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APPENDIX 5: Geophysical Survey



**Grimethorpe, Barnsley,
South Yorkshire**

Geophysical Survey Report

**for Enviromena Project
Management UK Ltd**

December 2024

Ecus Ltd

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Executive Summary

Ecus Ltd was commissioned to carry out an archaeological geophysical survey for Enviromena Project Management UK Ltd in September 2024 at a site 570 m northwest of the village of Grimethorpe, east of Barnsley, South Yorkshire. The area of geophysical survey was 78.9 ha and comprised 13 arable fields and an area of paddocks.

The survey produced good data throughout and confirmed the presence of anomalies of likely archaeological origin. A substantial network of interconnected rectilinear and linear anomalies identified within the survey results indicates an early agricultural land use for the site. Multiple potential ditch boundary features, as well as agricultural enclosures, have been identified across both the east and west parts of the site.

A probable pit alignment of unknown date is noted crossing Field 13 on a broadly north west to south east alignment. It is on a similar alignment to the network of linear anomalies, and so may indicate an earlier boundary feature through continued agricultural land use.

Further anomalies have been identified that correspond to the location of former boundary features recorded on historic Ordnance Survey (OS) mapping from the 19th century (39). There is also evidence of ridge and furrow cultivation across the site.

The western part of the site is dominated by increased magnetic responses associated with the former opencast Grimethorpe Colliery. While this has limited detection of archaeological anomalies in this area, its extent has been outlined by the survey results, and it is not likely there are archaeological materials present where the colliery once was.

The remaining anomalies are thought to be natural, associated with localised variation in the underlying geological deposits, or modern in origin, associated with recent agricultural practices such as ploughing.

1. Introduction

1.1 Project Background

1.1.1 Ecus Ltd was commissioned by Enviromena Project Management UK Ltd to carry out a geophysical survey ahead of planning application for the development of land at Grimethorpe, Barnsley (hereafter 'the Site'). The Site is centred on National Grid Reference (NGR) 440190 409220 (Figure 1).

1.2 Location, Topology and Geology

1.2.1 The Site is c. 570 m north-west of Grimethorpe, east of Barnsley, South Yorkshire. The area of geophysical survey was 78.9 ha and comprised 13 arable fields and an area of paddocks.

1.2.2 Most of the survey fields were bounded by trees and hedgerows. For the wider Site, further agricultural land bounds the northern, eastern and western boundaries with residential properties beyond to the east and west. An industrial estate is located to the south of the Site. Engine Road bisects the eastern and western portions of the Site.

1.2.3 The topography undulates throughout the Site. The eastern area consists of several small land parcels and had a south-facing slope: the northern part lies at 65 m above Ordnance Datum (aOD) falling to c. 42 m aOD at the southern end.

1.2.4 The central land parcels are made up smaller paddocks and are on a south-facing slope: at 48 m aOD to the north and 36 m aOD to the south.

1.2.5 The western land parcels also consist of agricultural fields and slope to the south and east, falling from c. 57 m aOD at the northern boundary to 52 m aOD to the south west.

1.2.6 The underlying bedrock geology of the eastern and central portions of the Site comprises intermittent bands of Pennine Middle Coal Measures Formation – Sandstone and Mudstone, Siltstone and Sandstone. Toward the east of the Site this changes to intermittent bands of Ackworth Rock (Sandstone) and Pennine Upper Coal Measures Formation – Mudstone, Siltstone and Sandstone. The underlying superficial deposits are largely not recorded or not present, although a small area of Alluvium – Clay, Silt, Sand and Gravel is recorded in the central southern portion of the Site (British Geological Survey 2024).

2. Archaeological and Historical Background

2.1 Introduction

2.1.1 The summary below of archaeological and heritage records is compiled from public historic environment records within a 1 km search radius of the Site. While not exhaustive, the summary aims to present a digest of the known archaeological and historical resource considered relevant to the interpretation of the geophysical survey data.

