pre-construct geophysics

archaeological surveys

GEOPHYSICAL (GRADIOMETER) SURVEY

LAND OFF SCAWBY ROAD, BROUGHTON, NORTH LINCOLNSHIRE

NGR 496100 408250

REPORT PREPARED BY DAVID BUNN

ON BEHALF OF PCAS ARCHAEOLGY

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Contents

Illustrations

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Non-technical summary

- *To inform a forthcoming application for planning permission, a fluxgate gradiometer survey was undertaken on land to the west of Scawby Road, Broughton, North Lincolnshire.*

- *To the greater extent, the recorded magnetic variation is considered to indicate features of natural or modern origin. A single north-south aligned linear anomaly exhibits some potential as a buried ditch, but this anomaly could also indicate a glacial fissure or cultivation scar.*

- *Generally, the geophysical survey results suggest that the site has limited archaeological potential.*

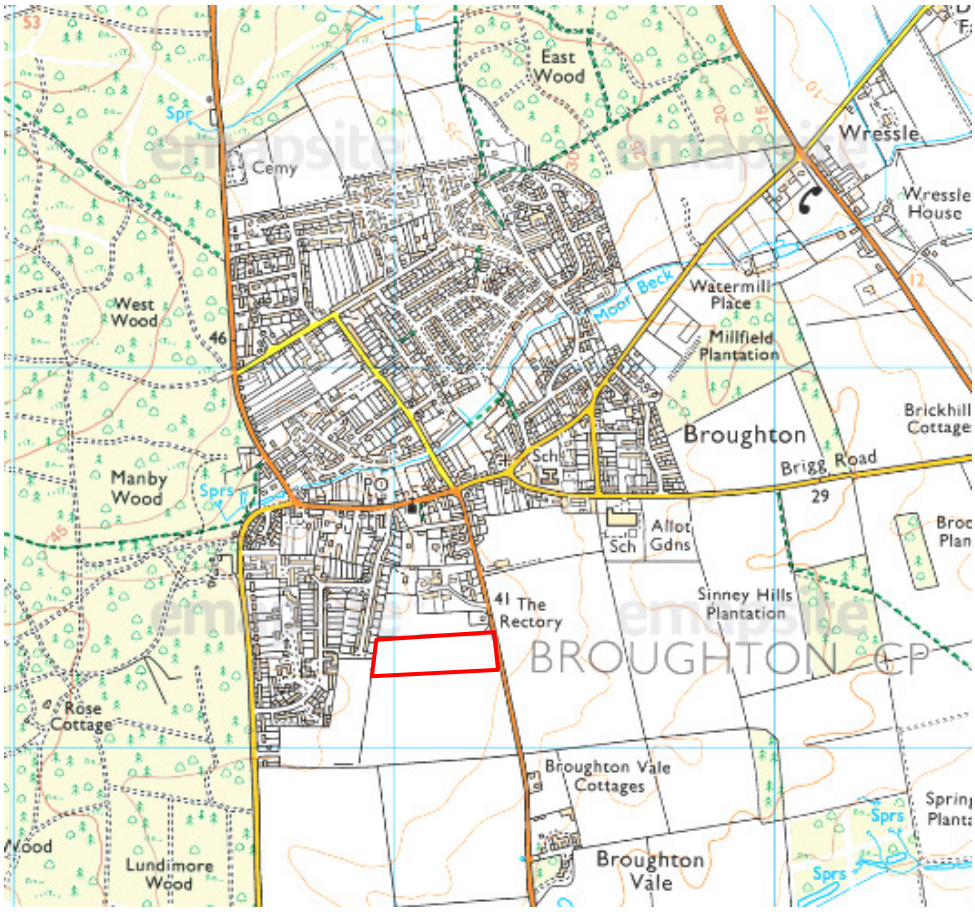

Fig. 1: Location of site

1.0 Introduction

On behalf of DDM Agriculture, PCAS Archaeology Ltd. commissioned a geophysical survey of land at Broughton in North Lincolnshire (centred at NGR c.496100 408250).

2.0 Site Description (Fig. 1)

The c.2.9 ha site is situated close to the southern edge of the village of Broughton. It encompasses a sub-rectangular area of land that forms the northern side of an arable field (stubble at the time of survey). It is bordered to the east by Scawby Road (B1207), to north-west by a residential development and by open land to the south-east, south and north.

