AB HERITAGE
ARCHAEOLOGICAL CONSULTANCY

The Duchess Community High School, Alnwick, Northumberland Geophysics Report

Client: GALLIFORD TRY

AB Heritage Project No: 10453

Date: 17/11/2014

The Duchess Community High School, Alnwick, Northumberland

Geophysics Report

Client	**Galliford Try**
Project Number	**10453**
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1.0	DRAFT	G. Rose	A.Buckley	17-11-14

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CONTENTS

FIGURES

FIGURES

APPENDICES

1. INTRODUCTION

1.1 Site Location & Description

1.1.1 The proposed development site (hereafter referred to as the site) is located approximately c.1km to the south of the town of Alnwick and 500m west the A1. The surrounding landscape is primarily rural, while to the north of the site there are substantial urban residential and industrial developments. The site is centred at approximately NU 18984 11843 (Figure 1).

1.1.2 The site is c. 8ha in size and consists of three fields of varying sizes, divided by metal fences. The central field is laid out as rugby pitch, and the western field is laid out as a football pitch with a car park at the north-western edge of the field. The field to the east of the site has currently open and, in the main, covered in overgrown grasses.

1.2 Geology & Topography

1.2.1 The site rises c. 15m from its eastern side, where it sits at c.65m Above Ordnance Datum (aOD), to the western side.

1.2.2 While the general level of the ground rises, the fields in the western part of the field have been previously re-profiled to create a flat/level surface suitable for use as playing surfaces. However, the field in the eastern part of the site retains an undulating topography.

1.2.3 The underlying bedrock geology throughout the majority of the site is the Carboniferous Limestone of the Tyne Limestone Formation and Alston Formation. Carboniferous limestone has the potential to mask archaeological features, as it produces varying results. The superficial deposits are of Devensian till (BGS, 2014).

2 AIMS & METHODOLOGY

2.1 Aims of 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.

2.1.2 The results of the geophysical survey are provided in this report, along with an interpretation of findings.

2.2 Methodology of Works Summary

Site Specific Information

2.2.1 A magnetometry survey was undertaken across the site of proposed development between Monday the 10th of November and Wednesday the 23rd of October 2014, covering an area of c. 8 hectares (ha).

2.2.2 The AB Heritage staff members utilised over the course of the works were Glenn Rose (Senior Project Archaeologist) and John Pykett (Archaeological Technician). The weather conditions for the work were mainly dry, though with periods of rain throughout the survey; this would have had no material impact on the survey.

2.2.3 The work was undertaken and concluded within 3 days, with all data capture downloaded periodically on site for a data quality check.

Equipment

2.2.4 The magnetic survey equipment used was one Bartington Grad-601 (fluxgate magnetometer). A detailed methodology for the works undertaken is contained in Appendix A, with Table 1 recording a brief summary of site specific information on how the magnetometer was set up.

Table 1: Setting Parameters of Magnetometer

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

2.2.5 A GPS was used to setup and reference the survey site using a Trimble GeoXR, which has a sub-centimetre accuracy.

2.3 Known Constraints

2.3.1 The site is bounded by hedgerows to the north, while metallic fences surround the rugby field. These fences, along with the rugby posts in the field, may create an area of magnetic disturbance in the geophysics survey of up to c.1m - 2m from the point of survey.

2.3.2 It should also be noted that, during the geophysical survey, a range of construction works were been undertaken along the western boundary of proposed development. The area of excavation was protected from the playing fields by a line of Harris fencing (Plate 1), while two metal storage containers were located in the north-western area of the site (Plate 2). The harris fencing may have resulted in some magnetic disturbance to the geophysics survey, of up to c.1m - 2m from the feature; however, the containers are likely to have created a high magnetic disturbance in the survey results, extending between c. 5m - 10m from the features.

Plate 1: Construction Works along Western Boundary of Site

Plate 2: Metal Containers in North-West of Site

2.3.3 In addition to the above areas, a man-hole cover was also identified in the north-western limits of the site, adjacent to the eastern side of the car park. This would obviously be associated with below ground services, and would indicate localised areas of past impact.

