AB HERITAGE
ARCHAEOLOGICAL CONSULTANCY

Carnemough Farm, Cornwall

Geophysics Survey Report

Client: FOUNDATIONS ARCHAEOLOGY

AB Heritage Project No: 10545

Date: 14/05/2015

Carnemough Farm, Cornwall
Geophysical Survey

Client	**Foundations Archaeology**
Project Number	**10545**
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1.0	DRAFT	GR	AB	14-05-2015

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1. INTRODUCTION

1.1 Project Background

1.1.1 AB Heritage has been commissioned to undertake a geophysical survey on behalf of Foundations Archaeology, at Carnemough Farm, Cornwall (See Figure 1).

1.1.2 The purpose of this work is to identify any potential surviving archaeological remains.

1.2 Site Location & Description

1.2.1 The surveyed area was c. 16 hectares (ha) within the land of Carnemough Farm (hereinafter, referred to as the site). It is located c. 2.5km to the north-east of Ladcock village, with an approximate centre-point of SW 91716 52043. The fields surveyed are surrounded by arable fields, while the site itself was under pasture at the time of survey.

1.3 Geology & Topography

1.3.1 The overlying soils at the site are slowly permeable seasonally wet soils, which are slightly acidic but base-rich loamy and clayey soils with impeded drainage.

1.3.2 The majority of the site is underlain by bedrock geology of slate, siltstone and sandstone of the Meadfoot Group. However, there are different superficial deposits in other areas including head deposits clay, silt, sand and gravel and Alluvial superficial deposits, of clay, silt, sand and gravel. The alluvial deposits have the potential to mask archaeological features.

1.3.3 The site height averages at c. 85m Above Ordnance Datum (AOD). The site slopes from c.100m AOD in the south and east, to a height of c. 70m AOD in the north and c. 85m AOD in the west.

2. AIMS & METHODOLOGY

2.1 Aims of Survey Works

2.1.1 Geophysical survey is a programme of non-intrusive archaeological work. The aims of this geophysical survey were to:

- Identify any geophysical anomalies of possible archaeological origin within the specified survey area;
- Accurately locate these anomalies and present the findings in map form; and
- Provide recommendations for any further archaeological work(s) necessary to contribute to the mitigation of the impacts of proposed development on these potential features.

2.2 Methodology of Survey Works Summary

Site Specific Information

2.2.1 A magnetometry survey was undertaken covering an area of c. 16 hectares, 20th to the 24th of April 2015.

2.2.2 The AB Heritage staff members who undertook the works were Tom Cloherty (Archaeological Technician), and Sam Burn (Data Collection Technician).

2.2.3 The weather conditions for the work were mainly dry and sunny throughout the survey; these conditions had no material impact on the survey.

Equipment

2.2.4 The magnetic survey equipment used was one Bartington Grad-601 (fluxgate magnetometers). Please see Appendix A, which contains a detailed methodology for the works undertaken; however, briefly, Table 1, below, shows site specific information on how the magnetometer was set up:

Table 1: Setting Parameters of Magnetometer

Grid Size	30x30 metres
Data Capture Distances	1m x 0.25m
Sensors	2
Sensitivity	0.1nT

2.2.5 A GPS was used to setup the geophysical survey was a Trimble GeoXR has a sub-centimetre accuracy suitable for this survey.

2.3 Known Constraints

2.3.1 The site has areas of pylons running through the site which are likely to create a magnetic disturbance of c. 3m - 4m from the pylon.

2.3.2 The undulating ground is likely to create a small amount of stagger (i.e. distortion) within the data.

3. RESULTS & INTERPRETATIONS

3.1 Geophysical Survey Results

Field 1

3.1.1 Several linears [**GP 1-a**] have been identified within the field running in a north to south direction. The central linear has a negative reading of between -4nt to –15nt, while the two linears flanking the central linear have a positive reading variation between 2 nt and 10 nt. The features have a length of between100m - 150m and a width of c. 2m - 4m.

3.1.2 A small positive linear runs in a north west to south east direction adjoining a linear [**GP 1-a**], which runs in a north to south direction over in the western side of the field, with a length of c. 50m and a positive reading of between 1nt to 5nt. In the south eastern side of the field there is also a small linear [**GP 1-m**] c.30m in length with a reading of between 1nt to 4nt.

3.1.3 In the eastern side of the field there are several larger features [**GP 2**] with a varying width of 2m to 10m and length of 10m – 50m. They have no clear correlating pattern, with a variation of positive readings between 2nt and 10nt.

3.1.4 In addition to the above, across the site were recorded multiple areas of magnetic debris [**GP 3**] and low positive features [**GP 2**].