2.2 Summary

2.2.1 One scheduled monument is located 1.5 km east of the Site. 'Hallsteads moated site, Grimethorpe' (NHLE 1012457) consists of a moated area to the north and south with a bank and ditch noted on the east side. The site was not known as 'Hallsteads' until the late 18th century. Though constructed in the medieval period, its original name is currently unknown. The earliest account of Hallstead Hall was in 1284 when it was under the ownership of Geoffrey de Neville. The hall was described to have both a garden and fishpond and was most likely constructed of timber. In 1479, under the ownership Sir James Harrington, the property was granted a licence to build additional stone walls and towers on the site. Harrington was later dispossessed of the property in 1485 and subsequently it fell into disuse and disrepair. By the mid-19th century, little or no masonry remained though the site of the hall was visible until the mid-20th century.

2.2.2 There is one Grade II and one Grade II* Listed building within an approximate 1 km study area. These pertain to medieval and post-medieval farmhouses and associated buildings. Grimethorpe Hall (NHLE 1151202) is a Grade II* hall house located c. 500 m east of the Site. Bridge Farmhouse (NHLE 1293449) is Grade II Listed and c. 600 m south-east of the Site.

2.2.3 No previous archaeological excavations are recorded within the survey area. Approximately 800 m north of the Site, a geophysical survey and excavation (Martin 2001) recorded details of a sub-enclosure dated to the 1st–2nd century AD.

2.2.4 An evaluation excavation was undertaken following a geophysical survey at Engine Lane (McComish & Pritchard, 2009). Some 25 trenches were dug that identified ridge and furrow and later bell pits.

2.2.5 Grimethorpe Colliery was once located 750 m south-east of the Site. This was founded in 1894 by the Mitchell Main Colliery Company and later became Carlton Main Colliery Company. In 1947, it became the property of the National Coal Board and was closed in 1993.

3. Geophysical Survey Methodology

- 3.1.1 All survey work was completed to appropriate standards, as outlined in current guidance (CIfA 2020a; 2020b, 2022; Schmidt *et al.* 2015).
- 3.1.2 The gradiometer survey was completed using Bartington Grad601-2 and Sensys FMG650/3 dual magnetic gradiometer systems with a data logger. Readings were recorded at a resolution of 0.01 nT and data collected with a traverse interval of 1 m, and a sample interval of 0.13 - 0.25 m (further details are available in Appendix A).
- 3.1.3 Data was collected by traversing the survey area in 4 m (Bartington Grad601-2) and 5 m (Sensys FMG650/3) increments employing a cart system to achieve the best possible results. Real Time Kinematic (RTK) differential GPS equipment was used to accurately determine the position of the survey equipment and monitor data.
- 3.1.4 The processing was undertaken using TerraSurveyor64 software and consisted of standard processing procedures. Illustrations were created using QGIS software.
- 3.1.5 Interpretation of identified anomalies was achieved through analysis of anomaly patterning and increases in magnetic response and was aided by examining the available supporting information including XY Trace Plots. XY Trace Plots are available on request. The interpretations follow Ecus colour coding and categorisations of anomalies and attempt, where possible, to suggest the nature of buried features.

4. Mitigating Factors

- 4.1.1 At the time of survey, the Site conditions were dry underfoot. Small areas of the paddocks were omitted due to overgrown vegetation and the presence of obstacles associated with horses and was deemed not suitable for survey by the survey team.
- 4.1.2 Several modern services were detected within the data, though this has not had a negative effect on the data except in their immediate periphery. Some areas were omitted from survey due to overhead powerlines and extant pylons.
- 4.1.3 The central portion of the western parcel of land (Fields 3 - 6 & 9 - 10) is the site of a former opencast Grimethorpe colliery which has widely been detected within the dataset and its broad extent defined by the survey results.
- 4.1.4 Field boundaries comprised wooden fencing, trees and drainage ditches. Where necessary, a 2 m-buffer to the boundaries was maintained. The 2 m-buffer was employed to minimise the effects or magnetic interference on the survey and to help to reduce, as far as reasonably practicable, any non-detection of potential buried features.
- 4.1.5 The results of geophysical survey may not reveal all potential archaeology within a survey area, and geological, agricultural, and modern features may limit the detection of weaker archaeological responses.