Plate 3: Area of Past Ground Disturbance in the North-West of Site

2.3.4 It should also be noted, as is pointed out above, that the western part of the field has been previously re-profiled to create a flat/level surface suitable for use as a playing surface. This may have reduced the ability of the geophysical survey to detect anomalies/potential archaeology in this part of the site

3 RESULTS & INTERPRETATIONS

3.1 Results

3.1.1 The results of the Alnwick School survey are documented on Figures 2 – 4. Of these, Figures 2 and 3 show the raw and processed geophysical data respectively, while Figure 4 shows the interpretations made from the results. The [**AB**] numbers provided in this section refer to numbers correlating to Figure 4.

Geophysical Anomalies [**AB 1 - 3**]

3.1.2 Geological features [**AB 1**] have been identified within the eastern side of the site. These features have a positive magnetic field with a reading of between 3-12 nanotesla (nt). They are sporadic in nature and have no specific correlation to each other, with a length of between c. 2m - 5m.

3.1.3 Magnetic disturbance [**AB 2**] has been identified throughout the site, with the majority of the disturbance associated with what appears to be the line of a modern utility, located along the northern edge of the site. Magnetic debris has also created di-polar anomalies [**AB 3**], which are spread throughout the site in an amorphous pattern.

3.2 Interpretation

3.2.1 Interpretation of the results of geophysical survey is based on professional judgement as to the likely/probable cause of an anomaly or reading. For example, strong dipolar discrete anomalies of small size are often associated with ferrous debris or similarly magnetic debris.

3.2.2 In addition, where a positive linear anomaly is recorded, which has a negative anomaly associated alongside either side of it, this can often relate to the line of a modern service.

Table 1: Interpretation of Geophysical Anomalies

AB No	Description	Potential Cause
AB 1	Geological features	Topography/change in geology
AB 2	Negative/ high positive area	Magnetic disturbance
AB3	DI-Polar (Positive with associated negative)	Magnetic Debris

3.2.3 No clear archaeological features were identified during the geophysical survey. However, possible geological features [**AB 1**] were recorded in the eastern limits of proposed development, with these concluded to relate to the natural variation in topography in this area.

3.2.4 The results recorded in the western limits of the site are mainly associated with Di-Polar anomalies from magnetic debris, and magnetic disturbance from modern utilities. This side of the site also contains sports pitches, with past levelling/landscaping events associated with their construction potentially truncating or obscuring detection of below ground archaeology.

4 CONCLUSION

4.1.1 A geophysical survey was undertaken by AB Heritage Limited covering the proposed site of works associated with the Duchess Community High School in Alnwick, Northumberland. On-site works were carried out between Monday the 10th of November and Wednesday the 13th of November 2014. The purpose of this 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 survey did not reveal any features that were concluded to be archaeological in nature, although previous landscaping works in the west of the survey site to create level playing fields may have reduced the ability to detect anomalies/potential archaeology in this part of the site.

4.1.3 The eastern side of the site has a varying/undulating topography, and it is concluded that anomalies [**AB 1**] detected in this areas are likely to be geological in nature, and associated with this variation in topography. What are concluded to be modern disturbances and associated magnetic disturbance [**AB 2 - 3**] were also identified throughout the site.

4.1.4 The results of this geophysical survey will be presented to the Northumberland County Council Planning Archaeologist (Nick Best) to inform the decision making process on the proposed development site and the need for/scope of any future archaeological works.

