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PRE-CONSTRUCT GEOPHYSICS

FLUXGATE GRADIOMETER SURVEY: LAND OFF SCHOOL LANE, OLD LEAKE, BOSTON, LINCOLNSHIRE

NGR	TF 405 501
SITE CODE	SLOL01

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Report prepared for Brown & Co.
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Contents

Illustrations

Summary

- *A fluxgate gradiometer survey was undertaken on 0.5 hectare of land off School Lane, Old Leake, Boston, Lincolnshire*
- *The survey identified significant levels of magnetic variation across the site, and this variability can be resolved into a series of magnetic anomalies*
- *Some of the anomalies appear to be associated with changes in the position of existing boundaries*
- *Other anomalies possibly represent elements of an earlier field system, while a number of small, discrete anomalies randomly distributed across the site suggest the presence of ferrous and ceramic debris in the topsoil*

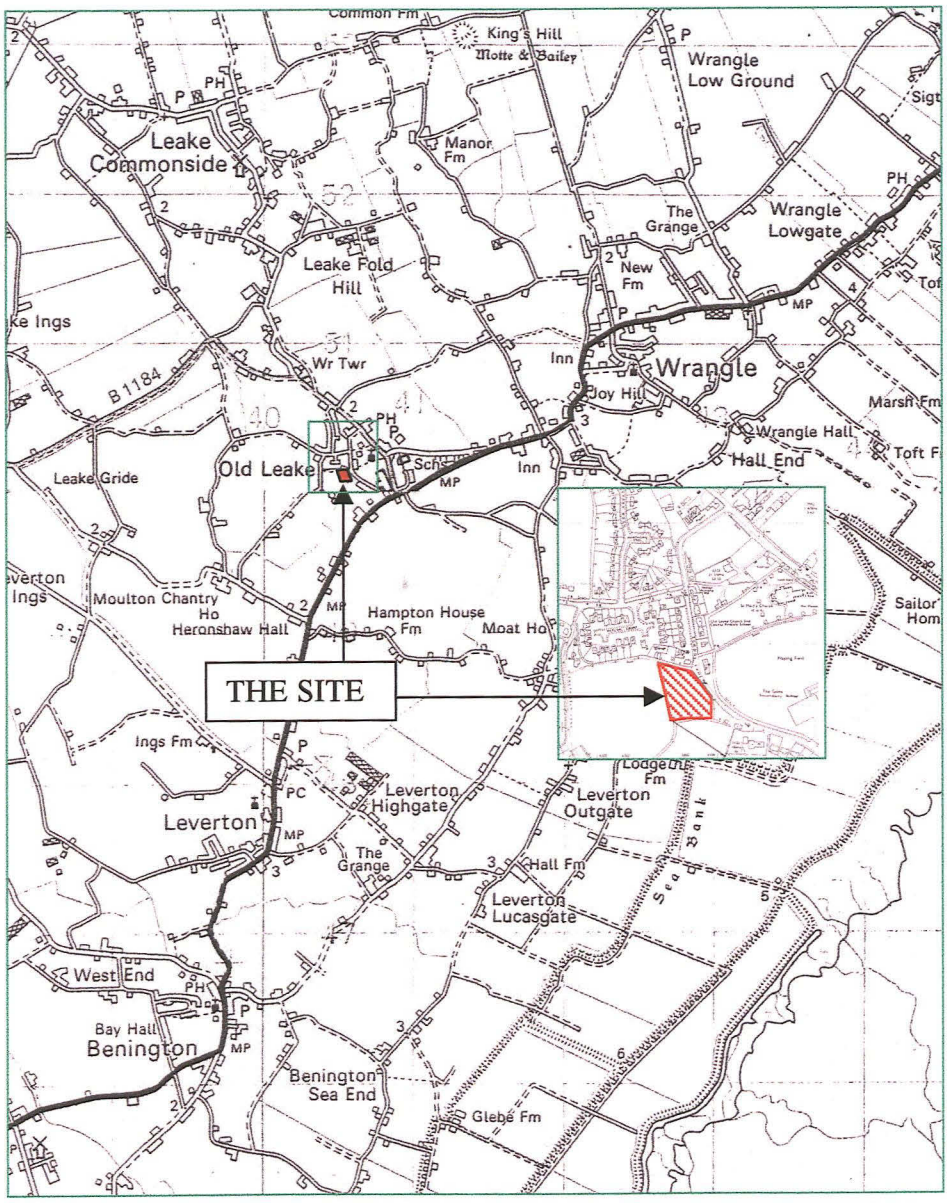

Fig.1: Location of site Scale 1:50000 (Inset 1:5000)