Field 2

3.1.5 A strong response feature [**GP 1-j**] with a reading of 12nt located within the northern half of the field is sub circular in shape with a diameter of c. 5m. A small positive linear is also located within the south eastern corner of the field [**GP 1-g**], with a 4nt and length of c. 25m.

3.1.6 Multiple curvilinear and linear features [**GP 2**] with a positive reading of 1nt – 2nt were also recorded as being located centrally within the field.

Field 3

3.1.7 The results from this field identified multiple linear features [**GP 1-a**] running in a north to south direction, with a negative linear flanked by two positive linears. These features extend up to a length of c. 175m.

3.1.8 Another linear [**GP 1-l**] runs centrally through the field in an east to west direction with a length of c. 150m. This feature has a positive central linear with a high positive reading of 15nt to 20nt flanked by negative linears, with a variation of between -2nt to -15nt. Other similar shorter linear features [**GP 1-l**] running in the same direction, are situated within the southern end of the field.

3.1.9 A rectangular feature [**GP 1-b**] is located in the south eastern side of the field covering an area of approximately 400m^2, the eastern side of the rectangular feature [**GP 1-a**] extends up to the centre of the field where a linear [**GP 1-l**] runs east to west.

3.1.10 A small linear feature [**GP 1-d**] c.15m in length running in a north east to south west direction, in the south eastern corner of the site has a variation in readings of between 3nt and 8nt.

3.1.11 Areas of magnetic disturbance [**GP 3**] are located within the southern area of site below two linear features [**GP 1-k**], along with di-polar [**GP 4**] anomalies located throughout the field, in an amorphous pattern.

Field 4

3.1.12 One central linear [**GP 1-a**] runs through the field in a north to south direction with a negative linear flanked by two positive linears to a distance of c. 175m.

3.1.13 Multiple linear and curvilinear [**GP 1-e,h**] features run through the field mainly within the southern half of the site, with a variation in positive readings between 2nt - 10nt. Some sub-circular features [**GP 1**] are also present within the western side of the field.

3.1.14 Di-Polar anomalies [**GP 4**] are also located throughout the field within an amorphous pattern the majority are located within the southern half of the field.

Field 5

3.1.15 Magnetic debris identified as Di- Polar anomalies [**GP 4**] are located throughout the field.

Field 6

3.1.16 A linear feature [**GP 1 a**] is located centrally within the field running in a north to south direction, shown as a positive linear flanked by two negative linears. Small circular features have also been identified within the western and northern area of the site. The western feature [**GP 1 n**] has a five meter diameter and a strong positive reading of 20nt.

3.1.17 Smaller linear features [**GP 1-c, f**] running from the western boundary in a north east direction have a positive reading of between 2 to 4nt, with the longest linear feature up to c. 45m in length. Another linear feature [**GP 1- l**] runs north to south in the south eastern corner of the field with a length of c.60m and a reading of up to 5nt.

3.1.18 Other features identified within this field, and predominately in its north eastern limits, relate to mainly magnetic disturbances [**GP3**], and a minimal spread of magnetic debris [**GP 2**] throughout the field.

3.2 Geophysical Survey Interpretation

Table 2: Interpretation of Geophysical Anomalies

AB No	Appearance	Potential Cause
GP 1 [a]	Negative linear flanked by two positive linears either side and positive linear features	Possible archaeological features / Likely field boundaries
GP 1 [b-n]	Positive circular, Linear and curvilinear features	Possible archaeological features

GP 2	Positive un- formed features	Geological features
GP 3	Multiple variation between negative and positive	Disturbed ground or metallic objects
GP 4	Negative and positive anomaly (Di-polar)	Magnetic debris

3.2.1 All features located within the site running in a north to south direction with a negative linear flanked by two positive linears [**GP 1-a**] are likely to be previous field boundaries within the site.

3.2.2 Other possible archaeological features [**GP1 b-n**] exist within the site, with a particular interest to features identified in field 4 [**GP 1-e**] and 3 [**GP 1-b**] due to their form and, in the case of field 3 [**GP1-e**], high positive readings.

3.2.3 The change in drift geology within the site appears to show within the geophysical data [**GP 2**], with the variation of anomalies likely to reflect the movement of drift geology. This movement / change in drift geology is particularly noticeable in fields 1,2 and 3.

3.2.4 Magnetic disturbance [**GP 3**] is shown within the site mainly within the north east half of field 6 and the south half of field 3, which is likely due to disturbed ground. Magnetic debris [**GP 4**] anomalies are in an amorphous pattern throughout the site, with no clear correlating pattern.