5 ARCHIVE

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

Table 2: 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

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Appendices

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

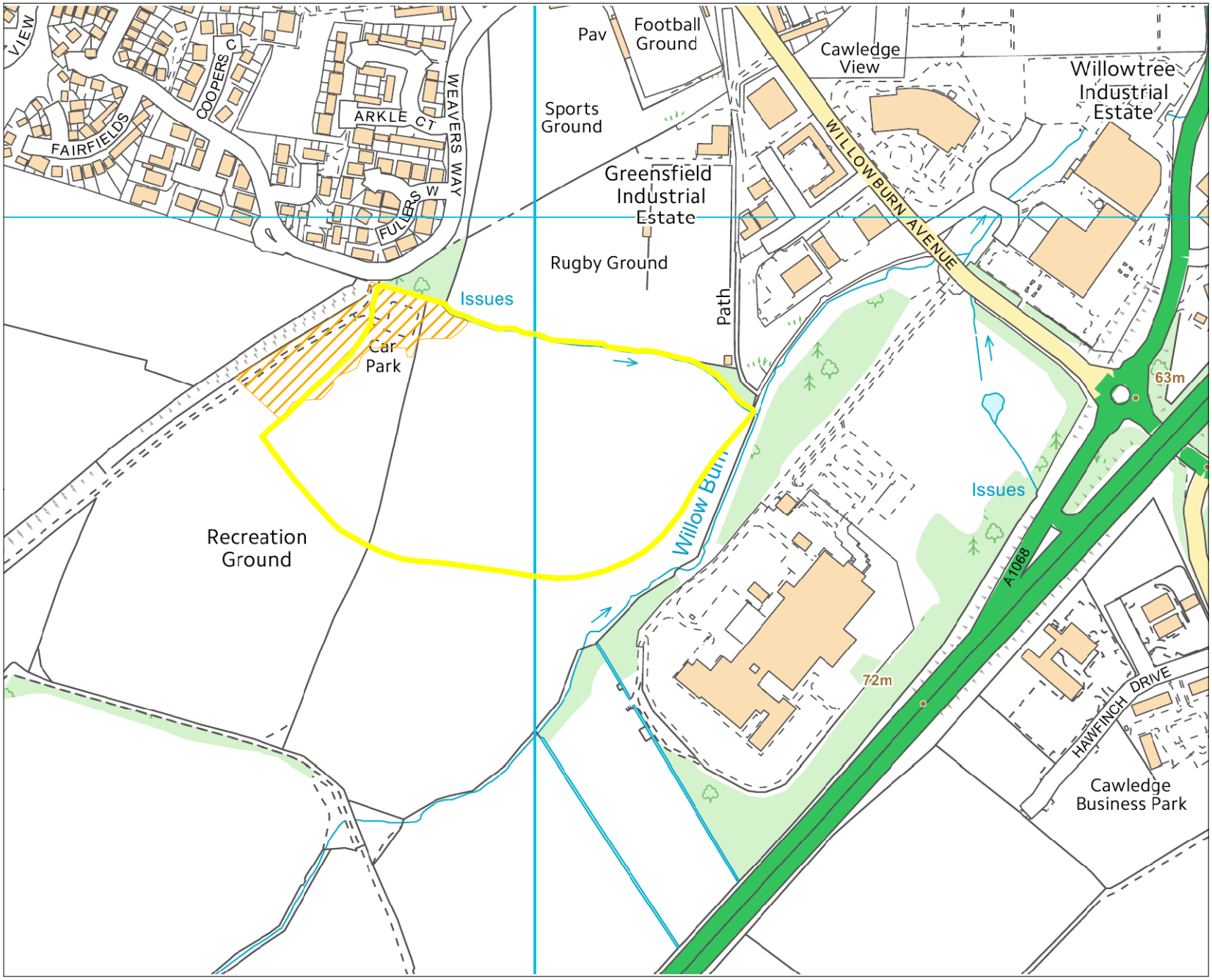
The readings are logged continually by the data logger during the survey, which is then downloaded on site to a site laptop. At the end of each job, data is transferred to the office PC's for processing and presentation.

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.



