

HRLG/02



# LAND AT HIGHFIELD ROAD, LYDNEY, GLOUCESTERSHIRE

GEOPHYSICAL SURVEY

commissioned by Edenstone Homes

January 2017



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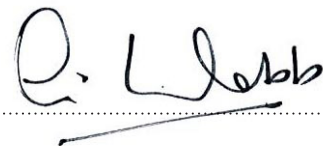
January 2017

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NGR SO 6448 0388  
PARISH Forest of Dean  
LOCAL AUTHORITY Gloucestershire  
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 **HEADLAND  
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## PROJECT SUMMARY

Headland Archaeology (UK) Ltd undertook a geophysical (magnetometer) survey, covering 3 hectares, on land at Highfield Road, Lydney, to inform future archaeological strategy in advance of a proposed residential development. The survey area, and the land surrounding it, has been previously subject to evaluation trenching as part of an earlier planning application. The trenching revealed evidence of Roman settlement activity in the south-east of the current survey area as well as several undated features to the north-west. The survey has clearly identified the northern extent of a rectangular enclosure at the south-eastern site boundary, probably defining the northern limit of the Roman settlement activity. Several pit-type anomalies within the interior and immediately outside of the enclosure may be due to soil-filled pits and/or spreads of archaeological material. In addition, two broad amorphous areas containing high magnitude anomalies may be indicative of industrial activity, possibly iron smelting, an activity which is known in the surrounding landscape. No anomalies consistent with the presence of a Roman road, which is postulated to pass through the west of the site, have been identified.

Based on the results and interpretation of the geophysical survey the archaeological potential in the vicinity of the rectangular enclosure at the south-eastern site boundary is assessed as high. A moderate to high potential is ascribed to the two areas of possible industrial activity with the remainder of the site having low potential for the presence of unrecorded archaeological remains.

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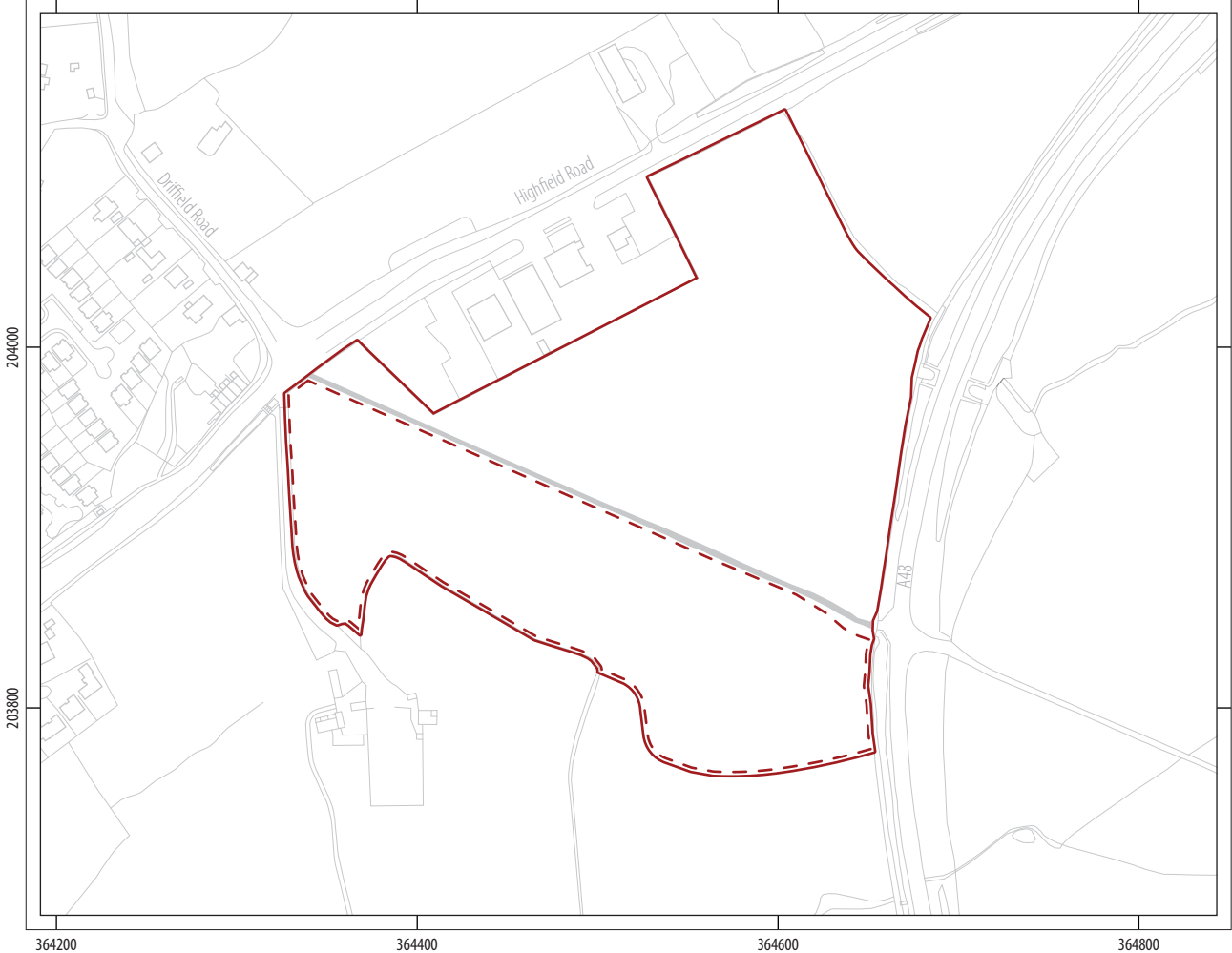
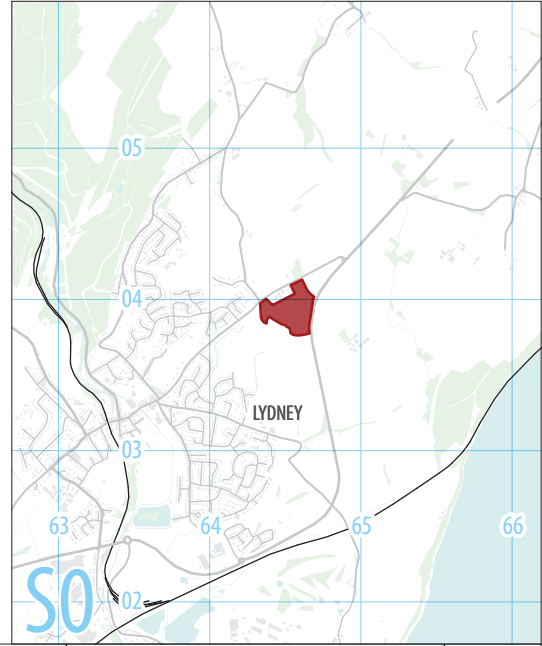
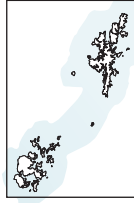
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**HRIG/02**  
 land at Highfield Road  
 Lydney  
 Gloucestershire