4. CONCLUSION

4.1.1 A geophysical survey was undertaken by AB Heritage Limited at Carnemough Farm, Cornwall. The purpose of this work was to understand the potential for any archaeological remains to survive undisturbed and, where possible, identify the form, function and extent of any potential remains.

4.1.2 The geophysical survey; identified likely extensive field boundary systems within the site, running north to south [**GP 1-a**]. Other features identified could have possible archaeological potential [**GP 1b-n**], with particular interest to features identified within fields 3 and 4.

4.1.3 The potential for archaeological features to survive within the limits of proposed development is concluded to be high, and further archaeological investigation is required to ascertain its significance or extent.

5. ARCHIVE

5.1.1 The Site Archive will contain the following, as a minimum:

Table 3: Site Archive Data

Archive	Format
Raw Geophysical Data files	XYZ and Text
Processed geophysical data files	JPEG, BMAP
Archaeological Interpretation	Shape Files ARC GIS
Final Report	PDF
Final Images	PDF

5.1.2 A physical and digital archive will be stored in a suitable format at AB Heritage Limited offices in Taunton, Somerset.

6. REFERENCES

BGS (British Geological Society) 2015.*Geology of Britain viewer.* http://mapapps.bgs.ac.uk/geologyofbritain/home.html.

IFA, 2011.Standard and Guidance for archaeological geophysical survey.

Jones, D.M. (ED) 2008. Geophysical Survey in Archaeological Field Evaluation. English Heritage.

Schmidt, A. 2002. Geophysical Data in Archaeology*: a Guide to Good* Practice. Oxford. Oxbow.

Appendix 1 Technical Information on Geophysical Survey

FLUXAGTE MAGNETOMETRY SURVEY

The magnetic survey is carried out using a fluxgate gradiometer, which is a passive instrument consisting of two sensors mounted vertically 1m apart. The instrument is carried about 30cm above the ground surface and the top sensor measures the Earth's magnetic field, whilst the lower sensor measures the same field but is also more affected by any localised buried field. The difference between the two sensors will relate to the strength of a magnetic field created by a buried feature, if no field is present the difference will be close to zero as the magnetic field measured by both sensors will be the same.

Factors affecting the magnetic survey may include soil type, local geology, previous human activity, disturbance from modern services etc.

Survey equipment

The Bartington Grad 601-2 dual magnetic gradiometer is capable of surveying to an accuracy of 0.1 nanotesla (nT).

Sample interval and depth of scan

The magnetometer data is collected in 30mx30m grids at a resolution of 1m x 0.25m. This sample density is recommended for site evaluation (English Heritage, 2008). This equates to 3600 points per 30mx30m grid. The magnetometer has a typical depth of penetration of 0.5m to 1.0m. This would be increased if strongly magnetic objects are buried within the site.

Data capture and processing

The readings are logged continually by the data logger during the survey, which is then downloaded on site to a site laptop. At the end of each job, data is transferred to the office PC's for processing and presentation.

This 'regular xy' data is then downloaded into specialist data processing software, at user defined sample intervals (in this case 1 m by 0.25 m). This is processed as standard magnetometer data.

GPS METHODOLOGY

An RTK GPS (Real-time Kinematic Global Positioning System) can locate a point on the ground to sub-cm accuracy, a far greater accuracy than a standard GPS unit. An RTK system uses a base station receiver and a number of mobile units (rovers). The base station takes measurements from satellites in view and then broadcasts them along with its known position to the rover receivers. The rover receiver also collects measurements from the satellites in view and processes them with the base station data. The rover then computes its location relative to the base.

During such a survey a Trimble GeoXR Differential Global Positioning System (dGPS), capable of Real Time Kinematic (RTK) is used to set out a nominal grid prior to the survey. This increases the accuracy and efficiency of the survey. The data is then downloaded from the unit on the day, using a USB stick.