Legend

Site Boundary

Not Accessable due to Current Construction

0 125 250 500 m

Figure 1: Site Location Plan

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Date: 17/11/14	Job Number: 10453
Drawn by: ZE	Approved by: GR

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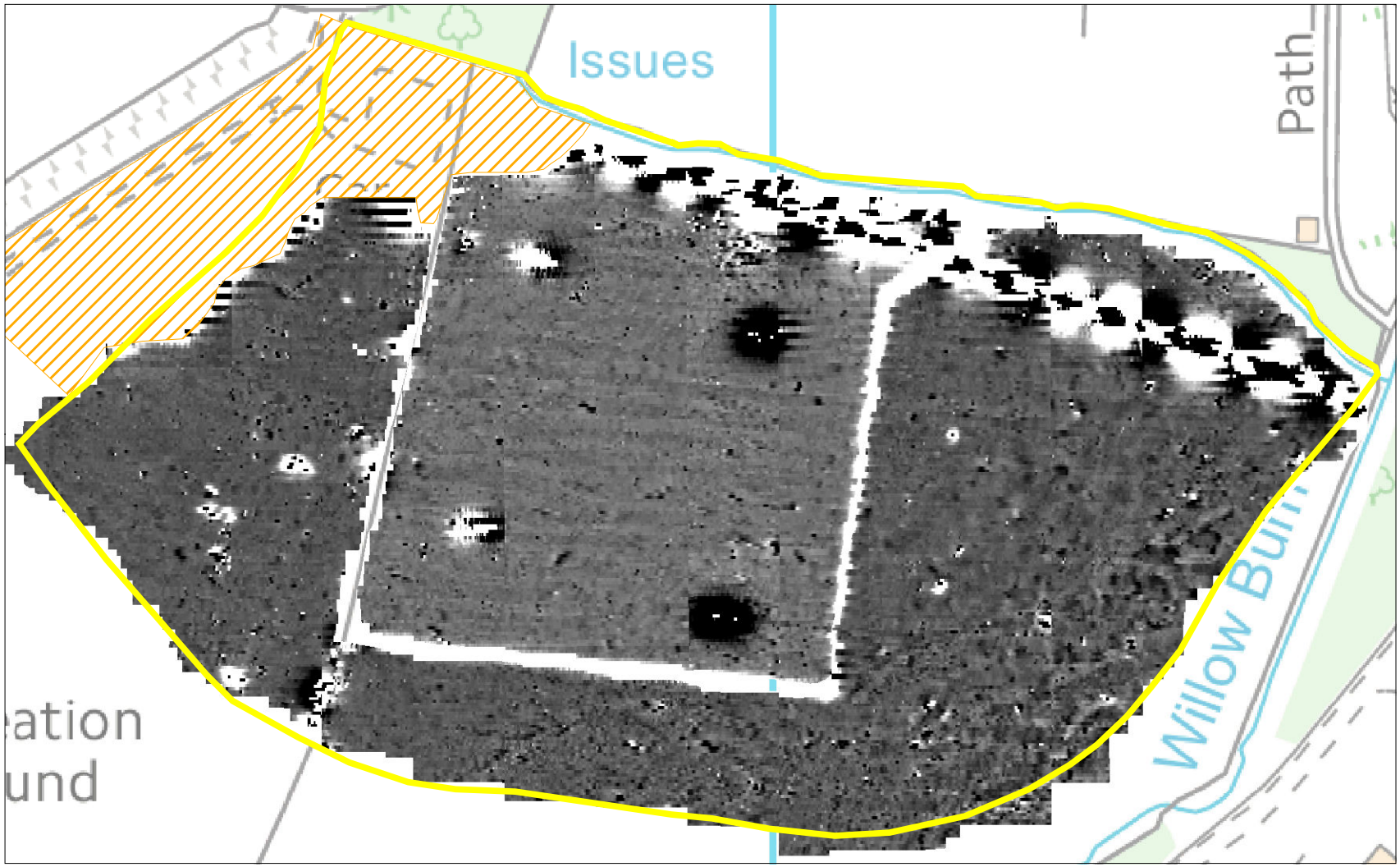