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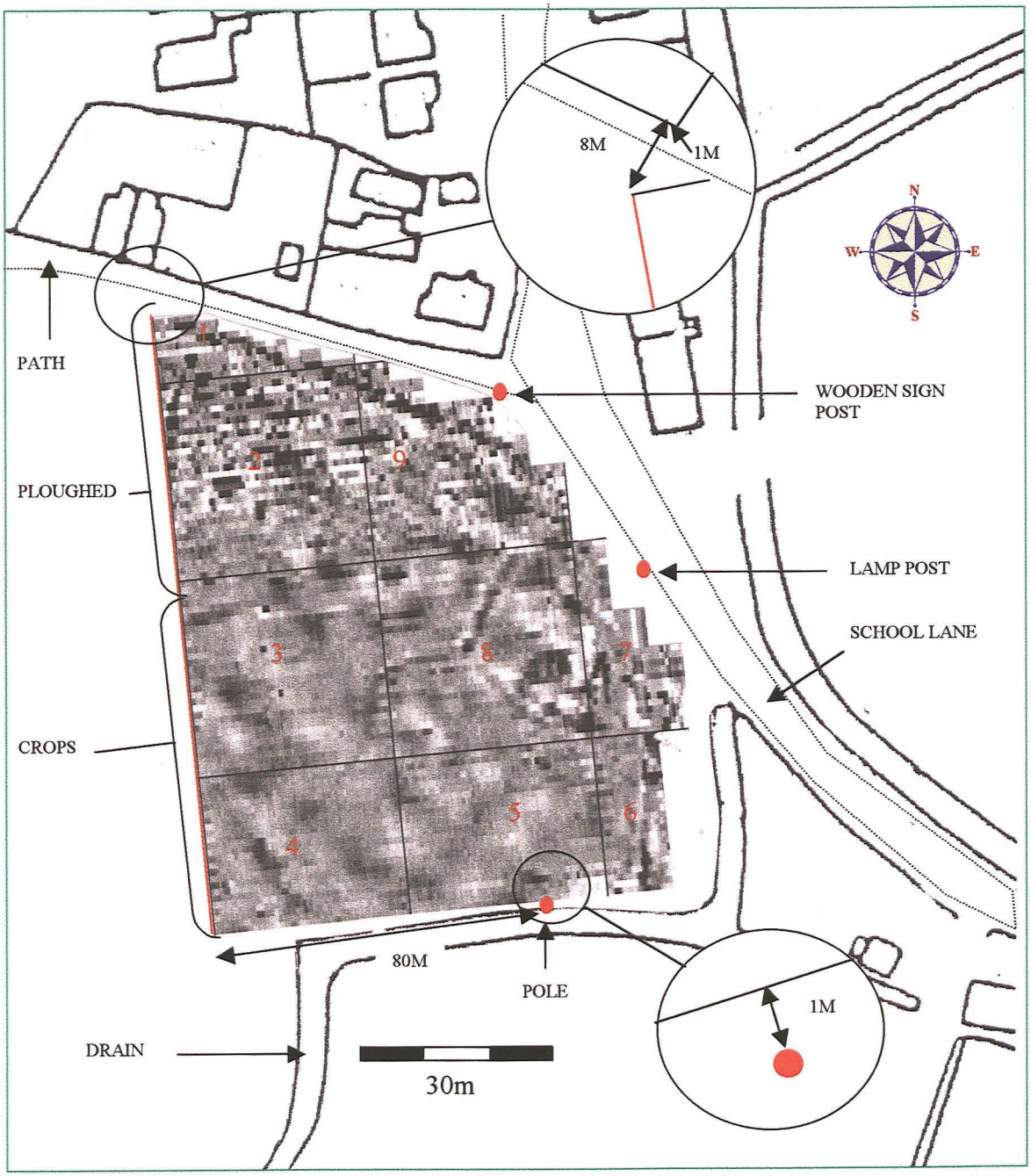

Fig.2: Location of survey. Scale 1:1000

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1.0 Introduction

Brown & Co., acting on behalf of their client, commissioned Pre-Construct Geophysics to undertake a fluxgate gradiometer survey of land off School Lane, Old Leake, Boston, Lincolnshire. This work was carried out as part of an archaeological evaluation of the site. The evaluation is a formal requirement of Boston Borough Council, and it is associated with a planning application for residential development (Ref. B/00/0026/OUTL).

