



GLADMAN DEVELOPMENTS LIMITED

LAND AT HEMPSTED LANE

GLOUCESTER

GLOUCESTERSHIRE

GEOPHYSICAL SURVEY REPORT

OCTOBER 2019

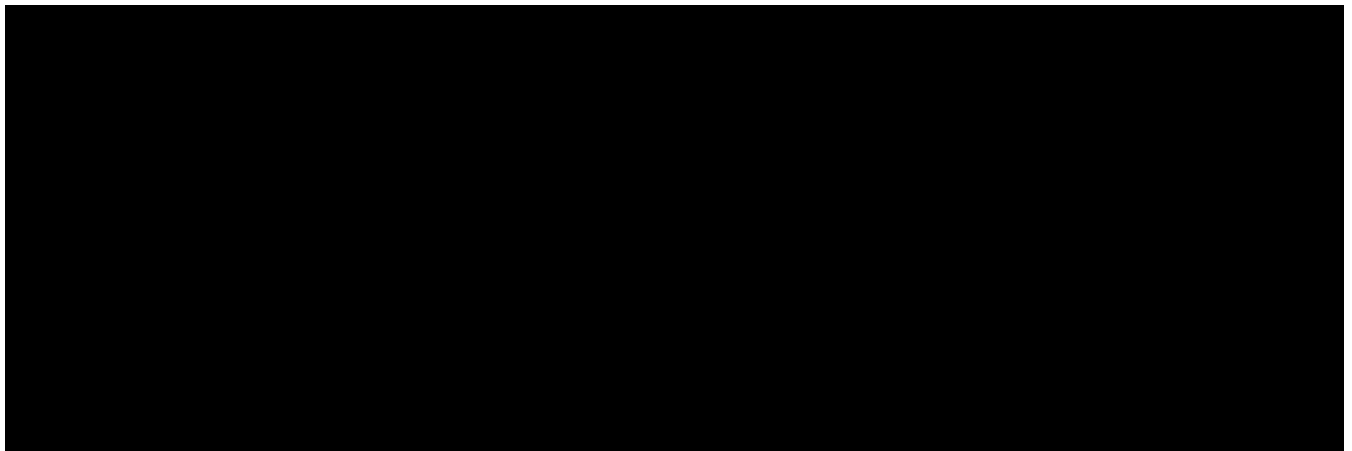
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GLADMAN DEVELOPMENTS LIMITED

LAND AT HEMPSTED LANE, GLOUCESTER, GLOUCESTERSHIRE

GEOPHYSICAL SURVEY

PREPARED BY:



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SUMMARY

Wardell Armstrong LLP (WA) was commissioned by the client Gladman Developments Limited to undertake a geophysical survey of land at Hempsted Lane, Gloucester (National Grid Reference (NGR): SO 81500 16549). The geophysical survey was required to support a planning application for a residential development. The geophysical survey was undertaken in accordance with a Written Scheme of Investigation (WSI) produced by WA (2019b). The objective of the geophysical survey was to determine the presence/absence, nature and extent of potential archaeological features within the study area, and the presence/absence of any known modern features within the survey area, which may affect the results.

The survey was undertaken over five days between the 30th September and the 4th October 2019 and comprised three fields of recently cropped arable land. The investigation revealed evidence of past agricultural activity and identified current and possible partially removed services. Evidence of archaeological activity was sparse, therefore the archaeological potential within the study area is overall considered to be low.

ACKNOWLEDGEMENTS

Wardell Armstrong LLP (WA) thanks the client Gladman Developments Limited for commissioning the project, and for all their assistance throughout the work.

The geophysical survey was undertaken by Mike Birtles with assistance from Mike Mann. The report was written by Mike Birtles. The figures were produced by Adrian Bailey. The project was managed by Damion Churchill, and the report edited by Alice Howell.

1 INTRODUCTION

1.1 Project Circumstances and Planning Background

1.1.1 Between 30th September and 4th October 2019, Wardell Armstrong LLP (WA) undertook a geophysical survey at land at Hempsted Lane, Gloucester, Gloucestershire (NGR: SO 81500 16549) It was commissioned by the client to provide information to support a planning application for a residential development.

1.1.2 A Historic Environment Statement has been undertaken for the study area (WA 2019a). Recorded archaeological remains within the study area are limited to the buried remains of medieval and post-medieval ridge and furrow (HER Ref: 50563), a post medieval ditch (HER Ref: 29777) and the route of the Government Pipelines and Storage System (GPSS) pipeline (HER Ref: 43288). However, it is recognised that there is also a potential for previously unrecognised buried archaeological remains to be present within the study area boundary.

1.1.3 The geophysical survey of land at Hempsted Lane was therefore commissioned in order to help determine the presence/absence, nature and extent of archaeological remains within the study area.

1.2 Project Documentation

1.2.1 A Written Scheme of Investigation (WSI) (WA 2019b) was produced to provide a specific methodology based on the brief for a programme of geophysical survey. This was approved by the Gloucester City Council archaeological planning advisor prior to the survey taking place. This is in line with government advice as set out in Section 16 of the National Planning Policy Framework 2019 (MHCLG 2019).

1.2.2 This report outlines the results of the geophysical survey undertaken, and the interpretation of the geophysical survey results in light of the historical and archaeological background of the study area.

2 METHODOLOGY

2.1 Standards and guidance

2.1.1 The archaeological geophysical survey was undertaken following the Chartered Institute for Archaeologists *Standard and Guidance for an archaeological geophysical survey* (CIfA 2014), and Historic England (English Heritage 2008) guidelines.