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Site Boundary

Not Accessable due to Current Construction

+10

Plotting Perameters

-10

Figure 2: Raw Geophysical Data

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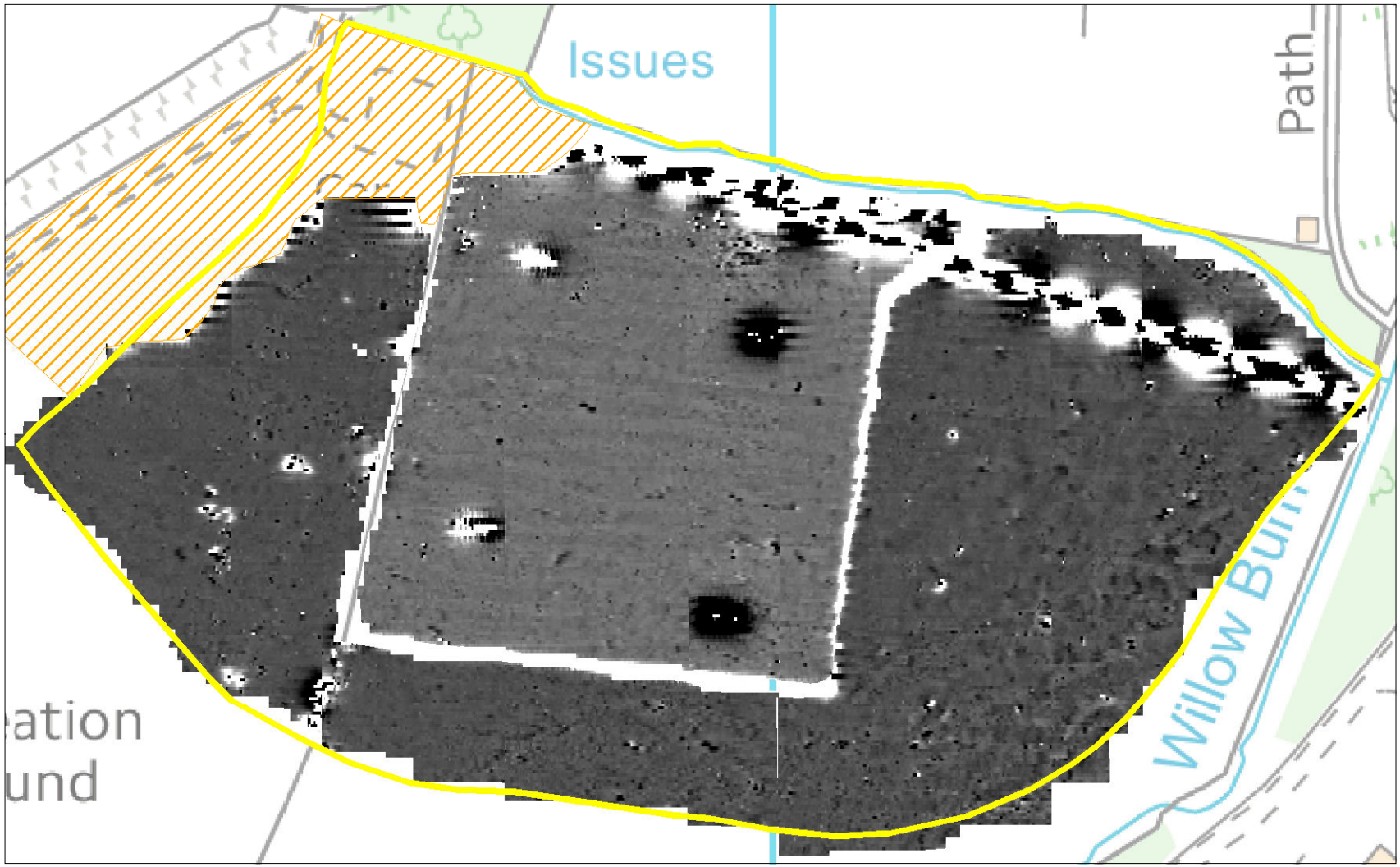