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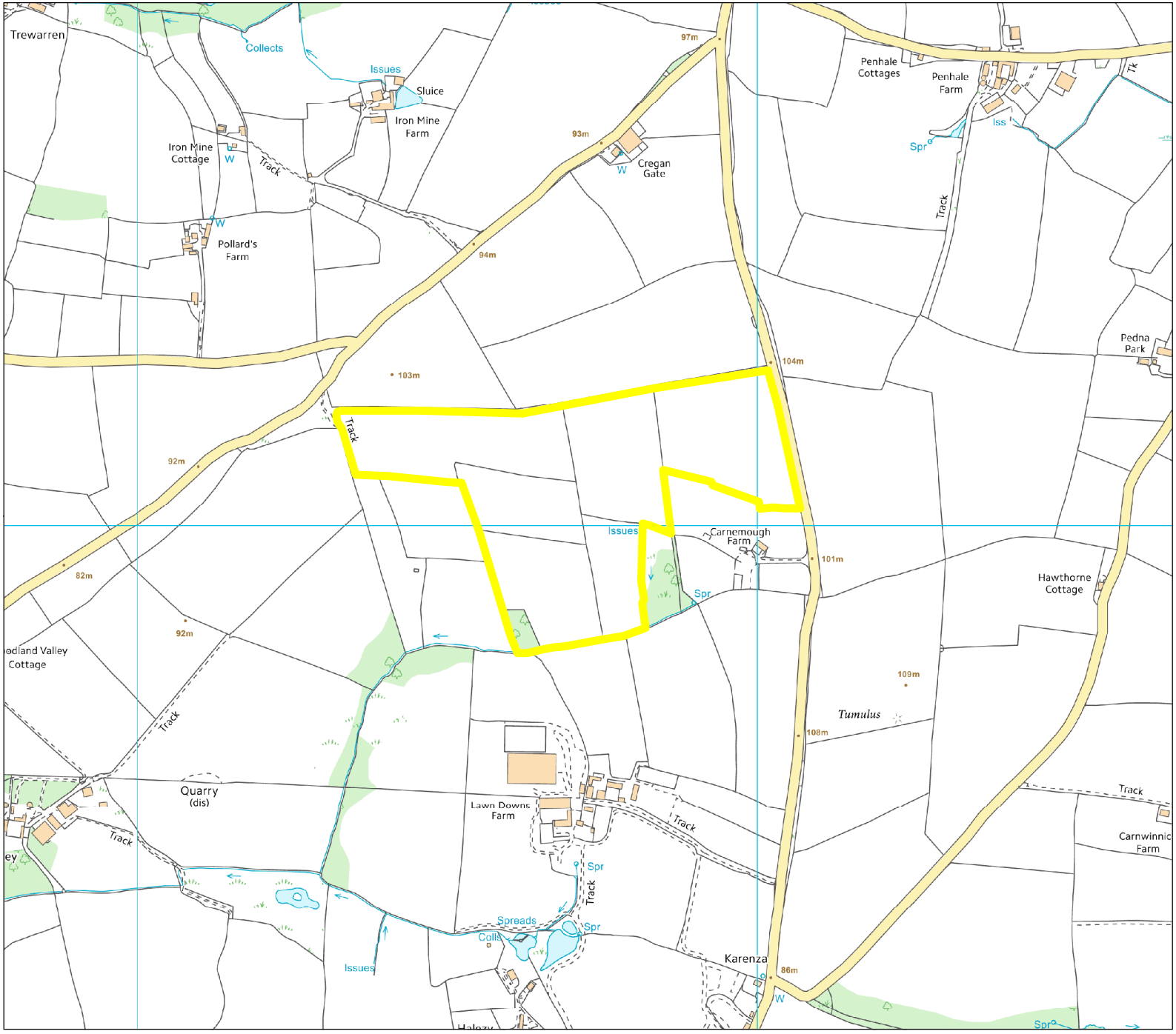

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Site Boundary

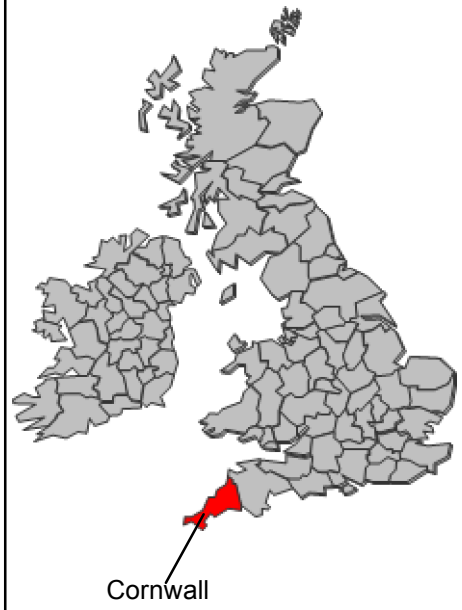

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Figure 1: Site Location and Field Identification