The survey was undertaken in accordance with a specification prepared by Pre-Construct Archaeology (Palmer-Brown, 2001). The methodology was based upon guidelines set out in the English Heritage document *'Geophysical Survey in Archaeological Field Evaluation'* (David, 1995).

2.0 Location and description

Old Leake lies in the fens of south Lincolnshire, approximately 8km to the north-east of Boston. The site of the proposed development is situated at the south-west edge of the village, immediately to the west of School Lane, and comprises a 0.57ha component of a 3.25ha field.

The site is bounded to the north by a path, beyond which lies housing. School Lane runs along the north-eastern perimeter, and a drain defines the south-eastern and southern boundaries. Telegraph poles are located along the south-eastern edge of the site. The modern ground surface is relatively level, but there is a slight east-facing slope.

At the time of survey, the northern third of the site had recently been ploughed, with the remainder supporting a brassica crop c. 0.3-0.4 m in height. The condition of the site severely impeded the progress of the survey, which was completed with some difficulty.

In this area of the silt fens, drift deposits of the Quaternary era are up to 20m in depth. Uppermost of these are the Terrington Beds, a series of sandy silts, sands and clays, representing younger marine alluvium, salt marsh, tidal creek and river deposits (B.G.S., 1995). Beneath the Terrington Beds are further drift deposits, possibly including Devensian Abbey Sand and Gravel, and beds of Glacial Sand and Gravel of Anglian age. These cover the upper beds of the solid geology, which consist of the mudstones of the Oxford Clay Series, deposited during the Upper Jurassic period.

Central National Grid Reference TF 405 501.

3.0 Archaeological and historical background

There is no evidence of activity within the area now occupied by the village, or its environs, prior to the Anglo-Saxon period. However, large areas of the Fenland Basin have been subject to sustained periods of inundation, linked to changes in sea level. It is therefore likely that at these times this region was unsuited to permanent occupation. Additionally, during these periods of flooding, significant quantities of alluvium are likely to have been deposited, which will mantle and mask traces of earlier activity.

The etymology of the name Old Leake, recorded in the *Domesday Book* as *Leche*, suggests that the origins of the settlement lie in the late Saxon period (Mills, 1993). Moreover, the Domesday Survey lists some 26 salthouses, amongst other possessions within the parish; such a large quantity suggests that a salt making industry existed prior to the Norman Conquest.

Salt manufacture during the medieval period usually involved 'sand washing': the collection of salt-rich muds, followed by filtration and the evaporation of brine. Archaeologically, evidence of the industry often takes the form of filter beds and areas of burning (burnt peat, oven remains, briquetage spreads, etc.).

An archaeological evaluation undertaken on land to the north-east of Church Road uncovered late Saxon features dating to the 9th-11th centuries AD (Palmer-Brown, 1996), although this work produced no direct evidence of salt production.

A recent desk-top assessment concluded that the current site is one of only moderate archaeological potential (Allen, 2000).

4.0 Methodology

Detailed area survey using a fluxgate gradiometer is a non-intrusive method of evaluating the archaeological potential of a site. The fluxgate gradiometer detects magnetic anomalies created by areas of high or low magnetic susceptibility. These areas are caused by changes in the composition of the subsoil or the underlying geology. Archaeological features result from man-made changes to the soil and the introduction of intrusive materials such as brick and stone. These features can create detectable magnetic anomalies. In addition, activities that involve heating and burning will create magnetic anomalies, as will the presence of ferrous metal objects.

The anomalies detected by a fluxgate gradiometer survey can often be resolved into entities sharing morphological characteristics with features of known archaeological provenance. This enables the formulation of an informed, but subjective, interpretation.

Magnetic variation between archaeological or naturally occurring features and natural geological strata can result from:

- their relative depth or density of fill

- the magnetic properties of materials introduced as a result of human activity (e.g. rubble, stone, brick/tile, ferrous metal etc.) in contrast to those within surrounding natural deposits

- magnetic enhancement associated with areas of burning

- the magnetic properties of localised, naturally deposited, minerals, such as those occurring in the fills of palaeo-channels.

The area survey was conducted using a *Geoscan Research* fluxgate gradiometer (model FM36) with an electronic sample trigger set to take four readings per metre (a sample interval of 0.25m). The zigzag traverse method of survey was used, with 1m wide traverses across 30m x 30m grids. The sensitivity of the machine was set to detect magnetic variation in the order of 0.1 nanoTesla. The base line was established along the western edge of the survey area (Fig.1). Pegs were placed in grid corners to facilitate relocation of the survey.