0 200km  
 1:10,000,000 @ A4

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0 100m  
 1:4,000 @ A4

**KEY**  
 proposed development area  
 geophysical survey area



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# LAND AT HIGHFIELD ROAD, LYDNEY, GLOUCESTERSHIRE

## GEOPHYSICAL SURVEY

### 1 INTRODUCTION

Headland Archaeology (UK) Ltd was commissioned by Hunter Page Planning Ltd (The Planning Consultant) on behalf of Edenstone Homes (The Client), to undertake a geophysical (magnetometer) survey of land south-east of Highfield Road, Lydney, to inform forthcoming archaeological strategy in advance of a proposed residential development.

The work was undertaken in accordance with a Written Scheme of Investigation (Headland Archaeology 2016a) which was submitted to and approved by Charles Parry, Archaeological Advisor to the Local Planning Authority, and with guidance contained within the National Planning Policy Framework (DCLG 2012). All work was also undertaken in line with current best practice (Chartered Institute for Archaeologists 2014, English Heritage 2008).

The survey was carried out on December 7th and December 8th 2016 in order to provide information on the archaeological potential of the site.

#### 1.1 SITE LOCATION, TOPOGRAPHY AND LAND-USE

The proposed development area (PDA) covers approximately 7ha and is located within a single, irregularly-shaped field to the north-east of Lydney, Gloucestershire (see Illus 1). The geophysical survey covered only the southernmost part of the PDA, an area of 3ha, bound to the north by a surfaced farm track and centred on SO 6448 0388.

The PDA is bound to the north and north-west by Highfield Road and by a petrol station and commercial units which front onto it. The south-western boundary is defined by mature hedgerows beyond which lie the ruins of Rodley Manor with mixed arable/pasture extending south and westwards. The southernmost part of the PDA is unbound and extends onto arable farmland. The A48 bounds the site to the east and with a low boundary forming the north-eastern site limit.

The survey area is located on a south-east facing slope, decreasing from 75m above Ordnance Datum (AOD) at Highfield Road in the north-west to 50m AOD at the A48 bypass in the south-east.

At the time of the survey the PDA was under improved pasture (see Illus 2).

#### 1.2 GEOLOGY AND SOILS

The underlying bedrock comprises argillaceous rocks and interbedded sandstone of the Maughans Formation. No superficial deposits are recorded (NERC 2016).

The soils are classified in the Soilscape 8 association, characterised as loams and clays with impeded drainage (Cranfield University 2016).

### 2 ARCHAEOLOGICAL BACKGROUND

The PDA has previously been subject to evaluation by trial trenching (Wessex Archaeology 2003; see Illus 4) as part of a previous planning application. Four trenches within the current survey area contained undated archaeological features/deposits. In addition, trenching immediately south of the current survey area identified features interpreted as the likely focus of Roman settlement. Subsequent, retrospective geophysical survey (Headland Archaeology 2015) of this area identified anomalies consistent with this interpretation.

Several other archaeological investigations including a landscape assessment of land east of Lydney in 2002 (HER 32916), a previous DBA (HER 21616) and heritage statement (HER 44593) and an assessment of the Lydney bypass in 1991 (HER 16656) have included the PDA within their scope of investigation. These works are summarised in a recent Heritage Statement (Headland Archaeology 2016b).