Project: Carnemough Farm

Date: 30/04/15	Job Number: 10545
Drawn by: ZE	Approved by: GR

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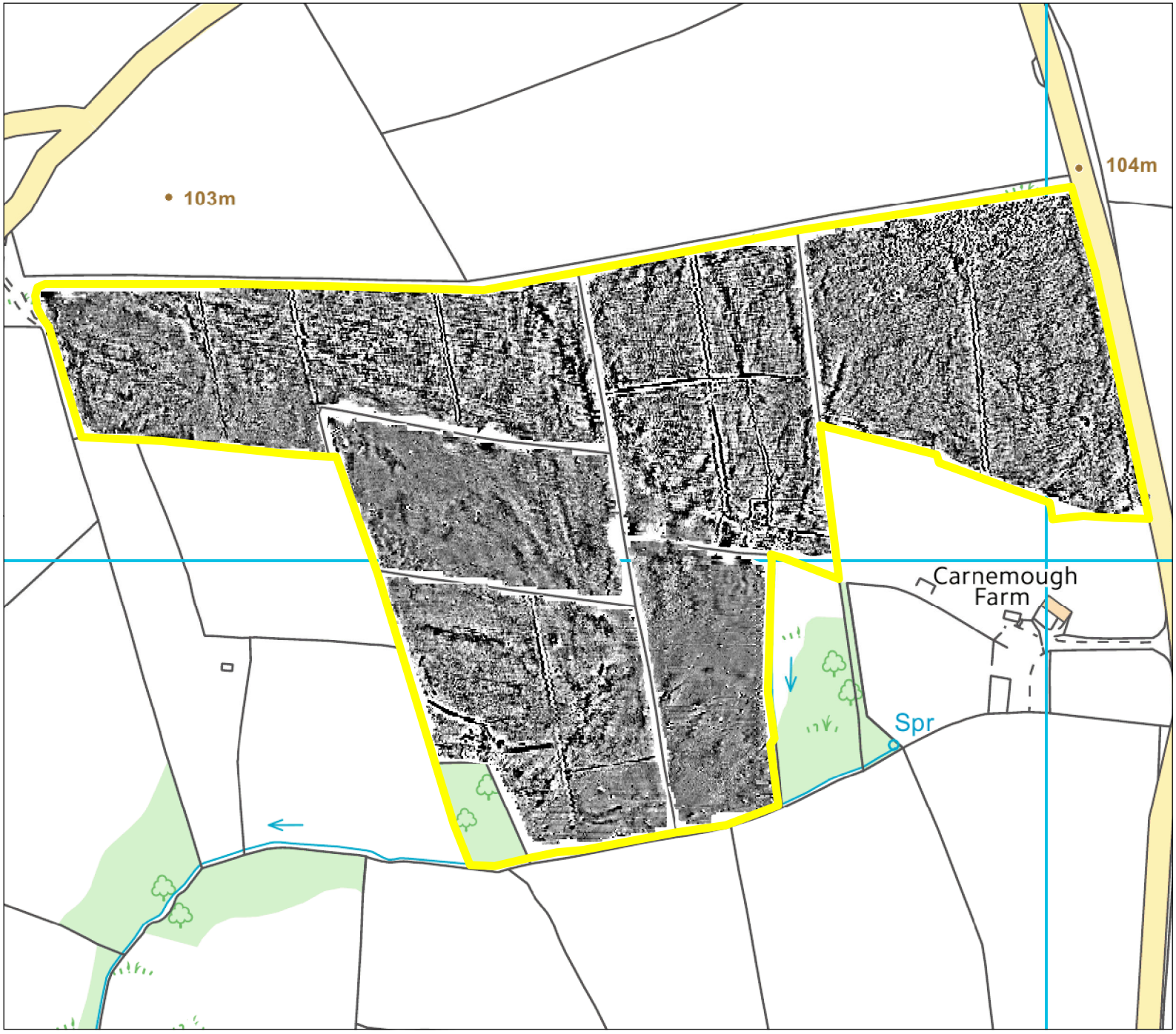

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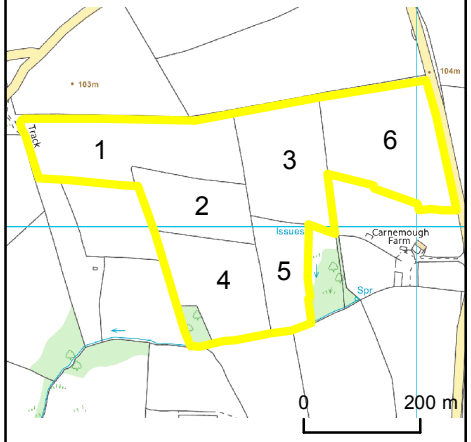