2.2 Documentary Research

2.2.1 A Historic Environment Statement was prepared by WA (2019a), which set out the archaeological and historical background of the study area and provided an assessment of the significance of all known and potential heritage assets up to 0.5km from the area of investigation. A summary of the document is presented in section 3.2 of this report.

2.3 The Geophysical Survey

Technique Selection:

2.3.1 Geomagnetic survey was selected as the most appropriate technique, given the non-igneous environment, and the expected presence of cut archaeological features at depths of no more than 1.5m. This technique involves the use of hand-held gradiometers, which measure variations in the vertical component of the earth's magnetic field. These variations can be due to the presence of sub-surface archaeological features.

2.3.2 Data was recorded by the instruments and downloaded into a laptop computer for initial data processing in the field using specialist software.

Field Methods:

2.3.3 Geomagnetic measurements were determined using a Bartington Grad 601-2 dual gradiometer system, with twin sensors set 1m apart. It was expected that significant archaeological features at a depth of up to 1.5m would be detected using this arrangement. The survey was undertaken using a zig-zag traverse scheme, with data being logged in 30m grid units. A sample interval of 0.25m was used, with a traverse interval of 1m, providing 3600 sample measurements per grid unit, with measurements being recorded at the centre of each grid cell.

Data Processing:

- 2.3.4 The data was downloaded on-site into a laptop computer for processing and storage. Geophysical survey data was processed using Terrasurveyor software, which was used to produce 'greyscale' images of the raw data. Positive magnetic anomalies are displayed as dark grey, and negative magnetic anomalies are displayed as light grey. A palette bar shows the relationship between the grey shades and geomagnetic values in nano-tesla (nT) for each area.
- 2.3.5 Raw data were processed in order to further define and highlight the archaeological features detected. The following basic data processing functions were used:
- **Despike:** to locate and suppress random iron spikes in the gradiometer data (despike was performed on all survey grids using a window of 11x3 and threshold of 2.0).
 - **Destripe:** to reduce the effect of striping in the gradiometer data, sometimes caused by the misalignment of the twin sensors (zero mean traverse was performed on all survey grids using a threshold of 2 standard deviations).
 - **Clip:** to clip data to specified maximum and minimum values, in order to limit large noise spikes in the geophysical data (clipped from -5nT to 5nT).

Interpretation:

- 2.3.6 Four types of geophysical anomaly were detected in the gradiometer data:
- *Positive Magnetic:* Regions of anomalously high or positive magnetic data, which may be associated with the presence of high magnetic susceptibility soil filled features, such as pit or ditches.
 - *Dipolar Magnetic:* regions of paired positive and negative magnetic anomalies, which typically reflect ferrous or fired materials, including fired/ferrous debris in the topsoil, or fired structures such as kilns or hearths.
 - *Bipolar Magnetic:* typically linear regions of alternate positive and negative magnetic anomalies, which typically reflect buried service pipes or drains.
 - *Magnetic Disturbance:* areas of high amplitude magnetic disturbance or interference, which may be associated with the presence of modern structures, such as services, fences or buildings.

Presentation:

2.3.7 The greyscale images were combined with study area survey and Ordnance Survey (OS) data to produce the geophysical survey figures used in the report. Colour-coded geophysical interpretation diagrams are provided for each area in the report, showing the locations and extent of the magnetic anomalies. Archaeological interpretation diagrams are also provided, which are based on the interpretation of the geophysical survey results in light of the archaeological and historical context of the study area.

Archive:

2.3.8 A full professional archive has been compiled in accordance with the project specification, and the Archaeological Data Service recommendations (ADS 2013). The archive comprises a compressed (zipped) file folder, containing the geophysics data, documentation (metadata), and other project material (report and field notes). Copies of the report will be sent to the Gloucester HER and will be available upon request. The archive can be accessed under the unique project identifier GM10710.

2.3.9 Wardell Armstrong LLP supports the **Online Access to the Index of Archaeological InvestigationS (OASIS)** project. This project aims to provide an on-line index and access to the extensive and expanding body of grey literature, created as a result of developer-funded archaeological work. As a result, details of the results of this project will be made available by WA as a part of this national scheme. The OASIS reference for the project is: wardella2-369964.

3 BACKGROUND

3.1 Location and Geological Context

3.1.1 The study area is located at land south of Hempsted Lane, Gloucester, NGR SO 81500 16549. The study area's environs comprise arable farmland. The study area is bounded to the north by housing and Hempsted Lane, to the east by Secunda Way, to the west by Rea Lane and the south by pasture farmland. The study area is located approximately 1.5km southwest of Gloucester. The area of investigation lies at a height of 20m aOD (above Ordnance Datum) with the ground sloping down gently to the south.

3.1.2 The study area is approximately 12.5 hectares in size and is comprised of three rectangular fields separated by a mix of hedgerows and concrete posts. The study area has recently been harvested having been utilised for growing cereal crop.

3.1.3 The bedrock of the study area comprises Blue Lias Formation and Charmouth Mudstone Formation (undifferentiated), formed during the Jurassic and Triassic Periods. Whilst the overlying superficial deposits across the majority of the study area have not been recorded, the far south of the study area, adjacent to the north of an unnamed watercourse is recorded as Tidal Flat Deposits comprising clay, silt and sand (BGS, 2019). Magnetic survey over mudstone can produce good results, and previous surveys over similar geologies have shown magnetic susceptibility exists, which can produce moderate anomaly strengths. Magnetic survey over some gravel geologies can produce a more ambiguous response. This response will also depend on local variations in drainage and overlying soils.