The data from the survey was processed using *Geoplot* (*v. 3.0*). It was desloped (a means of compensating for sensor drift during the survey) and clipped to reduce the distorting effect of extremely high or low readings caused by discrete pieces of ferrous metal. The results are plotted as greyscale and trace images.

The site was surveyed by David Bunn on 17th January 2001.

Instrument	Geoscan Research fluxgate gradiometer FM36 Sample trigger ST1
Grid size	30m x 30m
Sample interval	0.25m
Traverse interval	1.0m
Traverse method	Zigzag
Sensitivity	0.1nT
Processing software	Geoplot (*v. 3.0*)
Weather conditions	Cold, sunny
Area surveyed	c.0.57ha

Table 1: Summary of survey parameters

Fig.3: Image of raw data showing strong anomalies (coloured)

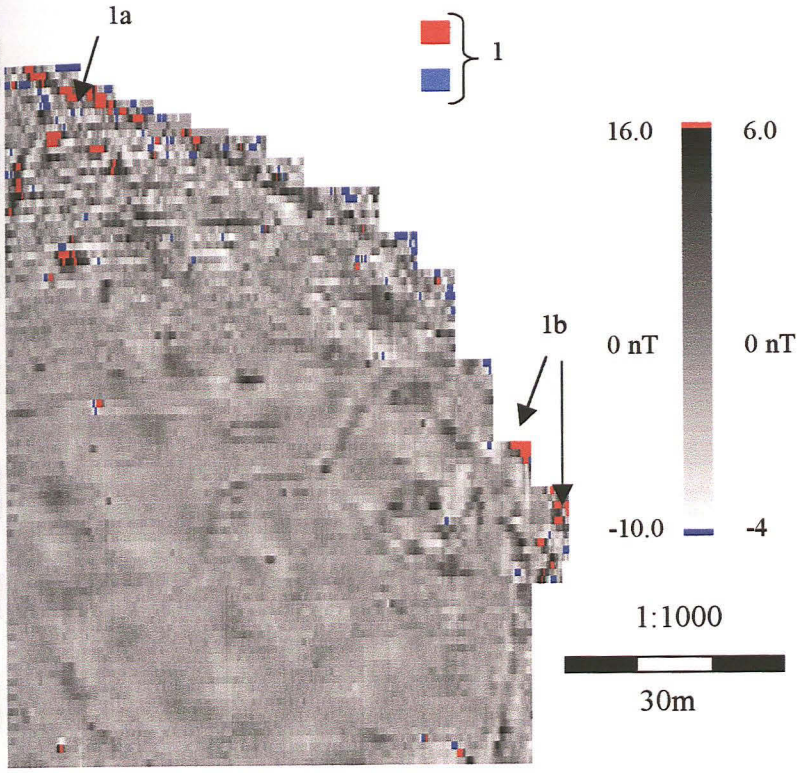
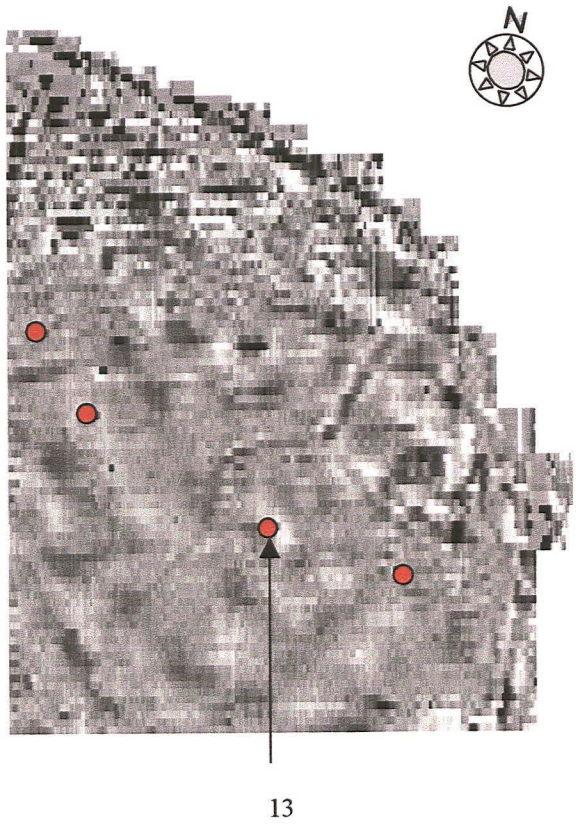