5. Results of Interpretation

5.1.1 Key anomalies found within the survey data are listed in Table 1 and refer to interpretation figures presented (Figures 3, 5, 7, 9, 11, 13, 17, 19, 21 and 23).

Table 1: Survey Anomalies Field 1

Anomaly Number	Anomaly Type	Description	Interpretation
1. (Figure 3; Field 1)	Archaeology	Weakly positive, oval anomaly in the approximate centre of Field 1. Extending from the south-east corner of (2), measuring 30 m in diameter.	This anomaly indicates a ditch feature. Based on its shape, size and position, the anomaly is suggestive of an earlier agricultural feature. The anomaly is incomplete and fragmented in parts, suggesting possible disturbance from historical cultivation.
2. (Figure 3; Field 1)	Archaeology	Stronger, positive, portion of an interconnected network of linear and rectilinear anomalies. The anomaly is broadly square in shape and measures 60 x 76 m.	This anomaly is evidence of a ditch-cut feature, and likely comprises a large agricultural feature. Further extensions are noted to the north-east and south-east, although unclear due to the modern pattern of land division. Two parallel anomalies extend to the north (3).
3. (Figure 3; Field 1)	Archaeology	Extension to the north of (2), two parallel linear anomalies protrude for c. 19 m towards the northern boundary of Field 2.	This anomaly suggests a further extension of the network of anomalies noted to the south. This may indicate a portion of a further agricultural feature.
4. (Figure 3; Field 1)	Archaeology	Positive, broadly rectilinear anomaly to the south of Field 2. The anomaly measures 44 m north to south and 46 m east to west, although no clear western edge is noted due to the modern field boundary.	This anomaly indicates a further ditch-cut agricultural feature, and likely forms part of the same network of anomalies noted to the north at (1 – 3).

Anomaly Number	Anomaly Type	Description	Interpretation
5. (Figure 3; Field 1)	Possible Archaeology	Positive, semi-circular anomaly measuring approximately 11 m in diameter.	This anomaly may indicate a ring-ditch or gully. There is a positive, pit-like anomaly in its approximate centre. However, due to its position and shape at the modern field's boundary, a modern agricultural origin cannot be ruled out.
6. (Figure 3; Field 1)	Possible Archaeology	Weaker, fragmented linear and 'L-shaped' anomalies in the vicinity of anomalies (1 – 4). These are noted on a variable north west to south east alignment, compared with (1 – 4) on a broadly north to south alignment.	These anomalies may indicate a different phase of archaeological activity in the vicinity of anomalies (1 – 4). However, due to their weak response, a more confident origin cannot be ruled out, and a modern agricultural origin is possible.
7. (Figure 3; Field 2)	Possible Archaeology	Two weakly positive, disarticulated curvilinear anomalies. The first to the east measures 34 m long and the second to the west measures 27 m long and is bisected by a modern service.	The anomalies may indicate ditches, which could evidence earlier boundary features. However, a modern agricultural origin for these anomalies cannot be ruled out.
8. (Figure 5; Field 9)	Archaeology	Rectilinear anomaly on a north to south alignment. Measures 107 x 72 m	The anomaly appears to indicate a ditch feature, and based on its morphology is likely an earlier agricultural feature. There are extensions to the north east, north west, and south, suggesting this is part of a larger network. The anomaly is bisected by a service.

Anomaly Number	Anomaly Type	Description	Interpretation
9. (Figure 5; Field 9)	Possible Archaeology	Linear anomaly on a broadly east to west alignment measuring 53 m long. Rectilinear anomaly on a shared alignment with (8).	Internal anomalies within (8) which may indicate further archaeological features, although due to the weaker response or orientation, may be associated with a different origin such as historical or recent agricultural practice. The anomaly is also bisected by a service.
10. (Figure 5; Field 9)	Archaeology	Rectilinear anomaly with a southern extension and appears to comprise of two parallel agricultural ditches at the north/eastern portion in Field 9.	This anomaly indicates an agricultural ditch feature and likely an earlier boundary. The anomaly continues to the west at (11).
11. (Figure 5; Field 6)	Archaeology	Continuation of the anomaly at (10) through Field 6. Through Field 6 the feature becomes weaker and fragmented, with an extension to the north at its western end. The whole length is 134 m.	This anomaly indicates a ditch and is likely a continuation of the northern extent of (10) to the east in Field 9.
12 (Figure 5; Fields 6, 8)	Archaeology	Rectilinear anomaly spanning 48 x 53 m across the boundary between Field 6 and Field 8.	This anomaly likely indicates an earlier agricultural ditch feature. Its southern extent broadly corresponds to the projected alignment of (11) so may form part of the same system of boundary features.