3.0 Geology and topography

The solid geology of the site comprises Kirton Cementstone Beds - predominantly interbedded mudstone and limestone with limestone only recorded at the southern edge. This sedimentary bedrock was formed approximately 168 to 170 million years ago in the Jurassic Period in a local environment previously dominated by shallow carbonate seas.

Superficial deposits are not recorded.

The site occupies a slight east-facing slope between the 45m and 40m contour lines.

4.0 Archaeological Context

Online sources[1] do not list any known archaeological resources within the proposed development site. However, a number of relevant known or suspected monuments lie within relatively close proximity. These include:

- 'vague and fragmentary' cropmarks of two potential enclosures within the central part of the field containing the site, as visible on Google Maps aerial images, 2012 (North Lincolnshire HER No.22608);

- a linear cropmark c.350m to the south-west, of uncertain origin though possibly a modern vehicle track heading towards a pit (HER No. 20860);

- two parallel linear ditches, visible as cropmarks on an 1989 aerial photograph c.600m to the south-east, to the west of Sinney Hills Plantation (HER No. 20576);

- a large oval feature and possibly a ring ditch are visible within Sinney Hills Plantation on a 1970 aerial photograph approximately 800m to the east (HER No. 21472). This continues into the field to the east and may signify a former plantation;

- a small number of features, including a probable Saxon 'grubenhauser', that were discovered by trial trench evaluation in 2015 on land approximately 200m to the north of the site near Church Lane, Broughton (HER No. 26088).

5.0 Methodology

The survey methodology was prepared with reference to relevant heritage industry guidance and best practice advice, including the *EAC Guidelines for the use of Geophysics in Archaeology* (Schmidt et al. 2016), and the '*Standard and Guidance for Archaeological Geophysical Survey'* (Chartered Institute for Archaeologists, 2014).

Fluxgate Gradiometry is a non-intrusive scientific prospecting tool that is used to determine the presence/absence of some classes of sub-surface archaeological features (e.g. pits, ditches, kilns, and occasionally stone walls).

Gradiometry can help to establish the presence/absence of buried magnetic anomalies, which may indicate sub-surface archaeological features, and may therefore form a basis for subsequent archaeological trenching, where required.

The use of magnetic surveys to locate sub-surface ceramic materials and areas of burning, as well as magnetically weaker features is well established, particularly on large greenfield sites. The detection of anomalies requires the use of highly sensitive instruments; in this instance the Bartington 601 Dual Fluxgate Gradiometer, calibrated to the mean magnetic value of the survey area. Sensors mounted vertically and separated by 1m, measure slight, localised distortions of the earth's magnetic field, which are recorded by a data logger.

The fieldwork was undertaken on the 12th November 2020. The zigzag traverse method was used, with readings taken at 0.25m intervals along 1.0m wide traverses.

The survey grid was established by Global Positioning Satellite to an accuracy of +/- 0.1m using a Leica CS15 RTK with Leica SmartWorx Viva software.

The data were processed by the author using *Terrasurveyor V3*.

The greyscale of the unprocessed data is presented on Fig. 2 (clipped to +/-10 nT to enhance resolution). A 'Despike' function was applied to reduce the effect of extreme readings induced by metal objects, and 'Destripe' to eliminate striping introduced by zigzag traversing. The processed data are presented as a greyscale image on Fig. 3.

Anomalies in excess of +/-10nT are highlighted pink and blue on the interpretive image (Fig. 4). These are characterised magnetically as dipolar 'iron spikes', often displaying strong positive and/or negative responses, which reflect ferrous-rich objects. Examples include those forming/deposited along current or former boundaries (e.g. wire fencing), services and random scatters of horseshoes, ploughshares etc across open areas. Fired (ferro-enhanced) material, such as brick/tile fragments (often where the latter are introduced during manuring or land drain construction) usually induce a similar though predominately weaker response, closer to c+/-5nT (highlighted in pink/blue on interpretive images). Collectively, concentrations of such anomalies indicate probable rubble spreads, such as backfilled ponds/ditches and demolished buildings. On a cautionary note, fired clay associated with early activity has the same magnetic characteristics as modern brick/tile rubble. As such, the interpretation of such variation must consider the context in which it occurs. It should also be noted that this technique only records magnetic variation (relative to natural background levels). As such, the magnetic response of archaeological remains will vary according to geology/pedology. Additionally, remains may be buried beyond the effective 1 - 2m range of the instrumentation.