The land to the south-west of the PDA, around Rodley Manor, has also been investigated through geophysical survey (HER 48409 and 48410), topographic survey (HER 21524), and trial trenching (HER 48048). The investigations have identified substantial subsurface building remains as well as significant evidence for small-scale medieval iron smelting. The standing buildings of Rodley Manor Farm and Crump Farm were also subject to Historic Building Assessment (HER 32917). This site has been recently excavated, but the results are not yet publicly available.

The projected route of a Roman road is recorded on a north-east/south-west alignment within the west of the PDA (HER 6212; see Illus 4).

Analysis of historical mapping (Old-maps 2016) indicates that the division and layout of land within the survey area has changed slightly since the publication of the first edition Ordnance Survey (OS) map (1881) with the removal of two field boundaries. One of these former boundaries is shown on the 1892–1905 six inch OS map aligned east/west within the south-east of the survey area (see Illus 4). A pond is shown on the northern side of the boundary. The second former boundary is shown on the first edition OS map towards the centre of the survey area, aligned north-east/south-west.

### 3 AIMS, METHODOLOGY AND PRESENTATION

The main aim of the geophysical survey was to provide sufficient information to enable an assessment to be made of the impact of any proposed development on any sub-surface archaeological remains, if present.

The general archaeological objectives of the geophysical survey were:

- › to provide information about the nature and possible interpretation of any magnetic anomalies identified;
- › to therefore model the presence/absence and extent of any buried archaeological features; 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. Features 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 and 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 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 V3.0.31.0 (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 1:4,000. Illus 2 is a site condition photograph. Illus 3 is a 1:3,000 scale survey location plan showing the GPS swath data. The survey location is shown overlying the 1892–1905 six inch OS map and showing previous trial trench locations as Illus 4 at the same scale.

Detailed data plots of the fully processed data (greyscale), the minimally processed data (XY traceplot), and an accompanying interpretative plot, are presented at a scale of 1:1,000 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. 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 Archaeology 2016a) and guidelines outlined by Historic England (English Heritage 2008) and by the Chartered Institute for Archaeologists (CIfA 2014). All illustrations from Ordnance Survey 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 most suitably display and interpret the data from this site based on the experience and knowledge of management and reporting staff.

### 4 RESULTS AND DISCUSSION

The ground conditions were good across the geophysical survey area and the data quality was correspondingly good throughout. The magnetic background is variable across the majority of the site being characterised by numerous discrete areas of magnetic enhancement which are due to localised variations within the depth and composition of the clay soils.

Against this background several anomalies have been identified. These are discussed below and cross-referenced to specific anomalies on the interpretative drawings, where appropriate.

#### 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 or material is common on most sites, often being present as a consequence of manuring or tipping/infilling. One notable cluster of ferrous anomalies (FP see Illus 7) is identified within the south-east of the survey area corresponding closely with the location of a pond which



**ILLUS 2** Survey area, looking south-east

is recorded on early OS maps. The anomalies are caused by magnetic material used to infill the former pond.

Magnetic disturbance around the field edges is due to ferrous material within or close to the adjacent field boundaries. The band of magnetic disturbance along the northern edge of the dataset (FT see Illus 7) is caused by a metallated farm track.

## 4.2 GEOLOGICAL ANOMALIES

Numerous low magnitude discrete areas of magnetic enhancement (anomalies) are identified throughout the dataset. These are generally evenly distributed and are thought to be due to localised variations in the depth and composition of the prevailing soils. The anomalies increase in frequency to the west of a possible former field boundary (FB3 see Illus 7), perhaps resulting from differing land use or deeper cultivation.

## 4.3 AGRICULTURAL ANOMALIES

Two linear anomalies (FB1 and FB2 see Illus 7) are due to former field boundaries which are shown on the first edition Ordnance Survey map (1881). A third possible former boundary (FB3 see Illus 7) is detected as a north-east/south-west linear trend within the centre of the dataset. The anomaly is parallel with the former pattern of land division and corresponds closely to the projected continuation of a former boundary from within the lands of Rodney Manor (see Illus 7).

## 4.4 ARCHAEOLOGICAL AND POSSIBLE ARCHAEOLOGICAL ANOMALIES

Four broad areas of archaeological potential (AAP) have been identified by the survey. The first area (AAP1 see Illus 7) is identified within the south-east of the survey area, centred at SO 6461 0376, and is focused upon the northern extent of a rectangular enclosure (E1), the southern half of which was identified by previous geophysical survey (Headland Archaeology 2015; see Illus 7). The enclosure appears on a north-east/south-west alignment and is formed by fragmented linear anomalies (D1 and D2), probable soil-filled ditches. Several discrete anomalies within the interior and immediately outside of the enclosure may be due to archaeological activity i.e. soil-filled pits and/or spreads of archaeological material.

To the immediate west of AAP1 a broad area of increased background response is identified as AAP2, centred at SO 6455 0376. No archaeological pattern is discernible within this background although an undated pit was revealed during trial trench evaluation. Several discrete anomalies within this area may be caused by similar features.