Anomaly Number	Anomaly Type	Description	Interpretation
13 (Figure 5; Field 8)	Archaeology	<p>'T -shaped' / rectilinear anomaly in the north-west corner of Field 8. The eastern portion measures 83 m on a north to south alignment. There is a perpendicular projection on an east to west alignment measuring 53 m.</p> <p>A further, probably western, side to the anomaly is noted in Field 7 on a north to south alignment, adjacent to the modern field boundary.</p>	This anomaly likely indicates a further agricultural ditch feature on the same north to south alignment as the anomalies to the southeast (8–11).
14 (Figure 5; Field 7)	Archaeology	Rectilinear anomaly on a shared alignment to the anomalies to the east at (12-13). This anomaly measures 14 x 46 m.	This anomaly is a further indication of an earlier agricultural feature. The anomaly appears to extend further to west and may be associated with an isolated anomaly to the east in Field 8).
15 (Figure 5; Field 7)	Possible Archaeology	More isolated positive circular anomalies. These measure between 1 and 4 m in diameter.	These anomalies indicate pit-like features in the underlying deposits. This could indicate earlier refuse pits or extraction activity. However, a natural geological origin cannot be entirely ruled out.
16 (Figure 7 and 9; Fields 3 – 6, 9, 10)	Increased Magnetic Response	Large portions of positive and negative variably strong and weak magnetic response. This broadly covers an area 430 m north to south and 395 m east to west.	This area of variable response corresponds to the location of the former Grimethorpe Colliery. The colliery is no longer visible in aerial imagery after 2003. However, it has had an impact on the detection of anomalies of archaeological origin which are either no longer present, or entirely covered by anomalies associated with the colliery.

Anomaly Number	Anomaly Type	Description	Interpretation
17 (Figure 9; Field 3)	Uncertain Trend	Curvilinear, positive low magnitude anomaly within the area of the former colliery. The anomaly measures c. 37 m long. Two parallel linear anomalies of a similar magnitude are noted to the east in Field 10.	These anomalies have the morphology of ditch features. While such a feature is most likely to be associated with the lands former use as a colliery, an earlier archaeological origin cannot be entirely ruled out. The anomalies to the east in Field 10 may indicate land drains.
18 (Figure 9; Fields 9 – 10)	Possible Archaeology	Weaker, fragmented linear anomalies in a broadly 'T-shape' across the southern end of Field 9 and east of Field 10. Measures 66 m north to south with the northern portion very fragmented.	These anomalies indicate ditch features and may be part of the wider earlier boundary system identified across the west of the site. However, a more recent agricultural origin, or one associated with the former colliery to the west (16) cannot be ruled out.
19 (Figure 13; Field 11)	Archaeology	Noted to the north of Field 11, portions of linear and rectilinear anomalies on a shared alignment with those to the west in Field 9 (9 and 10) are visible. The anomalies are on a north north-east to south south-west alignment.	These anomalies indicate ditch features in the underlying deposits and are likely archaeological in origin and associated with an earlier boundary or agricultural feature that is part of the same system of boundaries identified to the west.
20 (Figure 13; Field 11)	Possible Archaeology	Anomalies adjacent to (19) extending to the south through the north of Field 11.	These are noted within an area of increased magnetic response likely associated with the former railway line that traversed to the west making their interpretation more difficult. They are also seemingly bisected by a probable later boundary feature (21). However, the anomalies may be archaeological in origin.