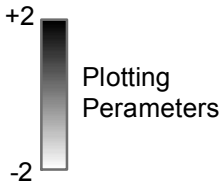

Figure 2: Raw Geophysical Data

Project: Carnemough Farm

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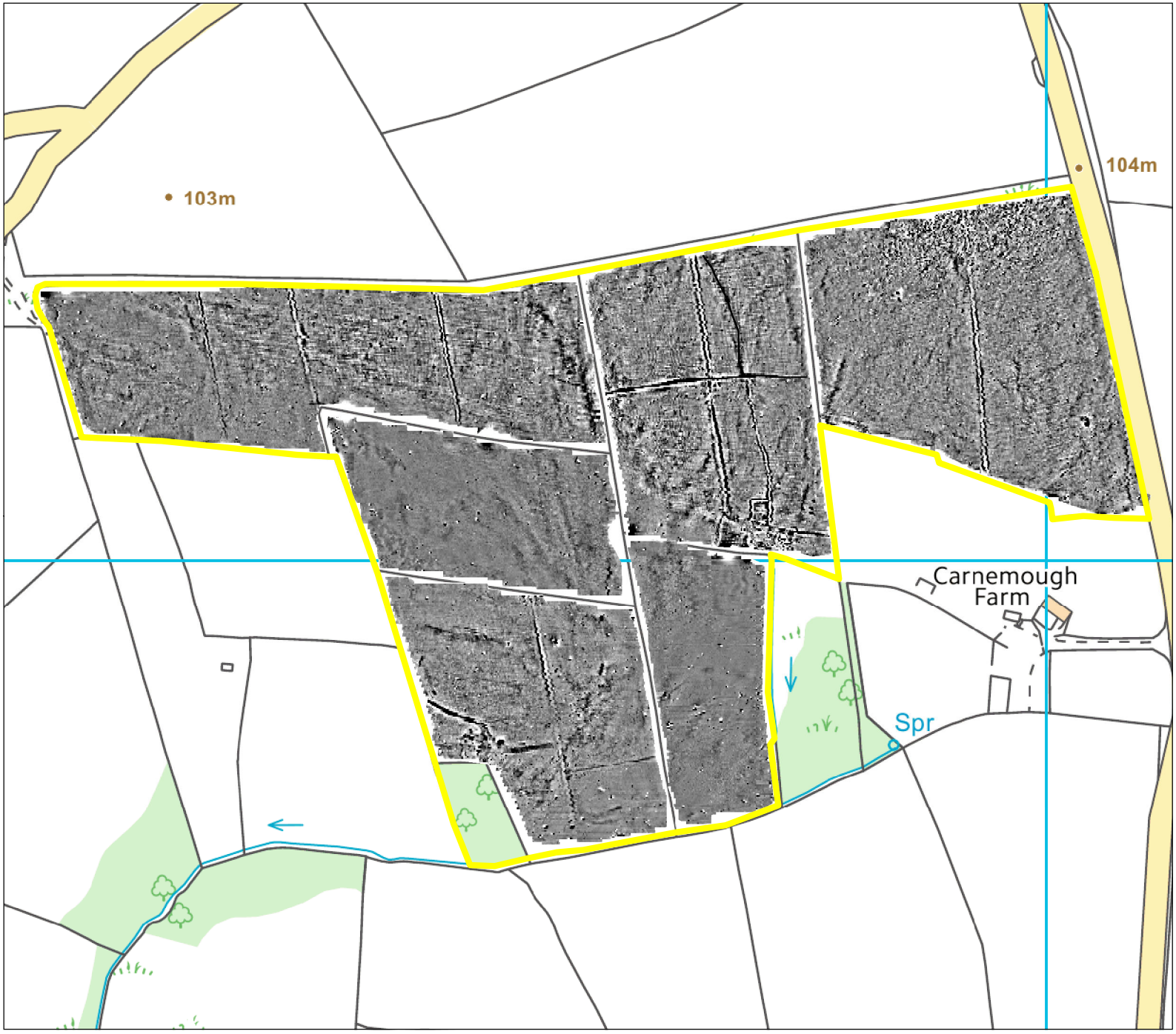

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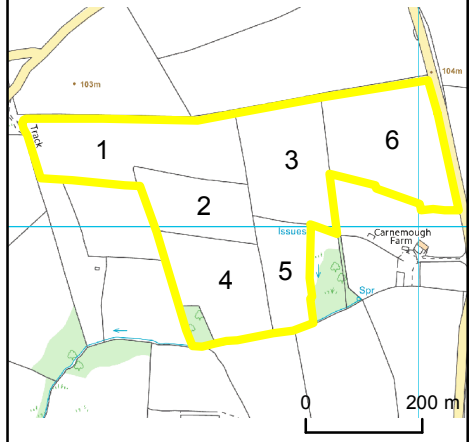

