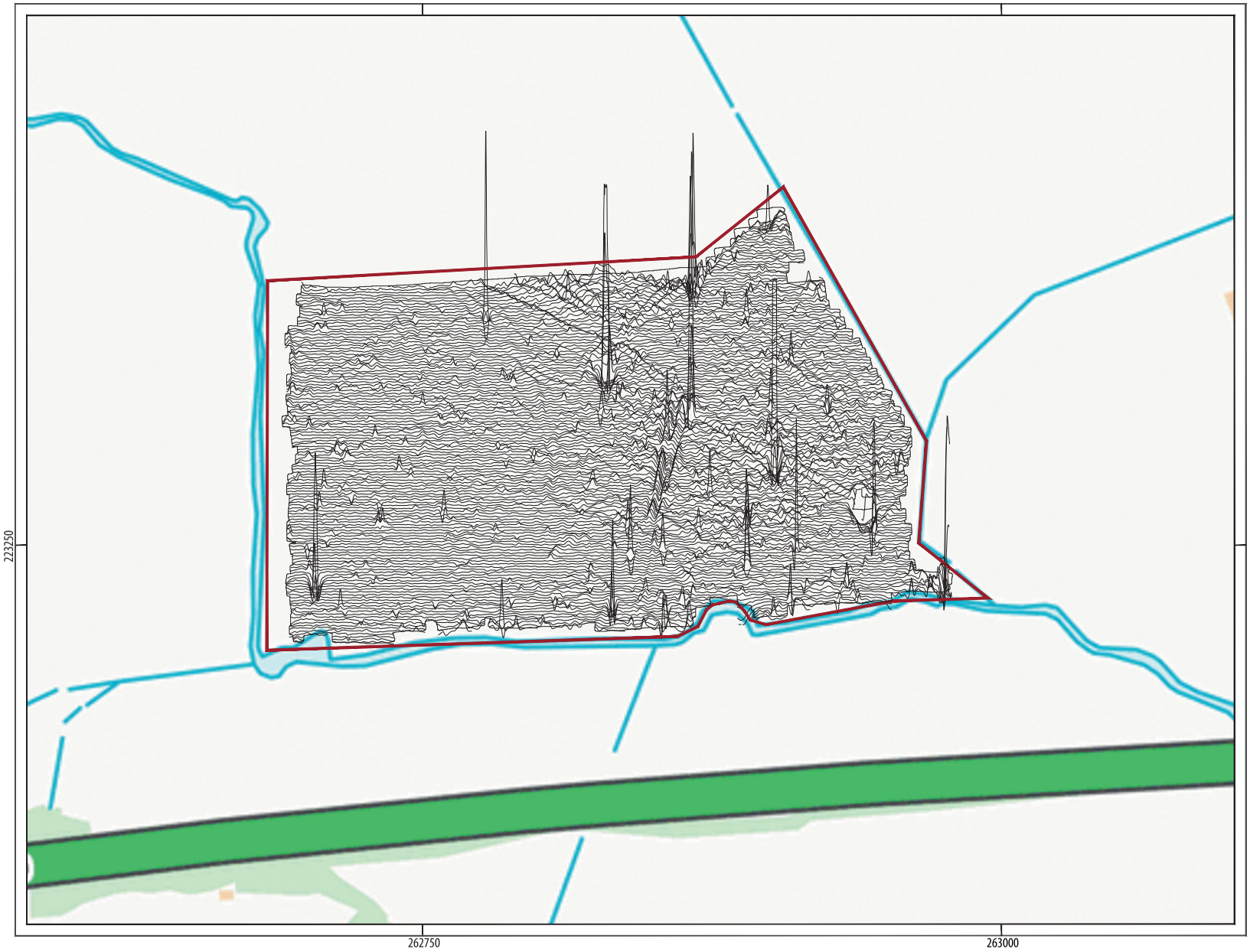
0 50m
1:2,500 @ A4

PROJECT	LIRC19 Llandeilo Interconnect Rhosmaen Carmarthenshire
CLIENT	Western Power Distribution

HEADLAND ARCHAEOLOGY
Headland Archaeology Yorkshire & North
Units 23-25 | Acorn Business Centre | Balme Road
Cleckheaton | BD19 4EZ
t 0113 387 6430
w www.headlandarchaeology.com

ILLUS 4 Survey location showing GPS swaths (1:3,000)

ILLUS 5 Processed greyscale magnetometer data (1:2,500)



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PROJECT LIRC19
Llandeilo Interconnect
Rhosmaen
Carmarthenshire

