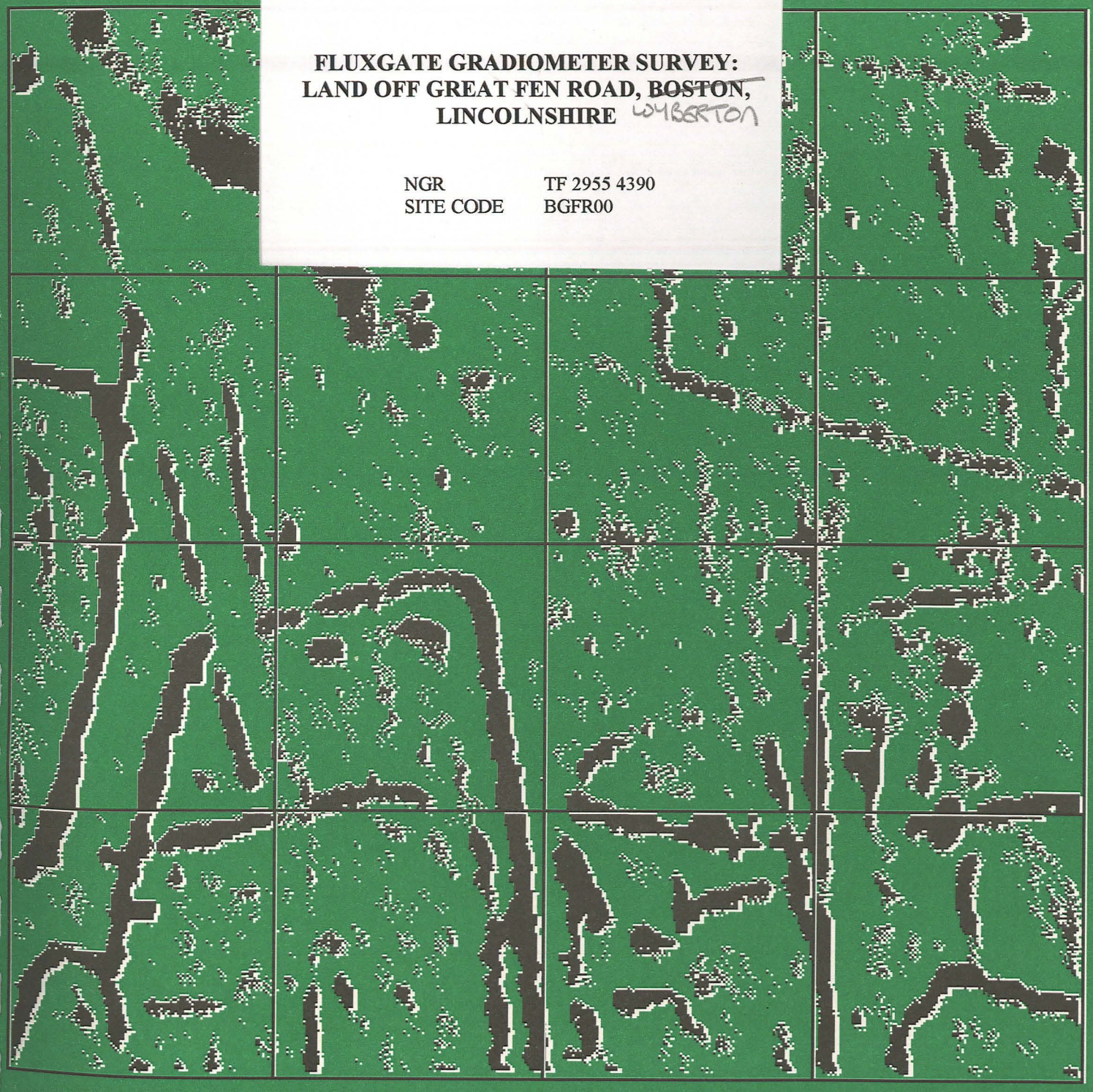
SMR

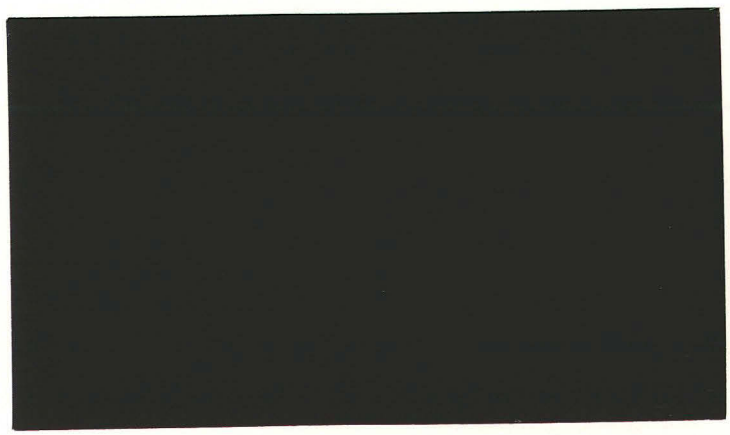
00/22

PRE-CONSTRUCT GEOPHYSICS

FLUXGATE GRADIOMETER SURVEY: LAND OFF GREAT FEN ROAD, ~~BOSTON~~, LOVBERTON LINCOLNSHIRE

NGR	TF 2955 4390
SITE CODE	BGFR00





EVENT LI1507
SOURCE LI6293

PRNS 13560 LI81135
13561 LI81136

FLUXGATE GRADIOMETER SURVEY: LAND OFF GREAT FEN ROAD, ~~BOSTON,~~ LINCOLNSHIRE LONGBERTON

NGR TF 2955 4390
SITE CODE BGFR00

Report prepared for KMB Architects
by Jim Rylatt and David Bunn

PRE-CONSTRUCT GEOPHYSICS
61 HIGH STREET
NEWTON ON TRENT
LINCOLN LN1 2JP
TEL&FAX:01777 228129

November 2000

Contents

	Summary	1
1.0	Introduction	4
2.0	Location and description	4
3.0	Archaeological and historical background	5
4.0	Methodology	5
5.0	Results	8
6.0	Conclusions	10
7.0	Acknowledgements	10
8.0	Bibliography	10

Illustrations

Fig.1 Location of site. Scale 1:25000.

Fig.2 Location of survey grids. Scale 1:2500.

Fig.3 Greyscale image of clipped data showing grids. Scale 1:1250.

Fig.4 Trace plot of raw data. Scale 1:1250.

Fig.5 Greyscale image of clipped data. Scale. 1:1250.

Fig.6 Interpretive image. Scale 1:1250.

Table 1 Summary of survey parameters.

Summary

- *A fluxgate gradiometer survey was undertaken on 3.0 hectares of land off Great Fen Road, Wyberton Fen, Boston, Lincolnshire*
- *The survey identified significant magnetic variation across the site, and this variability can be resolved into a series of magnetic anomalies*
- *Most of these anomalies have been interpreted as representing features of natural origin, either resulting from iron panning or as evidence of a paleo-channel*
- *Whilst some of the remaining anomalies can be associated with modern drainage, others possibly reflect the presence of sub-surface archaeological features, though these have proved difficult to resolve due to the masking effects of the features of natural origin*
- *A spread of discrete anomalies across the site attest to the possible presence of ferrous and brick/tile debris*