Two broad amorphous areas of archaeological potential, characterised by concentrations of high magnitude anomalies, are identified within the centre of the survey area (AAP3, centred at SO 6443 0392, and AAP4, centred at SO 6451 0384; see Illus 8). No

coherent archaeological pattern is visible amongst these anomalies although AAP3 is particularly notable for the presence of three extremely high magnitude anomalies (BM1-BM3) which may be due to thermoremanent magnetisation caused by intense burning. This interpretation is given further credence given that trial trench evaluation in the vicinity of AAP1 identified undated pits, ditches and a notable concentration of iron slag (Wessex Archaeology 2003; see Illus 7). Significant evidence for medieval iron smelting has been identified at Rodley Manor and it is possible therefore that these anomalies are caused by similar activity.

Five isolated broad and high magnitude anomalies (P1-P5 see Illus 7) are identified across the survey area. These are higher in magnitude than the surrounding discrete anomalies and are therefore ascribed a possible archaeological interpretation, perhaps being due to soil-filled pits.

## 5 CONCLUSION

The geophysical survey has successfully evaluated the survey area and has enhanced the archaeological record confirming the identification of the likely northern extent of a probable rectangular enclosure in the south-east corner of the proposed development area. Several discrete anomalies within the interior and immediately outside of the enclosure may be due to soil-filled pits and/or archaeological spreads. The relatively homogenous magnetic background to the north of the probable enclosure suggests that any settlement activity is restricted to this south-eastern corner of the survey area

Two broad amorphous areas of possible industrial activity within the centre of the survey area may indicate the site of industrial activity, possibly iron smelting, an activity which is known to have been carried out at Rodley Manor and in the surrounding landscape. Elsewhere, at least five isolated high magnitude anomalies may be due to soil-filled pits.

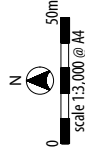
No anomalies consistent with the presence of a Roman road, which is postulated to pass through the west of the site, have been identified.

Therefore, on the basis of the results and interpretation of the geophysical survey the archaeological potential in the vicinity of the rectangular enclosure at the south-eastern site boundary is assessed as high. A moderate to high potential is ascribed to the two areas of possible industrial activity north of Rodley Manor with the remainder of the site having low potential for the presence of unrecorded archaeological remains.

## 6 REFERENCES

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- proposed development area
- geophysical survey area
- GPS swath
- location and direction of ILLUS 2