3.2 Historical and Archaeological Background

3.2.1 A Historic Environment Statement was produced to assess the known historical and archaeological background of the study area and the surrounding landscape to a distance of 0.5km (WA 2019a). It is not intended to repeat that information here and what follows is a brief overview, for further details please refer to the original document.

3.2.2 The archaeological and cultural heritage desk-based assessment included the consultation of the Gloucester City Historic Environment Record (HER) for entries within an area of approximately 0.5km radius from the study area boundary. What follows is a summary of the archaeological and historical background of the study area. Readers are directed to this report for further details (WA 2019a).

- 3.2.3 There is no recorded evidence for prehistoric or Romano British activity within the study area or in the immediate vicinity. However, it would appear that the majority of the study area lay just beyond the inter-tidal marshland forming part of a higher, drier eyelet of land with the far southern part of the study area located within the alluvial floodplain. As such, it is possible that the study area would have been attractive for settlement during the later prehistoric period.
- 3.2.4 Whilst it is probable that the study area remained on the periphery of the foci of settlement at Hempsted during the medieval/ post-medieval period, evidence in the form of medieval/ post-medieval ridge and furrow cultivation recorded in the study area illustrate that it was utilised as part of the surrounding field systems to the village during these periods (HER Ref: 50563). Certainly, by the post-medieval period, the study area was used for agrarian purposes. A post-medieval linear ditch extended into the eastern part of the study area, which was recorded during a watching brief (HER Ref: 29777). In addition, the route of the Government Pipelines and Storage System (GPSS) pipeline is recorded aligned north-east to south-west through the eastern part of the study area (HER Ref: 43288).
- 3.2.5 The earliest cartographic evidence studied was the Hempsted Parish Tithe map (1839) which shows the study area divided into seven parcels of land.
- 3.2.6 The field boundaries remain unchanged on the subsequent OS maps up to the 1974-94 OS map. This map showed the field boundaries had been removed and replaced by two field boundaries orientated north to south, dividing the study area into three rectangular fields.
- 3.2.7 No known previous archaeological works have been undertaken within the study area.

4 GEOPHYSICAL SURVEY RESULTS

4.1 Introduction

4.1.1 The geophysical survey was undertaken between the 30th September and 4th October 2019. The geophysical survey covered the majority of the study area associated with the proposed residential development.

4.1.2 Small discrete dipolar magnetic anomalies were detected which were dispersed across the whole of the study area. These are almost certainly caused by fired or ferrous litter in the topsoil, which is typical for modern agricultural land. These anomalies are indicated on the geophysical interpretation drawings, but not referred to again in the subsequent interpretations.

4.1.3 The results of the geophysical survey are depicted in Figures 2-10, with geophysics anomalies classified by type. Potential archaeological features are discussed below, with Historic Environment Record (HER) references given, where known.

4.2 Results

General observations (Figures 2-10)

4.2.1 A bi-polar magnetic response was detected traversing east-west across Areas 1 and 2 with a spur detected traversing in a northward direction through Area 1, and south through Area 2. Both spurs of this response are fragmentary and furthermore the projection west through Area 1 is also fragmentary suggesting this response represents the partial infill of a former field boundary shown on the 1839 Tithe Map (WA 2019a). The moderate strength of the response suggests a ceramic or industrial waste material was used. Despite being of similar magnitude, the extension of the response on a north-easterly direction through Area 2 is not shown on historic mapping.

4.2.2 Discrete di-polar responses detected in all areas are likely indicative of buried ferrous metal objects such as farm machinery.

Area 1 (Figures 3,6,9 and 10)

4.2.3 Area 1 was located to the west of the study area and was roughly rectangular in shape sloping downwards to the south. The field had been recently harvested allowing reasonable survey conditions.

4.2.4 A strong bi-polar response detected traversing the western boundary of Area 1 is indicative of a ferrous service.

- 4.2.5 Evidence of agricultural activity such as ploughing is detected traversing Area 1 in a northwest to southeast direction in the western portion and north to south in the eastern half of the area respecting the current field boundary.
- 4.2.6 A single positive magnetic small linear feature was detected in the southern portion of Area 1 which is likely indicative of a soil filled cut feature.
- 4.2.7 Based on the results of the geophysical survey, the archaeological potential for Area 1 is considered to be low.

Area 2 (Figures 4,7,9 and 10)

- 4.2.8 Area 2 was located centrally within the study area between Areas 1 and 3, the field was rectangular in shape sloping downwards to the south where a catchment pond for stormwater was situated. This pond and the environs to the immediate south were omitted from the survey. The field had recently been harvested allowing reasonable survey conditions.
- 4.2.9 Evidence of agricultural activity such as ploughing was detected traversing Area 2 in a north-south direction respecting the current field boundary.
- 4.2.10 A low magnitude linear positive response was detected traversing the north-eastern portion of Area 2, this is likely indicative of a soil filled cut feature.
- 4.2.11 Based on the results of the geophysical survey, the archaeological potential for Area 2 is considered to be low.