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Site Boundary

Not Accessable due to Current Construction

+ 17.5

Plotting Perameters

- 17.5

Figure 3: Processed Geophysical Data

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0 50 100 200 m

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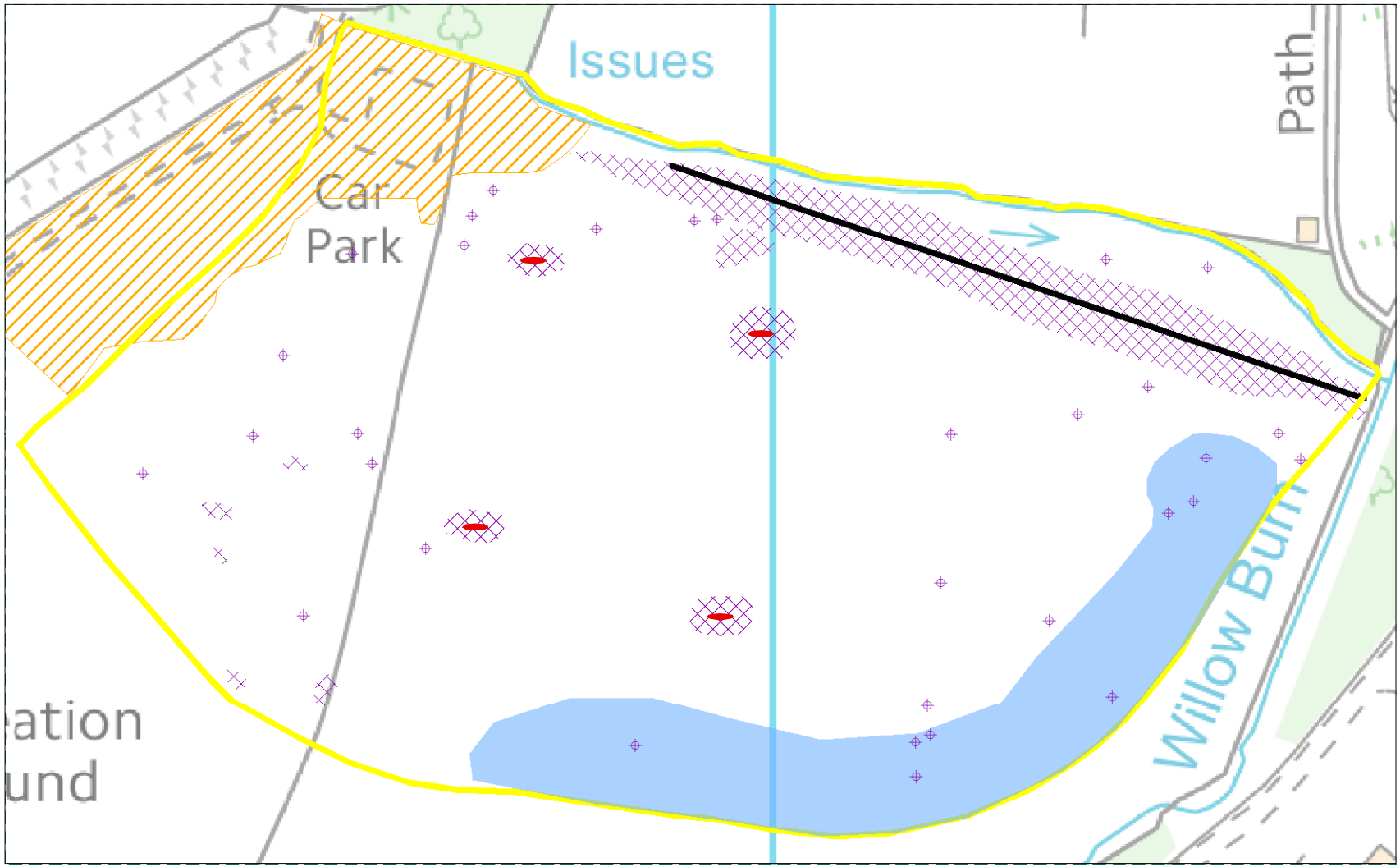

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Legend

- Geological Features [AB1]
- Magnetic Distrubance [AB2]
- Di-Polar Anomalies [AB3]
- Rugby Posts
- Potential Service
- Area of Current Construction
- Site Boundary

Figure 4: Geophysical Data Results Interpretation

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0 50 100 200 m

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