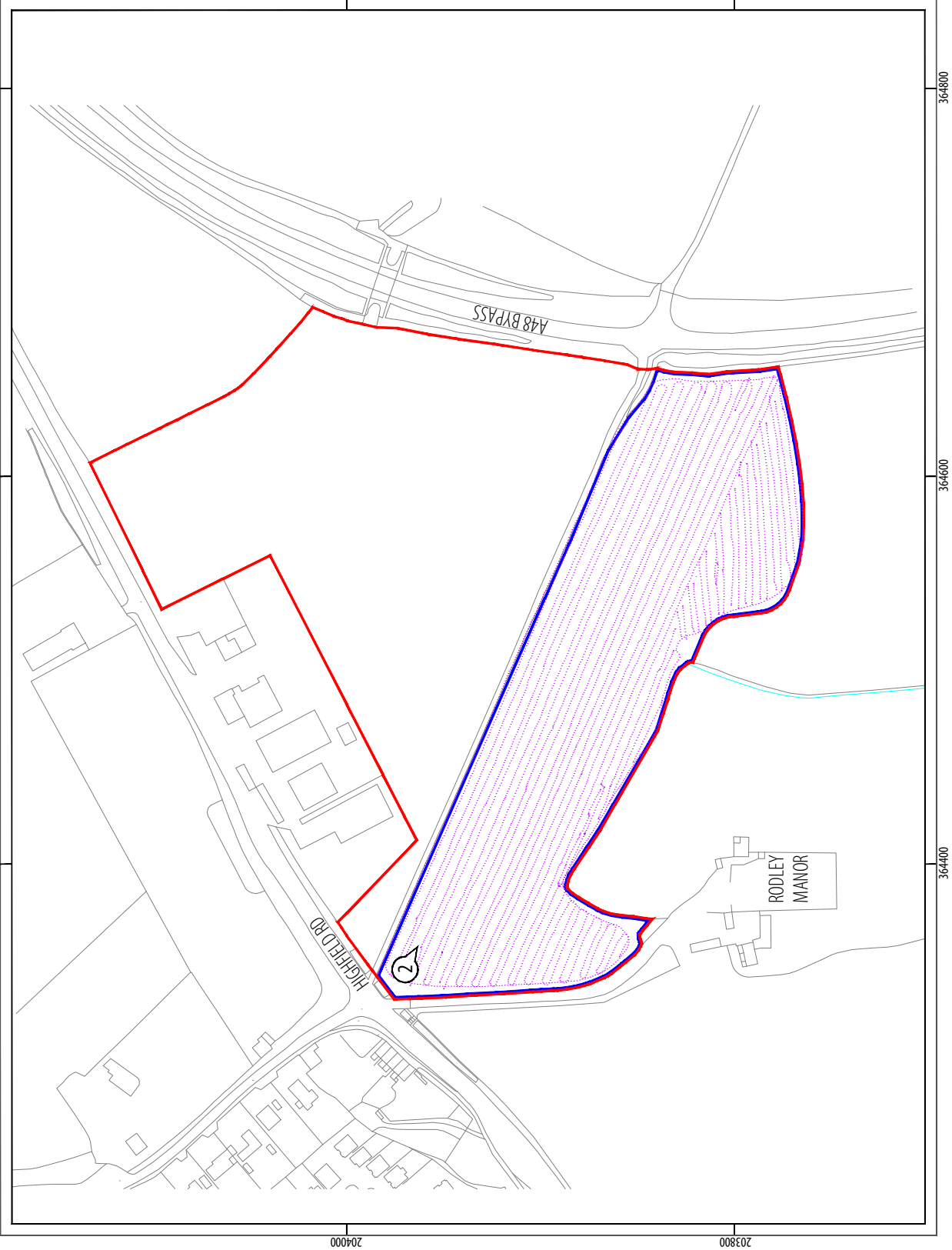


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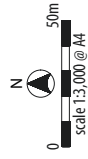
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ILLUS 3 Survey location showing GPS swaths (1:3,000)

- proposed development area
- geophysical survey area