Fig. 4: Clipped greyscale image



Boundary features

? Natural features (iron deposition, backfilled depressions)

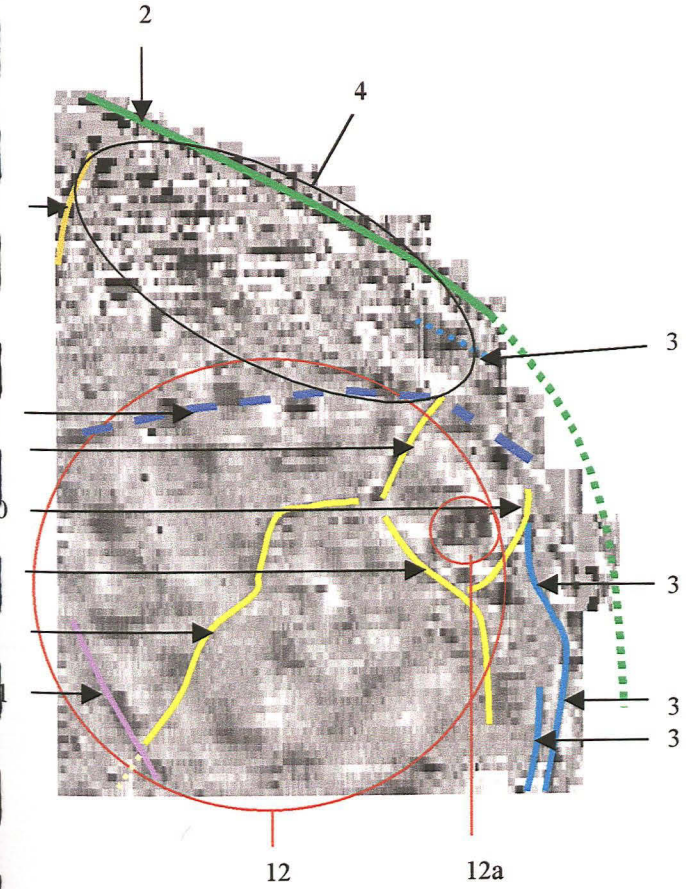


Fig.5: Interpretive plan

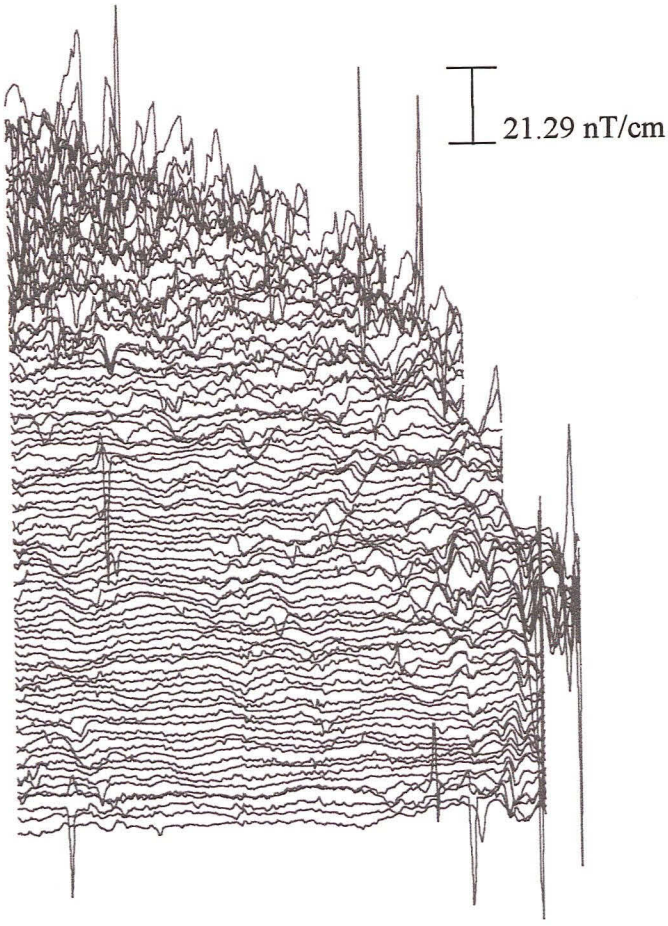


Fig.6: Trace plot of raw data

5.0 Results

The results are represented graphically in the greyscale and trace images (Figs. 3-6).