Area 3 (Figures 5,8,9 and 10)

- 4.2.12 Area 3 was located to the east of the study area bounded by Secunda Way to the east and narrowing to the south. The field had recently been harvested allowing reasonable survey conditions. A portion of the area to the west adjacent to Secunda Way showed strong dipolar linear responses relating to a gas pipeline. The alignment concurs with the HER record of the route for the GPSS pipeline (HER Ref: 43288).
- 4.2.13 Evidence of agricultural activity such as ploughing was detected traversing Area 3 in a north-south direction respecting the current field boundary.
- 4.2.14 Two moderate magnitude linear positive response were detected traversing the north western portion of Area 3 with a third traversing the area with a northwest to southeast direction in the central-southern portion of the survey area, these are likely indicative of soil filled cut features such as ditches.

4.2.15 Based on the results of the geophysical survey, the archaeological potential for Area 3 is considered to be low.

5 CONCLUSIONS

5.1 Interpretation

- 5.1.1 The geophysical survey surveyed the majority of the areas associated with the proposed residential development. The purpose of the survey was to determine the presence/absence, nature and extent of potential archaeological features within the study area, and to identify the presence/absence of any known modern features within the survey area, which may affect the results.
- 5.1.2 The geomagnetic anomalies with archaeological potential identified were concentrated in Areas 2 and 3. The remains primarily comprised positive magnetic anomalies indicative of soil-filled cut ditches.
- 5.1.3 The majority of geophysical responses detected are indicative of drainage features and services. Strong magnetic responses detected traversing Area 1 and 2 align with former field boundaries on the 1839 Tithe Map suggesting that they were infilled partially by thermo-remnant material such as industrial waste and may also contain ceramic land drains.
- 5.1.4 The survival of the archaeological features was moderate. Evidence of agricultural ploughing respecting previous field boundaries evident within NMP data was strong which has the potential to impact upon any surviving ephemeral archaeological remains.

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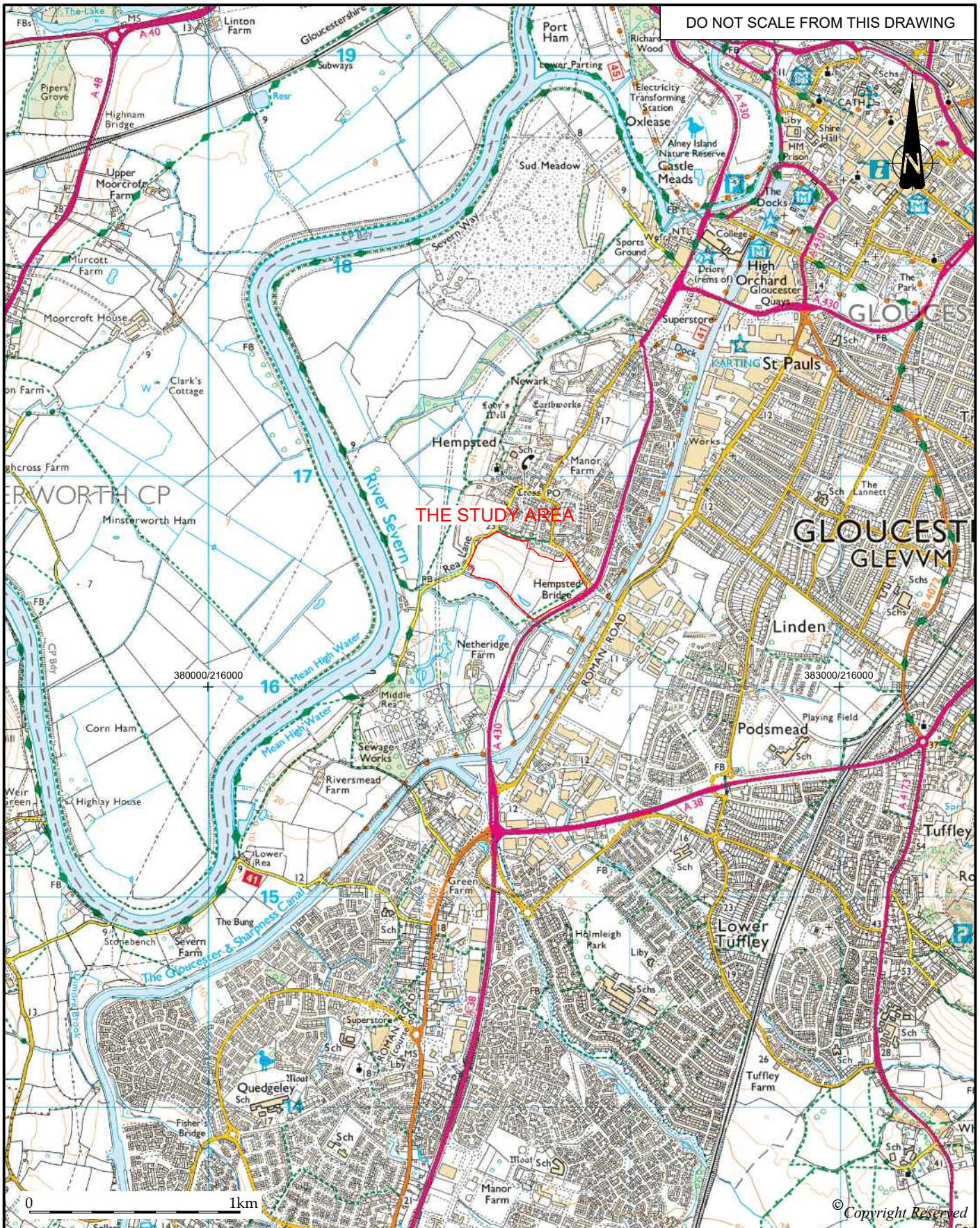
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APPENDIX 1: FIGURES