- negative trial trench (WA 2013)
- trench containing undated features
- postulated line of Roman road
- indicative interpretation of previous geophysical anomalies (HA 2015)



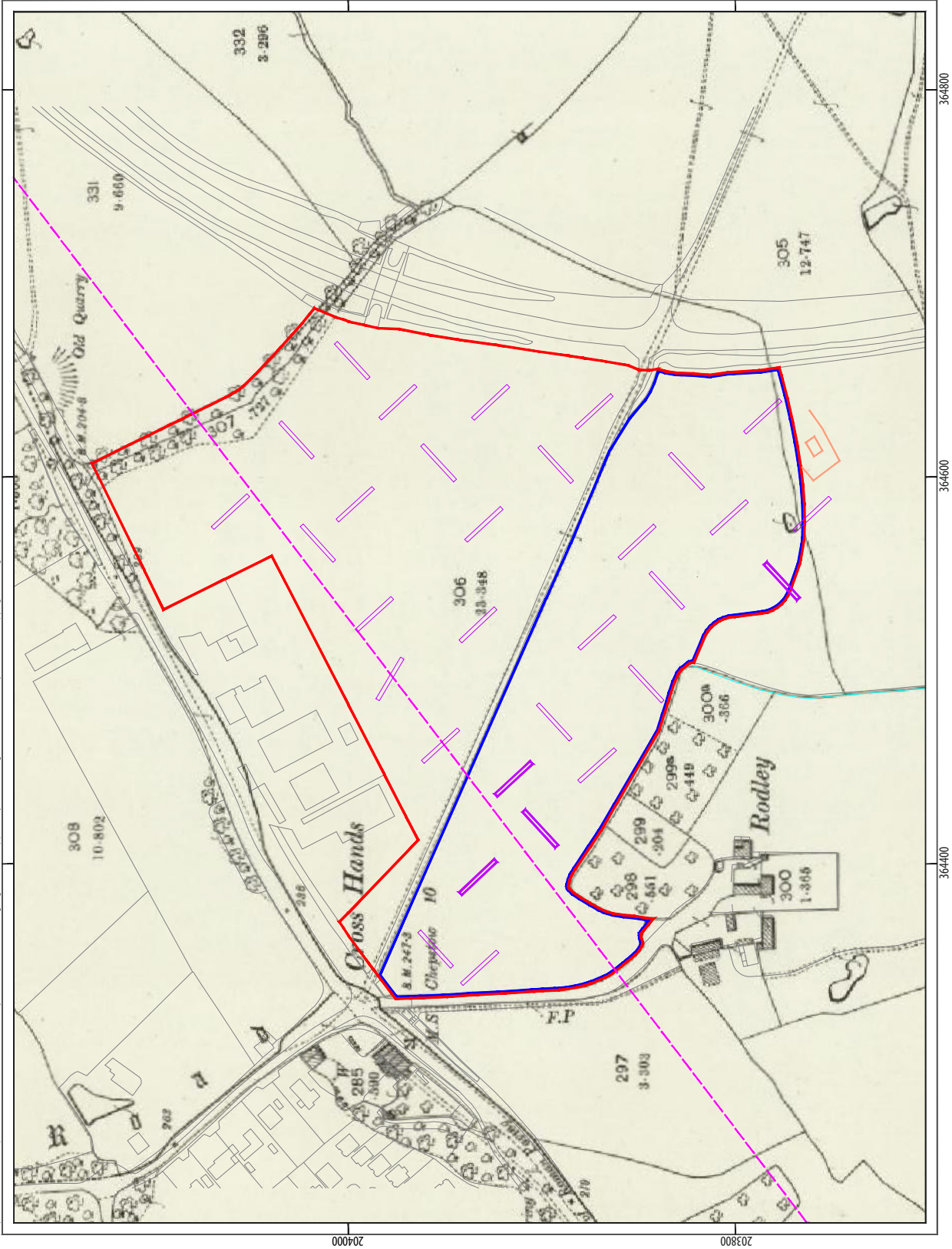
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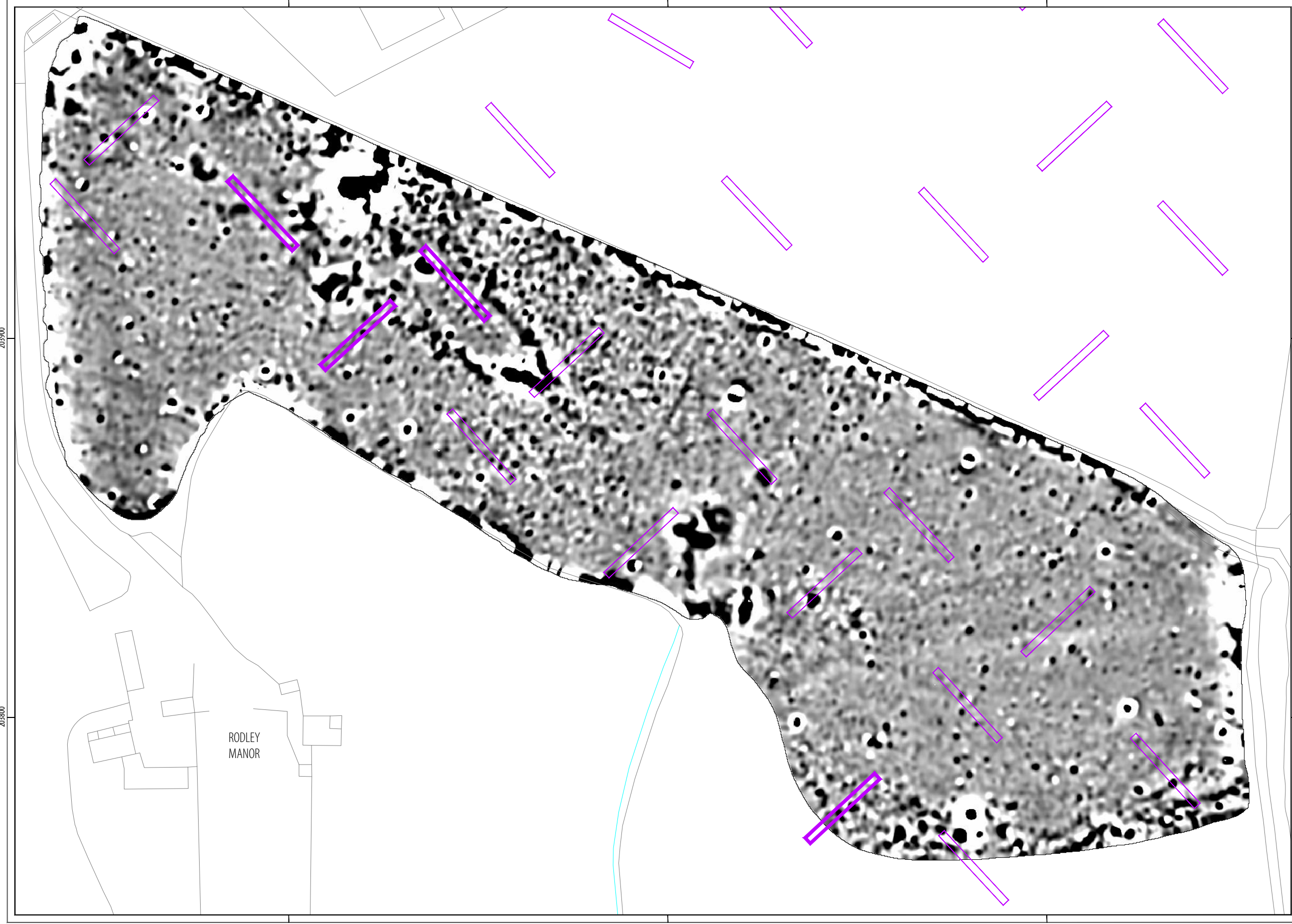