The interpretation of geophysical survey results should only be regarded as an aid to establishing the nature and origin of buried features. This can only be fully achieved by intrusive investigation.

6.0 Results and discussion (Figs. 2 - 4)

The survey recorded a single, magnetically weak linear anomaly that extends across the southern and central parts of the site (Fig. 4: red line). Whilst this exhibits some potential as a buried ditch (a former land division), this could also signify a soil-filled glacial fracture within the near-surface limestone geology, or even a a cultivation score.

A zone of stronger variation recorded in the north-eastern region, and a similar, albeit less widespread, area in the north-western corner (pink and blue) almost certainly reflects some form(s) of near-surface imported ferrous-rich debris, such as fragments of brick/tile. Similar, though more isolated examples were noted across the site.

An array of magnetically weak zones of variation recorded in the mid-northern region indicate natural inconsistencies (area broadly described by dotted green line).

7.0 Conclusions

For the most part, the recorded magnetic variation is considered to be of natural or modern origin. An isolated NS aligned linear anomaly exhibits some potential as a buried ditch though this could alternatively reflect a backfilled glacial fissure or cultivation scar.

Generally, the geophysical survey results suggest that the site has limited archaeological potential.

8.0 References

British Geological Survey. 2020. Geology of Britain viewer, 1:50,000 geological mapping, bedrock and superficial - http://mapapps.bgs.ac.uk/geologyofbritain/home.html

CIFA 2014 *Standard and Guidance for Archaeological Geophysical Survey.* Chartered Institute for Archaeologists.

Schmidt, A; Linford, Linford, P; N; David, A; Gaffney, C; Sarris, A; & Fassbinder, J; 2016. EAC *Guidelines for the use of Geophysics in Archaeology: Questions to Ask and Points to Consider. EAC Guidelines 2.* Euopae Archaeologiae Consilium.