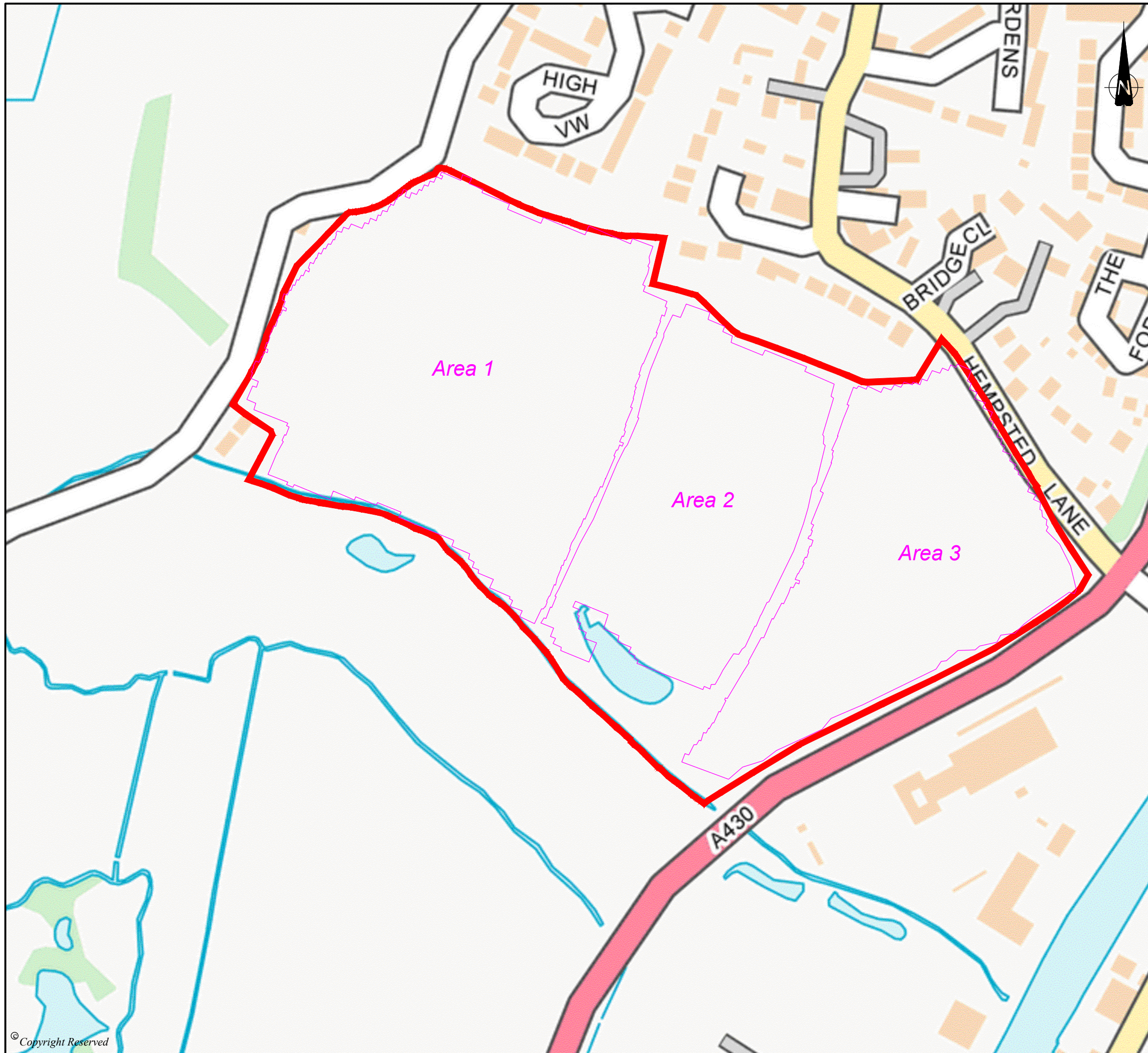


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THE STUDY AREA

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Figure 2:
Location of Geophysical Survey Areas

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**Figure 3:
 Geophysical Survey of Area 1
 Raw Data**