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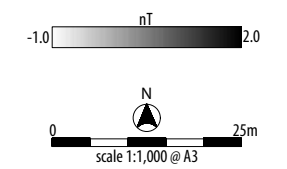
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ILLUS 4 Survey location overlying 1892–1905 six inch OS map and showing previous trial trench locations (1:3,000)



- negative trial trench (WA 2013)
- trench containing undated features

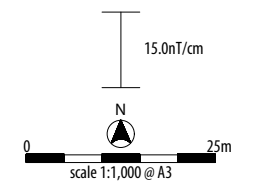
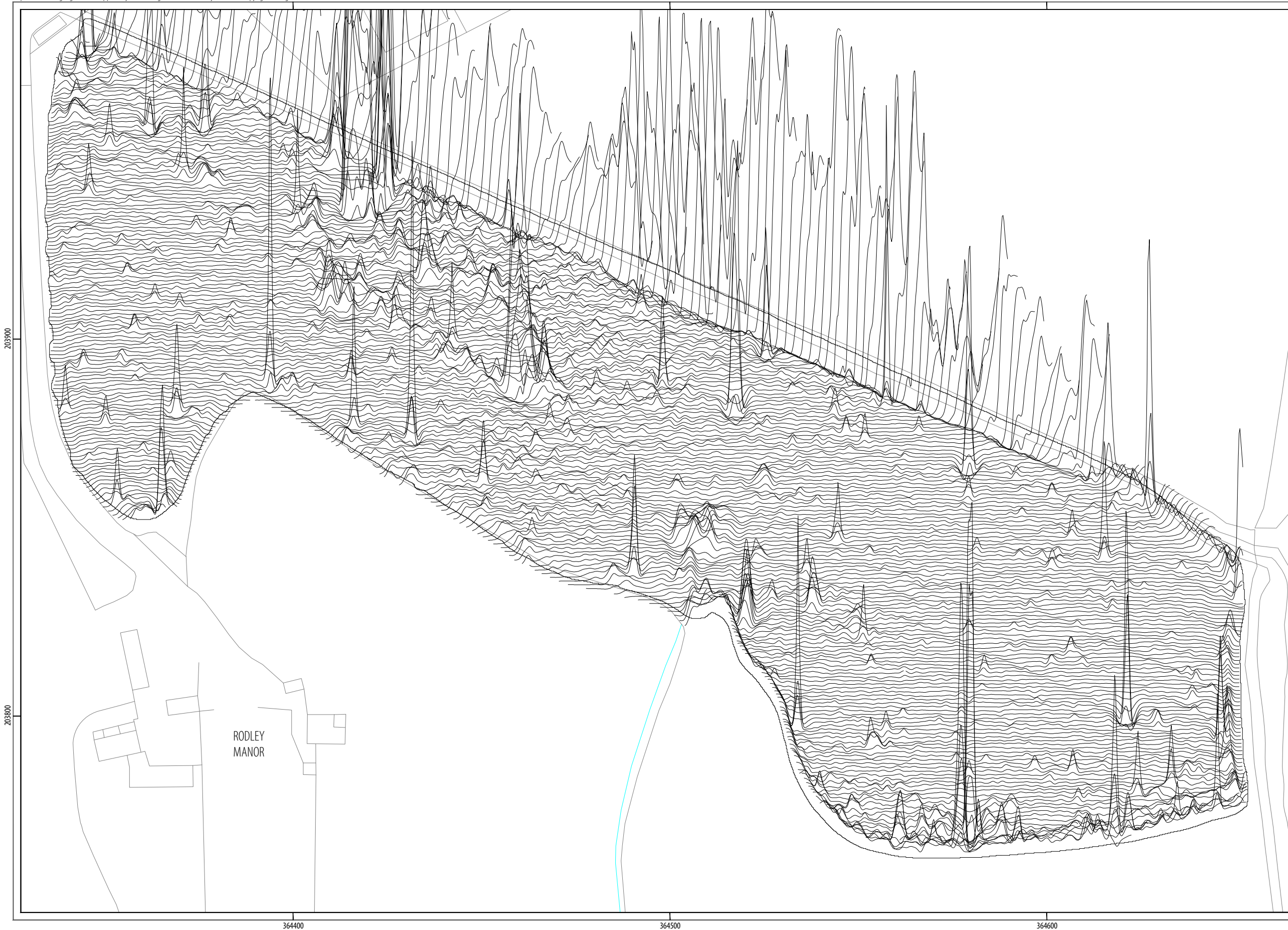


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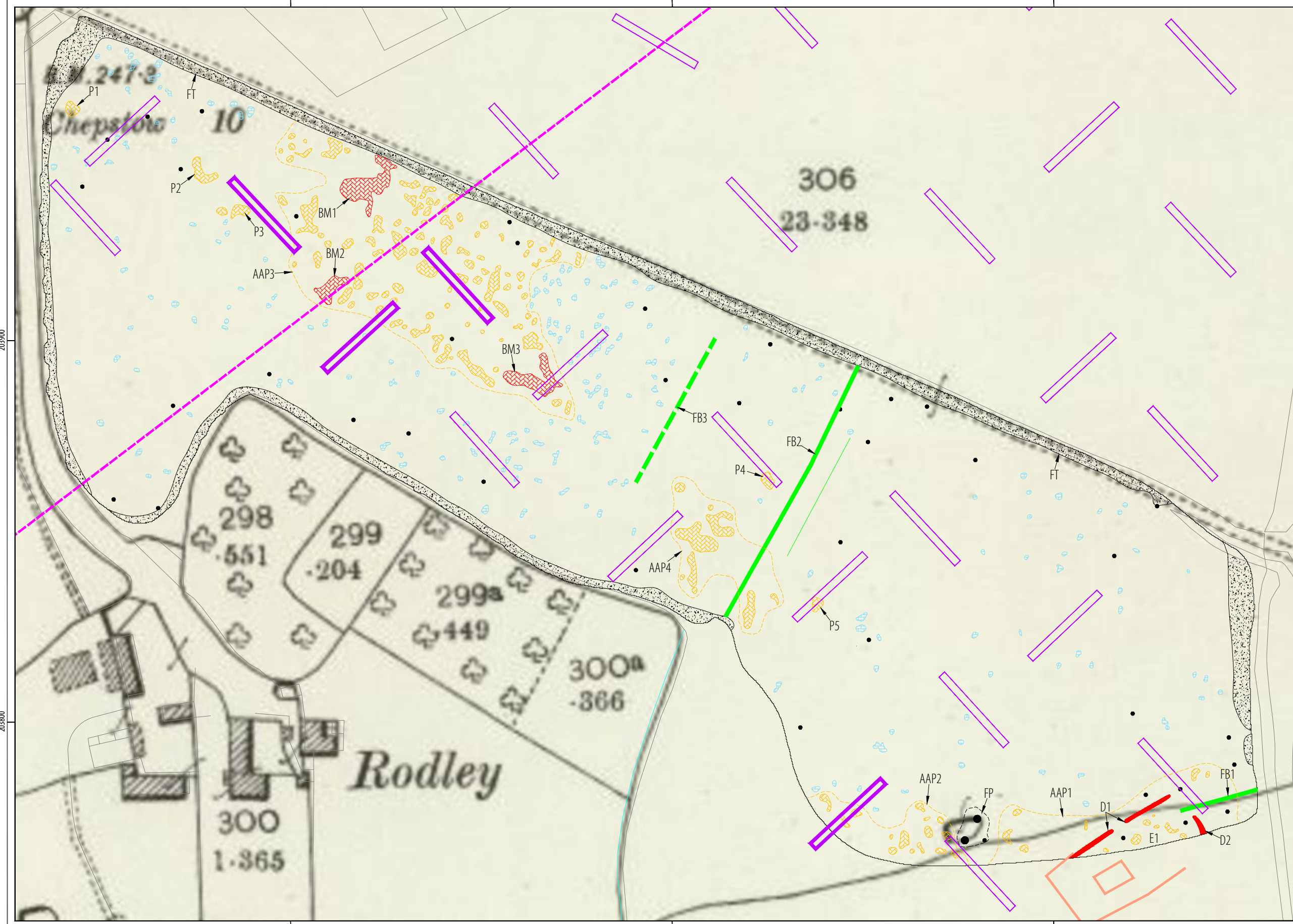
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ILLUS 6 XY trace plot of minimally processed magnetometer data