+5

Plotting Perameters

-5

Figure 3: Processed Geophysical

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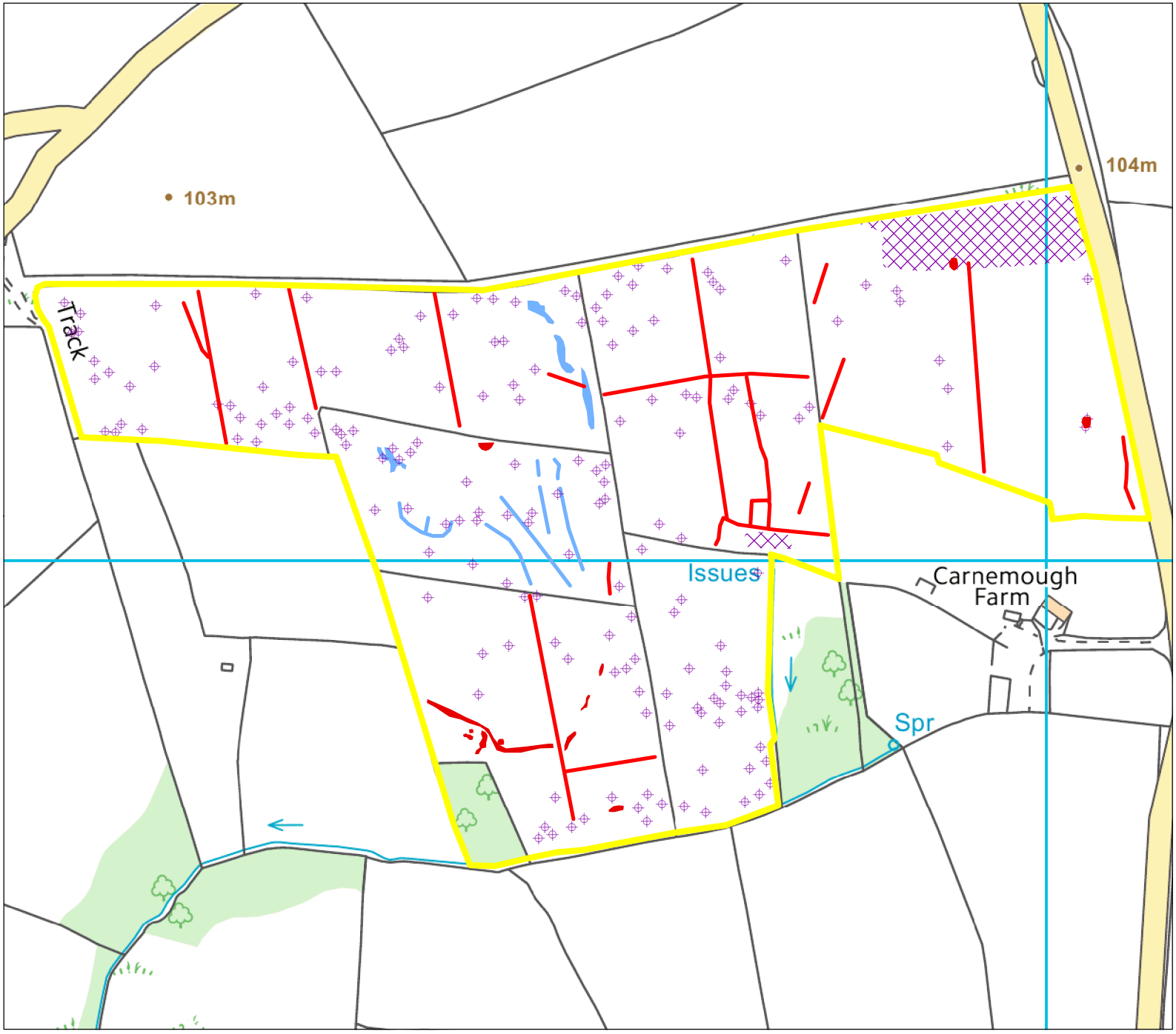

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- Possible Archaeology [GP1]
- Geological Features [GP2]
- Magnetic Disturbance [GP3]
- Di-Polar Anomalies [GP4]
- Site Boundary