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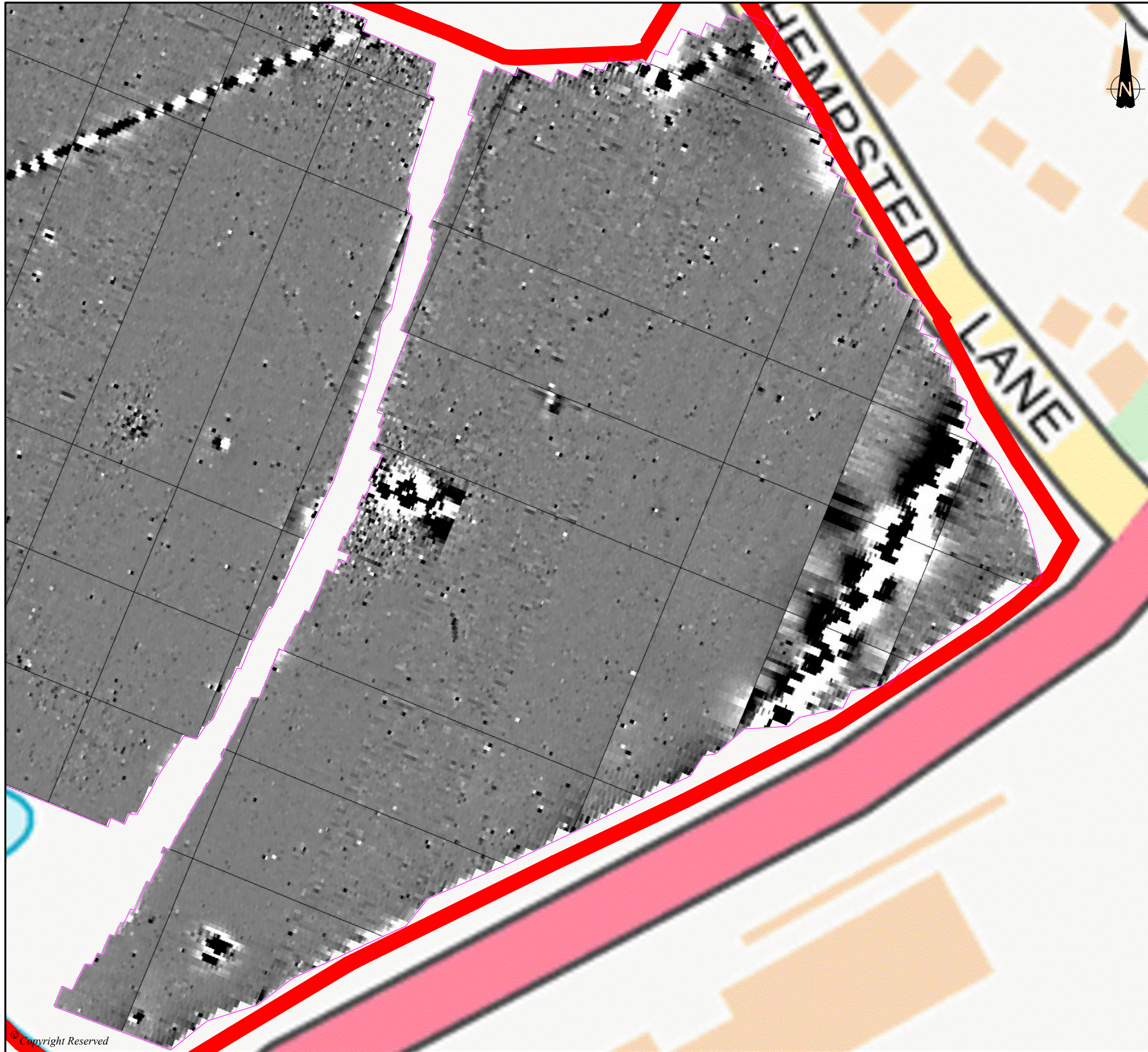
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Figure 4:
Geophysical Survey of Area 2
Raw Data

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Figure 5:
Geophysical Survey of Area 3
Raw Data

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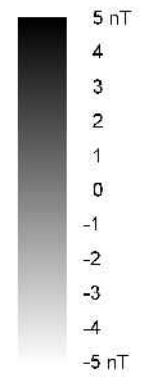
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Figure 6:
Geophysical Survey of Area 1
Processed Data

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Figure 7:
Geophysical Survey of Area 2
Processed Data