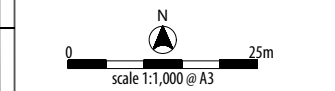




- negative trial trench (WA 2013)
- ▭ trench containing undated features
- postulated line of Roman road
- indicative interpretation of previous geophysical anomalies (HA 2015)

TYPE OF ANOMALY	INTERPRETATION
● dipolar isolated	ferrous material
● magnetic disturbance	ferrous material
— linear trend	agricultural
— linear	former field boundary
— linear	former field boundary?
● magnetic enhancement	geology?
● magnetic enhancement	archaeology?
● magnetic enhancement	area of burning?
● magnetic enhancement	archaeology

- ABBREVIATIONS
- AAP area of archaeological potential
  - BM burnt material
  - D ditch
  - E enclosure
  - FB former boundary
  - FP former pond
  - FT farm track
  - FU furnace
  - P pit



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## 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.

**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](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: headland5-273755

## PROJECT DETAILS

Project name	Land at Highfield Road, Lydney
Short description of the project	Headland Archaeology (UK) Ltd undertook a geophysical (magnetometer) survey, covering 3 hectares, on land at Highfield Road, Lydney, to inform future archaeological strategy in advance of a proposed residential development. The survey area, and the land surrounding it, has been previously subject to evaluation trenching as part of an earlier planning application. The trenching revealed evidence of Roman settlement activity in the south-east of the current survey area as well as several undated features to the north-west. The survey has clearly identified the northern extent of a rectangular enclosure at the south-eastern site boundary, probably defining the northern limit of the Roman settlement activity. Several pit-type anomalies within the interior and immediately outside of the enclosure may be due to soil-filled pits and/or spreads of archaeological material. In addition, two broad amorphous areas containing high magnitude anomalies may be indicative of industrial activity, possibly iron smelting, an activity which is known in the surrounding landscape. No anomalies consistent with the presence of a Roman road, which is postulated to pass through the west of the site, have been identified. Based on the results and interpretation of the geophysical survey the archaeological potential in the vicinity of the rectangular enclosure at the south-eastern site boundary is assessed as high. A moderate to high potential is ascribed to the two areas of possible industrial activity with the remainder of the site having low potential for the presence of unrecorded archaeological remains.
Project dates	Start: 07-12-2016 End: 08-12-2016
Previous/future work	Not known / Not known
Any associated project reference codes	HRLG16-02 - Contracting Unit No.
Type of project	Field evaluation
Site status	None
Current Land use	Cultivated Land 4 - Character Undetermined
Monument type	N/A None
Monument type	N/A None
Significant Finds	N/A None
Significant Finds	N/A 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)	argillaceous rocks and interbedded sandstone of the Maughans Formation.
Drift geology (other)	none
Techniques	Magnetometry

## PROJECT LOCATION

Country	England
Site location	GLOUCESTERSHIRE FOREST OF DEAN LYDNEY Land at Highfield Road, Lydney
Study area	3 Hectares
Site coordinates	SO 6448 0388 51.732049675232 -2.514388861185 51 43 55 N 002 30 51 W Polygon

## PROJECT CREATORS

Name of Organisation	Headland Archaeology
Project brief originator	Consultant

Project design originator	Headland Archaeology
Project director/manager	Webb, A.
Project supervisor	Bishop, R
Type of sponsor/funding body	Developer

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PROJECT ARCHIVES

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Physical Archive Exists?	No
Digital Archive recipient	In house
Digital Contents	"other"
Digital Media available	"Geophysics"
Paper Archive Exists?	No

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PROJECT BIBLIOGRAPHY 1

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Publication type	Grey literature (unpublished document/manuscript)
Title	Land at Highfield Road, Lydney, Gloucestershire: Geophysical Survey
Author(s)/Editor(s)	Harrison, D.
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