Field Identification

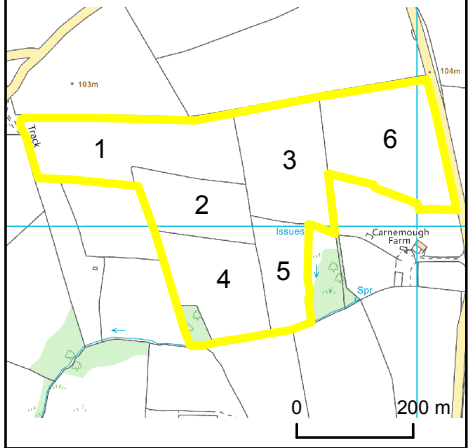

Figure 4: Interpretation of Geophysical Data

Project: Carnemough Farm

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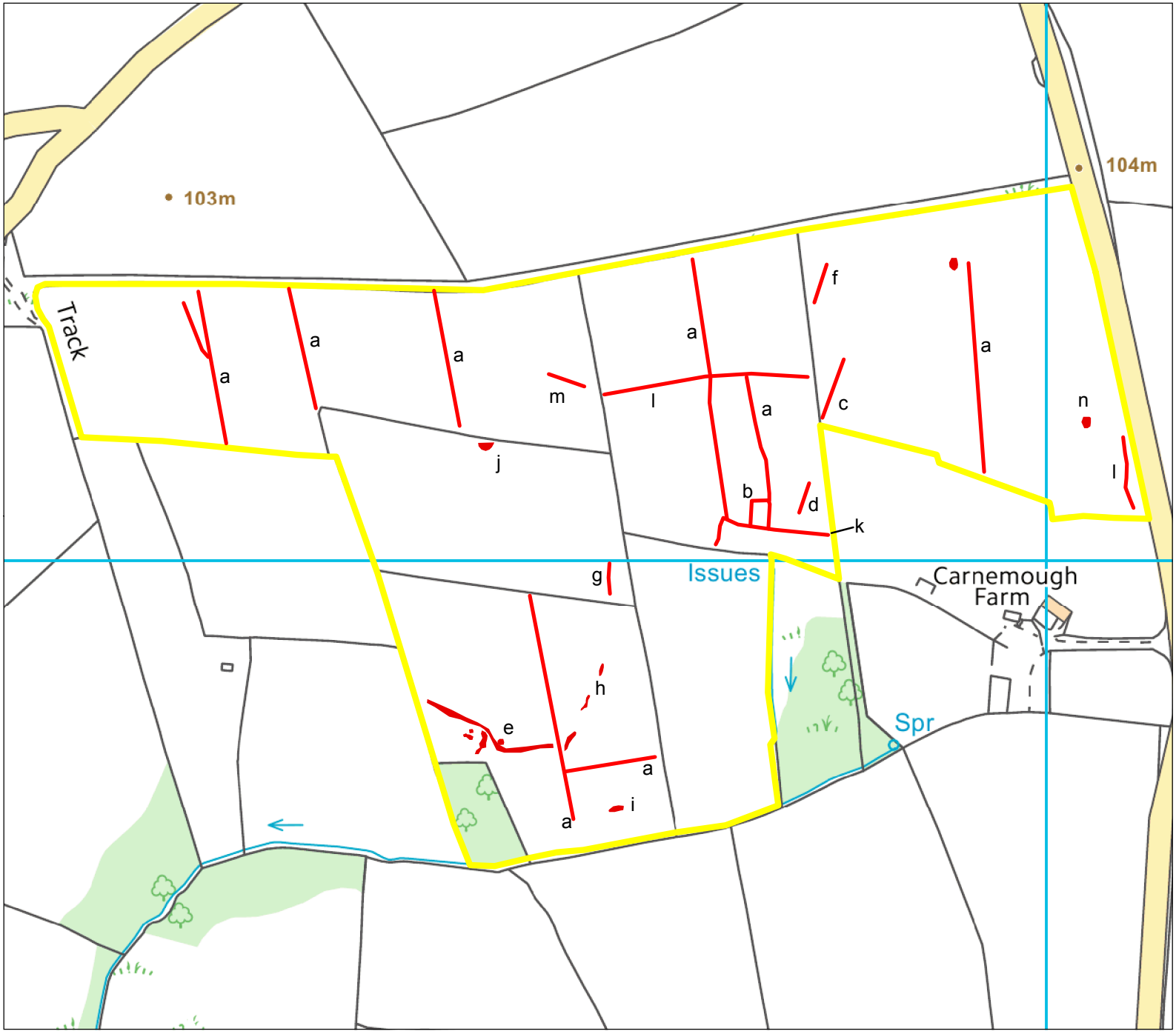

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Possible Archaeology [GP1] a - n

Site Boundary

Field Identification

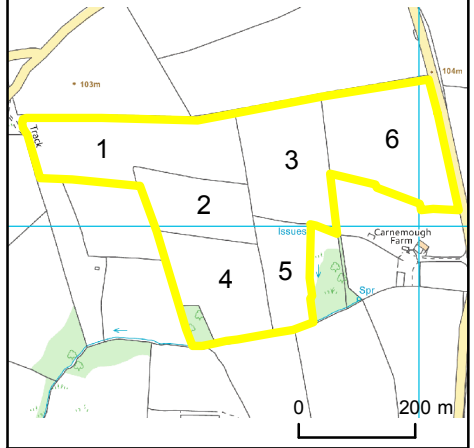

Figure 4: Interpretation of Geophysical Data

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