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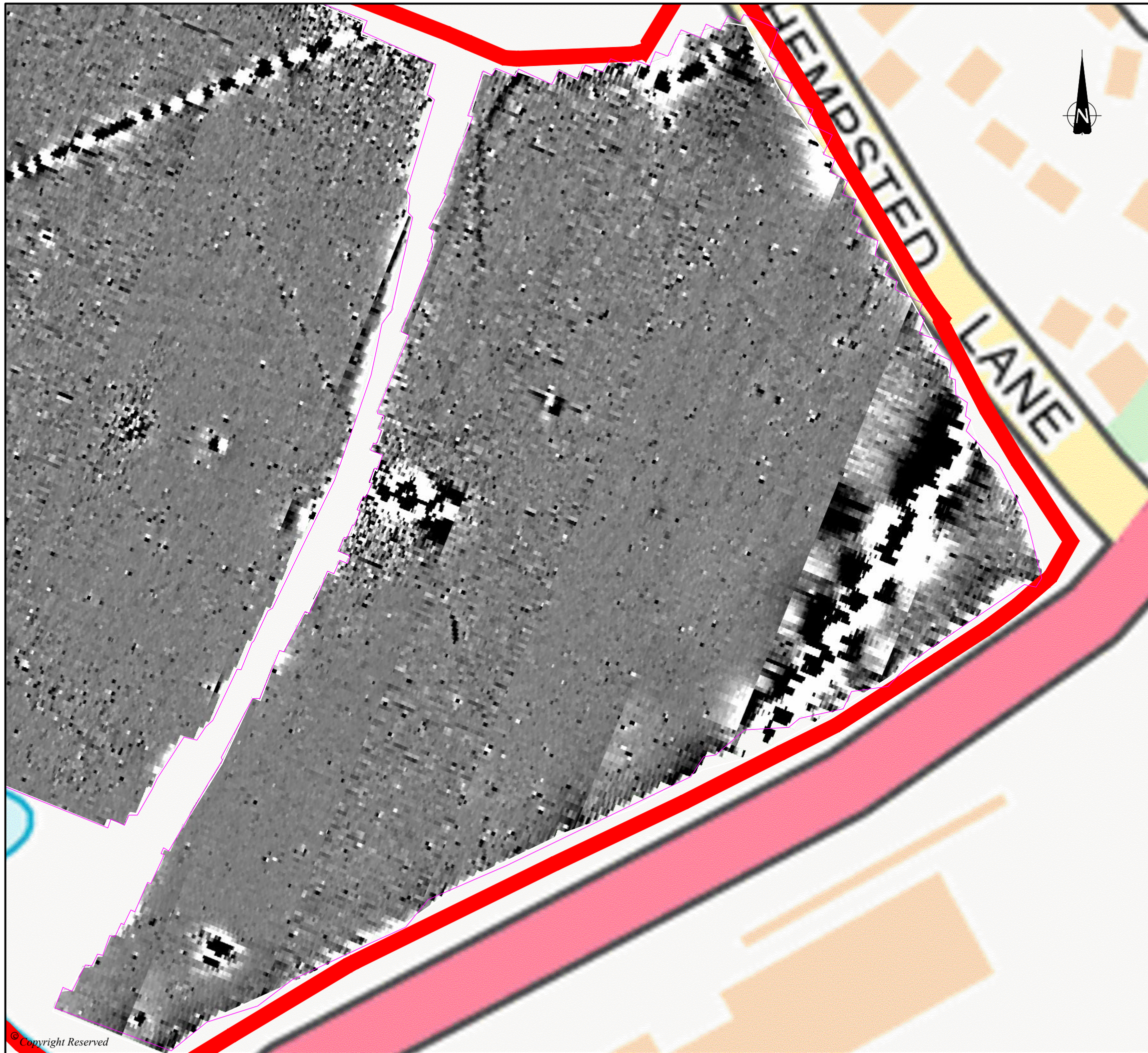
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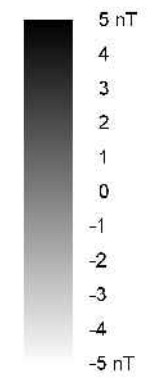
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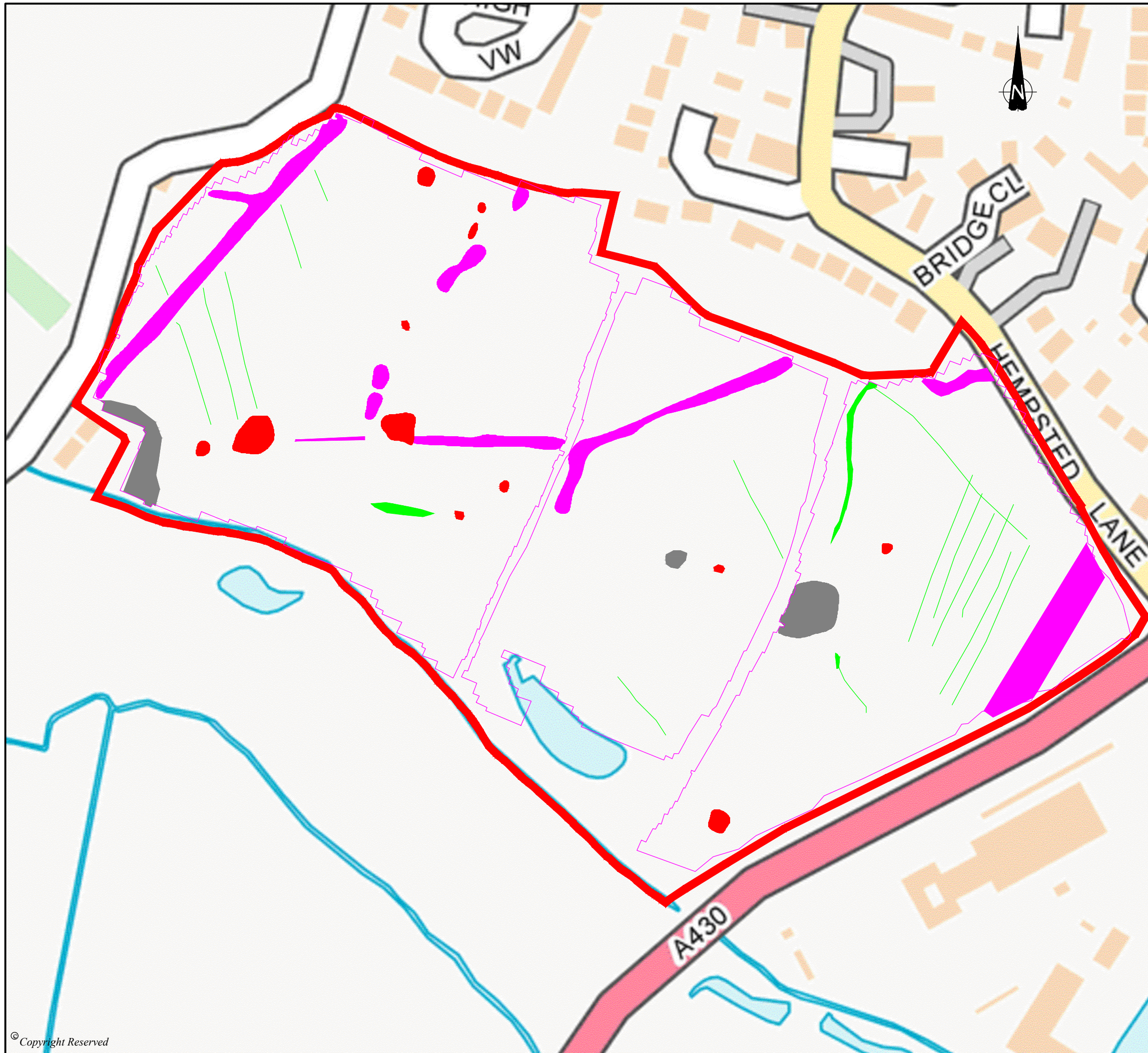
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**Figure 8
Geophysical Survey of Area 3
Processed Data**