CLIENT Western Power Distribution

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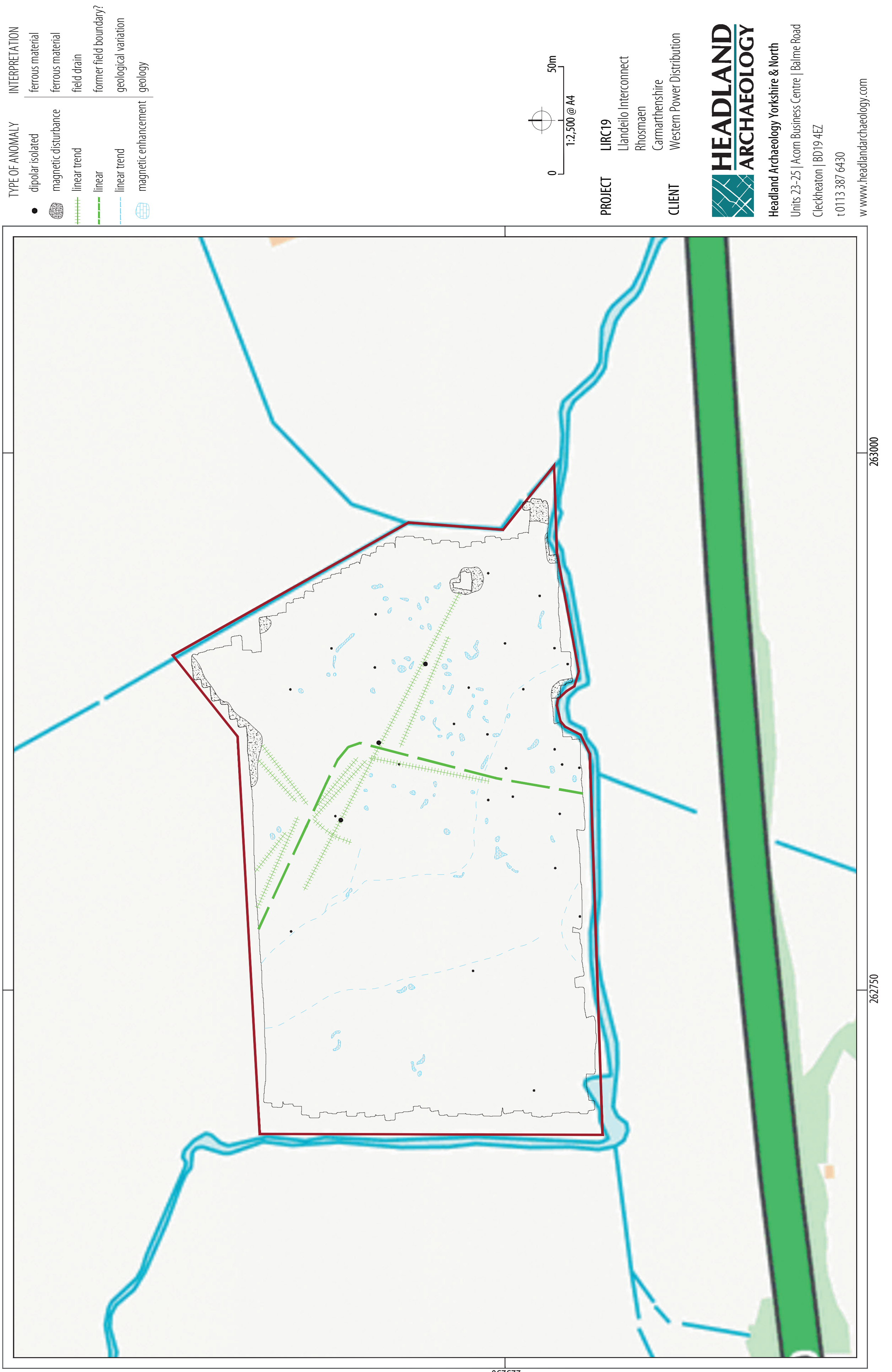
Headland Archaeology Yorkshire & North
Units 23-25 | Acorn Business Centre | Balme Road
Cleckheaton | BD19 4EZ
t 0113 387 6430
w www.headlandarchaeology.com

ILLUS 6 XY trace plot of minimally processed magnetometer data (1:2,500)



ILLUS 7 Interpretation of magnetometer data (1:2,500)

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.

part of the RSK Group

Headland Archaeology Scotland
13 Jane Street
Edinburgh EH6 5HE
t 0131 467 7705
e scotland@headlandarchaeology.com

Headland Archaeology Yorkshire & North
Units 23–25 & 15 | Acorn Business Centre | Balme Road
Cleckheaton BD19 4EZ
t 0113 387 6430
e yorkshireandnorth@headlandarchaeology.com

Headland Archaeology South & East
Building 68C | Wrest Park | Silsoe
Bedfordshire MK45 4HS
t 01525 861 578
e southandeast@headlandarchaeology.com

Headland Archaeology Midlands & West
Unit 1 | Clearview Court | Twyford Rd
Hereford HR2 6JR
t 01432 364 901
e midlandsandwest@headlandarchaeology.com

Headland Archaeology North West
Fourways House | 57 Hilton Street
Manchester M1 2EJ
t 0161 236 2757
e northwest@headlandarchaeology.com

www.headlandarchaeology.com