Figure 3 and the trace plot of the raw data (Figure 6) illustrate the range of magnetic variation within the survey area. The majority of the strongest anomalies (Fig.3: **1**) occurred along the northern and eastern edges of the site, close to a path and to School Lane respectively. Several of these high readings, **1a**, appear to be contained within the north-western end of a linear anomaly (Fig.5: **2**). Similarly, group **1b** may lie within a continuation of the same feature, although their proximity to the very edge of the survey area mitigates against a positive attribution.

A series of diffuse linear anomalies, **3**, that were detected to the south and west of **1b**, and which appear to mimic the orientation and form of the current boundary, may define one or more earlier alignments of the current perimeter of the field. However, it is also possible that some, or all, of the elements of **3** were actually associated with linear anomalies **7-11** (see below), and possibly represent a completely different phase of activity. An enclosure map of 1813, which was reproduced in the desk-top assessment (Allen, 2000), indicates that the footpath forming the north edge of the site was more substantial in the first quarter of the 19th century. Anomaly **2** is likely to define the edge of this earlier, broader access, but it is also possible that elements of **3** were also components of the boundary shown on this plan.

A large area of magnetic disturbance, **4**, situated immediately to the south of **2,** could also contain elements of linear boundary features representing continuations of components of **3**. However, **4** itself cannot be resolved into one, or more, discrete and morphologically diagnostic features. Consequently, **4** could reflect the presence of sub-surface rubble, possibly elements of a demolished structure situated in this area. Alternatively, it may merely be a bias within the data, produced as a result of the northern third of the field having recently been ploughed. It is also possible that there is an ill defined, east-west orientated, linear anomaly, **5**, which may be related to elements of **3**. However, this may also represent the visible northern extent of the geological patterning, **12**, evident in the southern half of the survey.

The 1813 map reproduced in the desk-top assessment shows a small enclosed unit of land, situated toward the north-western corner of the proposed development area. It is possible that anomaly **6** marks the eastern boundary of this feature.

A number of linear and curvilinear anomalies, **7-11**, were detected to the west of **3**. The spatial relationships between **7**, **8**, **9** and **10** suggest that these features were contemporary, and that they were elements of an interrelated system of land division. The sinuous form of **9** raises the possibility that it represents the course of a natural palaeo-channel/stream that was incorporated into this system. Anomalies **7**, **10** and the northern part of **8** may represent components of a small enclosure. The north-eastern boundary of this putative yard, or paddock, if it exists, has not been clearly discerned.

The mottled area of magnetic variation, **12**, may result from the leaching and redeposition of iron rich minerals from the uppermost deposits, a phenomenon noted elsewhere in fenland fluvial/alluvial environments (Lyall, 1995, Snee and Bunn, 1999,

Rylatt and Bunn, 2000). However, it is also possible that elements of **12** indicate the location of pits, or represent materials magnetically enhanced by burning, for example **12a**.

A number of small, randomly distributed discrete anomalies, **13**, were also detected. Such anomalies often mark the location of *in-situ* or mobilised burnt materials, the magnetically enhanced fills of pits, or pieces of ferrous and ceramic debris. The latter are often introduced as a result of agricultural activities, such as midden spreading.

6.0 Conclusions

The survey has detected a significant level of magnetic variation across the site. Some of this appears to be associated with natural soil processes (e.g. **12**), but some elements have morphological characteristics indicating that they are of human origin, and thus possess archaeological potential.

Cartographic evidence indicates that the northern boundary of the site has altered since the early 19th century, and this appears to be confirmed by the results of this survey. Additionally, a linear anomaly detected in the north-western corner of the survey, **6**, appears to represent the eastern boundary of a small enclosure that is also depicted on the 1813 map.

There are also a series of other linear and curvilinear anomalies that cannot be correlated with the cartographic data. Among these, anomalies **7**, **8**, **9**, **10**, **11** appear to constitute elements of a relatively coherent, and therefore presumably contemporaneous, system of land division pre-dating the 19th century. It is difficult to establish the date of this activity on the basis of existing sources of information. Nevertheless, the small enclosure that appears to be formed by **7**, **8** and **10** has a very similar alignment to School Lane, which may suggest that it is of medieval or post-medieval date. Alternatively, the morphological characteristics of this putative enclosure, and its radiating boundaries, has a close correspondence with features created during the late prehistoric and Romano-British periods (Winton, 1998). However, the absence of any evidence of activity prior to the Anglo-Saxon period increases the probability that the former interpretation and dating are correct.

7.0 Acknowledgements

Pre-Construct Geophysics would like to thank Brown & Co. for this commission.

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