DRG No.	GM10710_017_008	REV	-
DRG SIZE	SCALE	DATE	
A3	1:1,000	Oct 2019	
DRAWN BY	CHECKED BY	APPROVED BY	
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<input type="checkbox"/> CARLISLE	<input type="checkbox"/> MANCHESTER
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KEY:

- Study Area boundary
- Geophysical survey areas
- Positive magnetic responses
- Bi-polar magnetic responses
- Di-polar magnetic responses
- Magnetic disturbance

REVISION	DETAILS	DATE	DRN	CHKD	APPD
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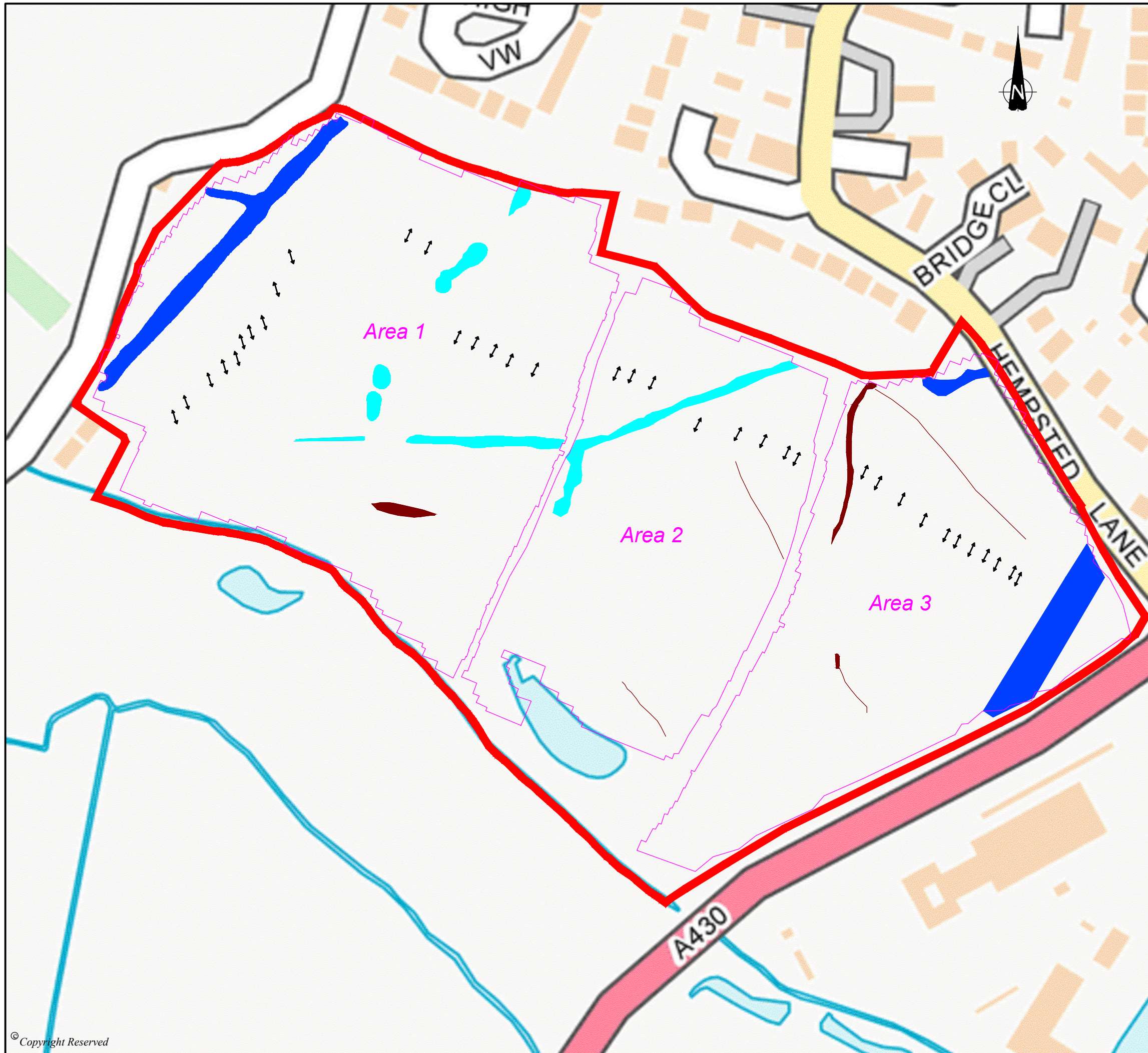
PROJECT
**Land at Hempsted Lane,
Gloucester, Gloucestershire**

DRAWING TITLE
**Figure 9:
Geophysical Interpretation**

DRG No.	GM10710_017_009	REV	-
DRG SIZE	A3	SCALE	1:2,000
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- KEY:
- Study Area boundary
 - Geophysical survey areas
 - Services
 - Possible soil filled features
 - Possible agricultural features
 - Possible agricultural features/ land drains

REVISION	DETAILS	DATE	DRN	CHKD	APPD
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PROJECT
Land at Hempsted Lane,
Gloucester, Gloucestershire

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Figure 10:
Archaeological Interpretation

DRG No.	GM10710_017_010	REV	-
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		DATE	Oct 2019
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