[1]https://www.heritagegateway.org.uk/Gateway/

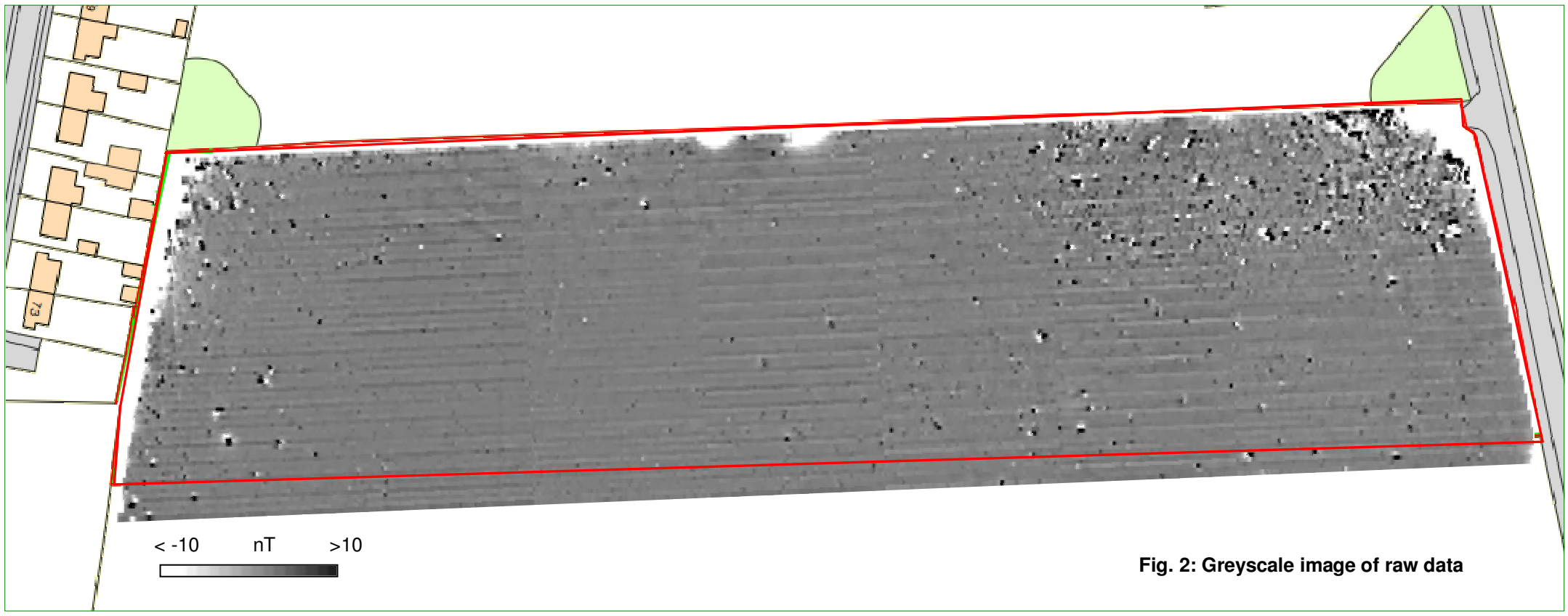

Fig. 2: Greyscale image of raw data

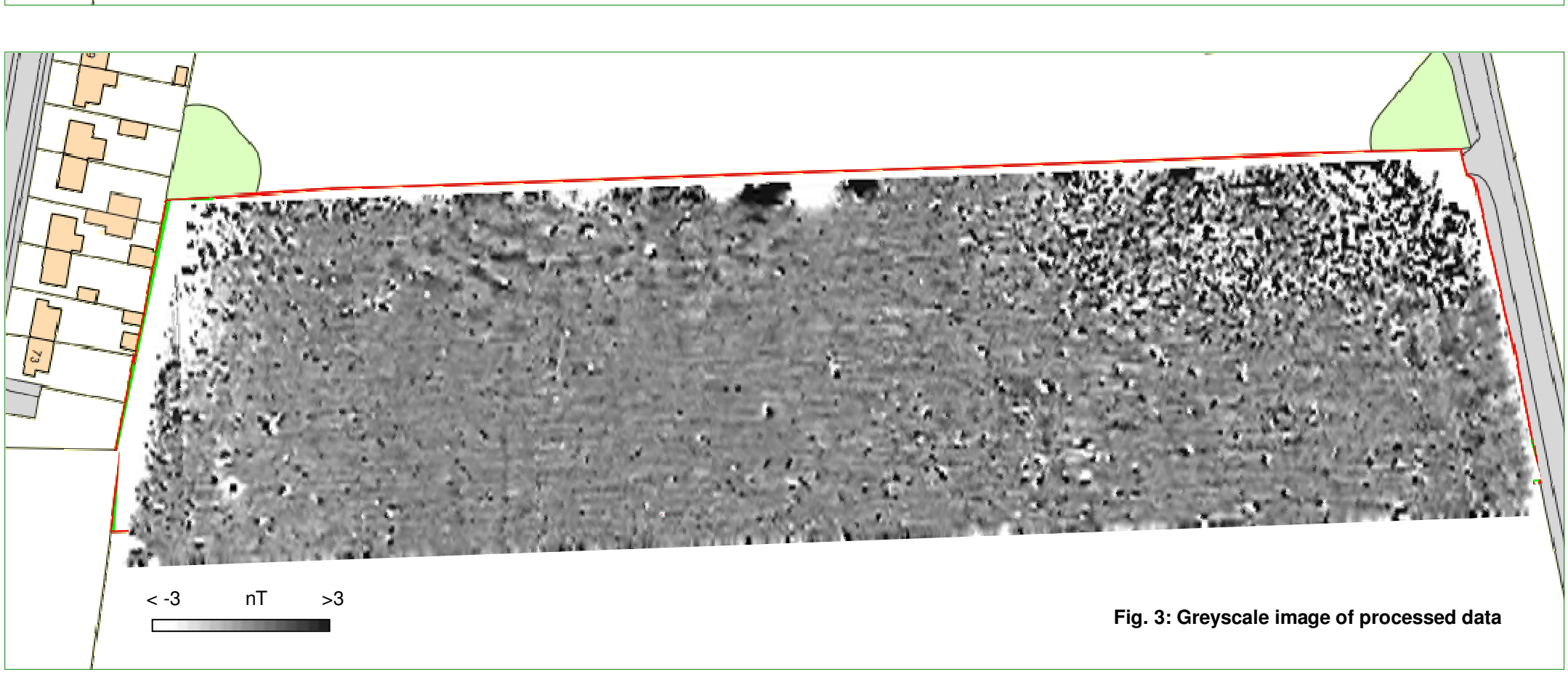

Fig. 3: Greyscale image of processed data

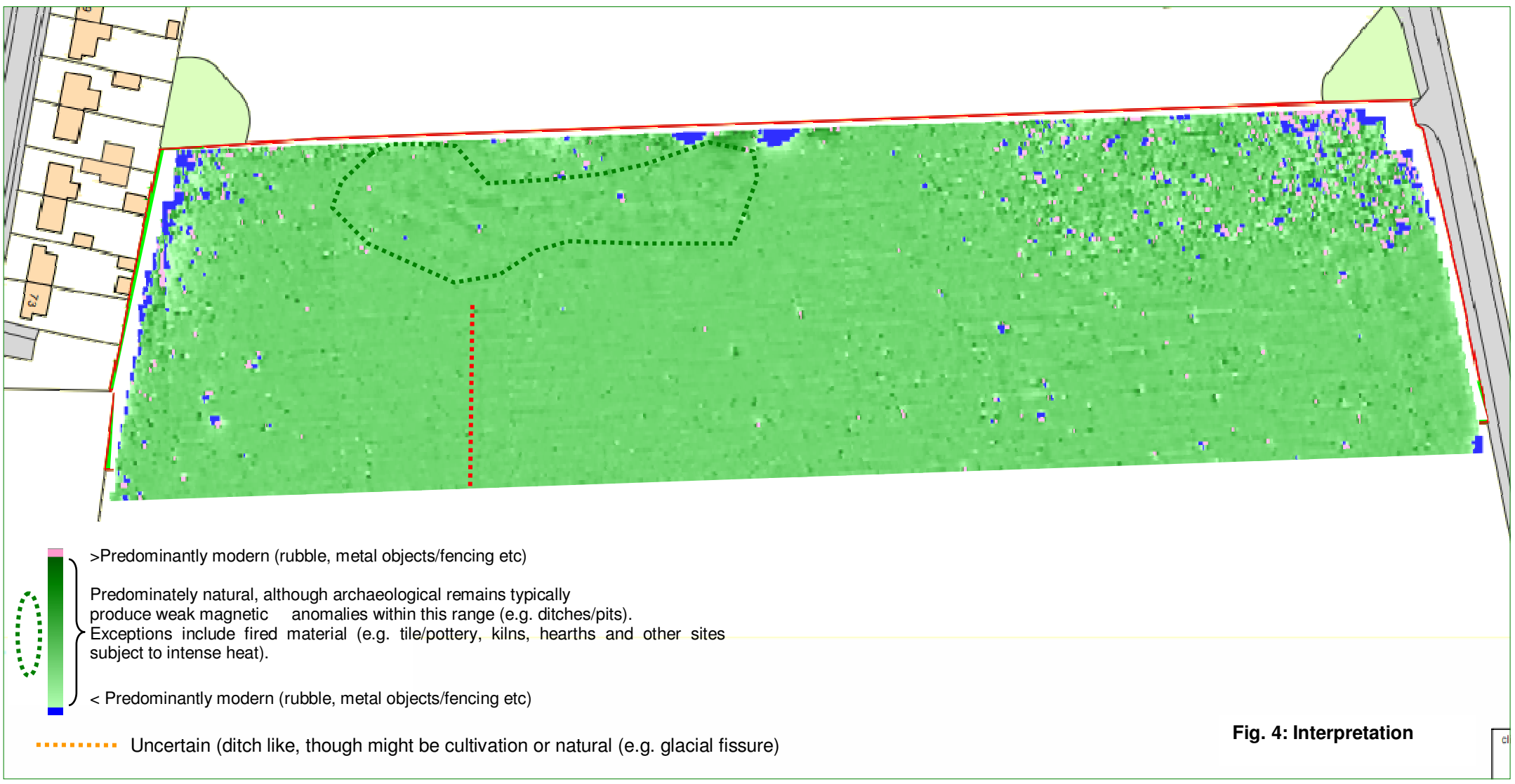

Fig. 4: Interpretation