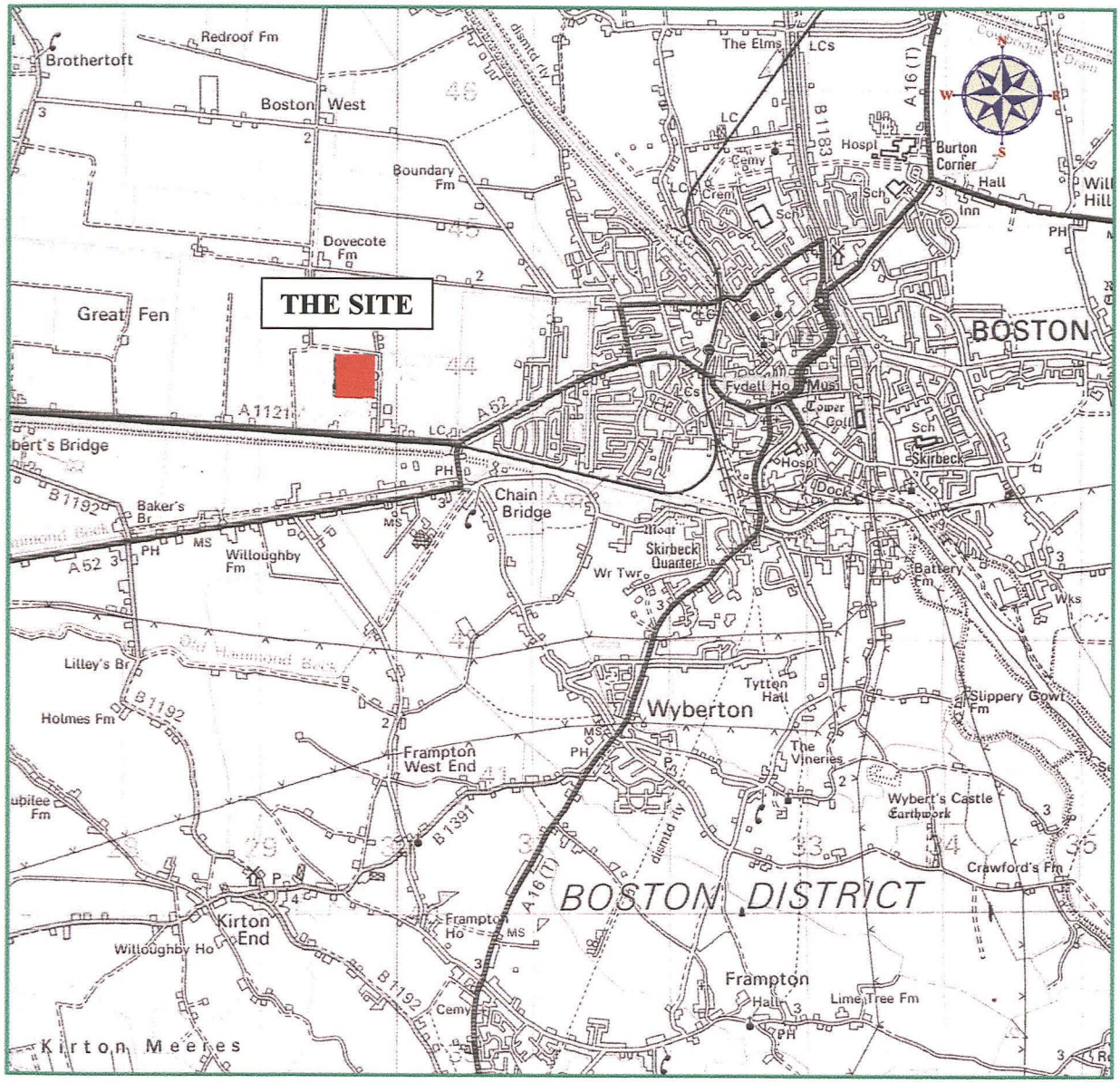


Fig.1: Location of survey 1:25000

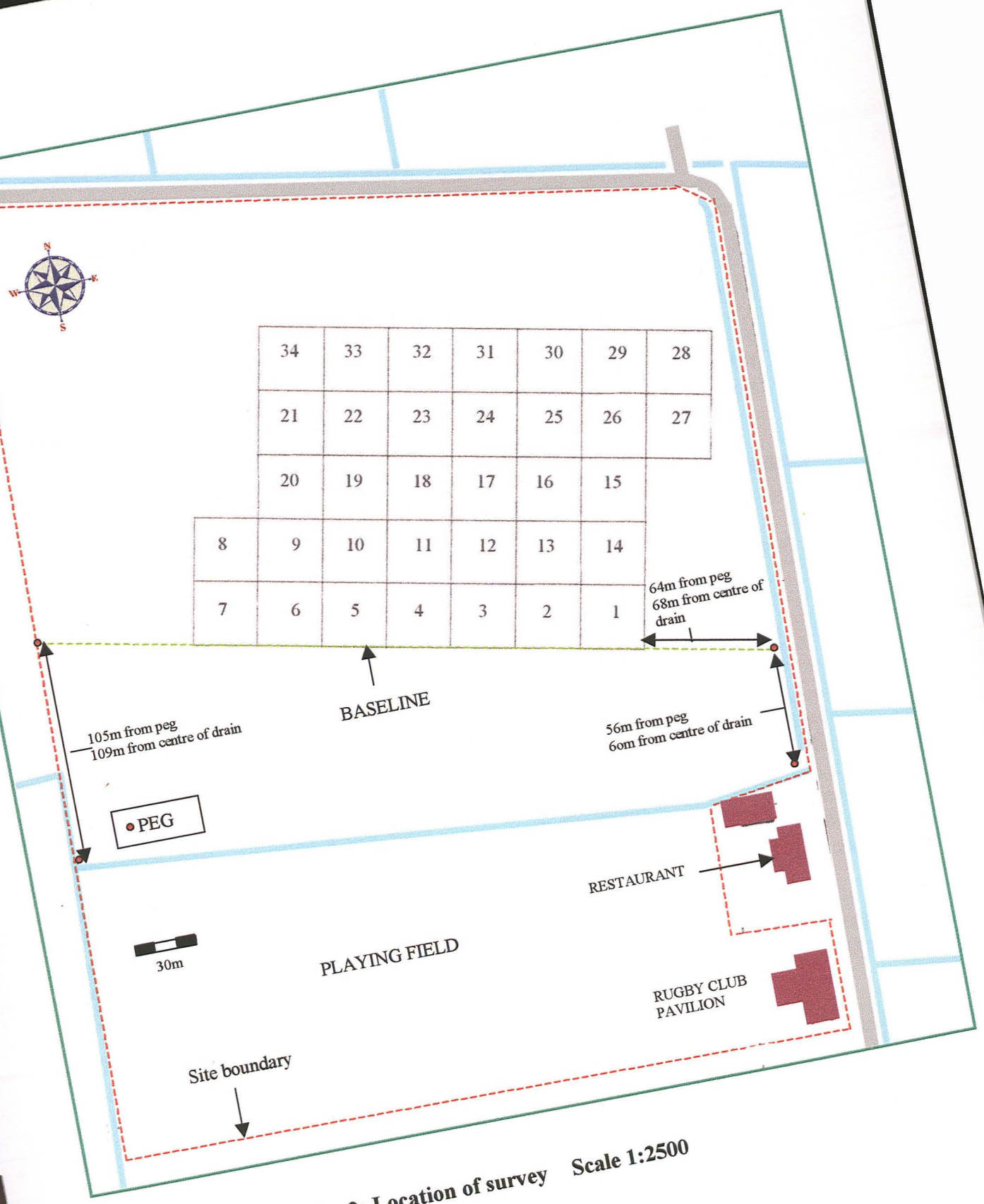


Fig. 2: Location of survey Scale 1:2500

1.0 Introduction

KMB Architects commissioned Pre-Construct Archaeology (Lincoln) to undertake an archaeological evaluation of c.12 ha of land off Great Fen Road, Boston, in advance of the construction of a rugby and athletics stadium (planning application no: B/99/0604). The initial component of this evaluation was a fluxgate gradiometry survey of a 3 ha unit of the site that had been identified as the potentially most affected by the development.

The survey was undertaken by Pre-Construct Geophysics, in accordance with a specification prepared by Pre-Construct Archaeology (Palmer-Brown, 2000).

The gradiometer survey 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

Boston is situated in the Fens of south Lincolnshire, approximately 45km south-east of Lincoln and 7km from the north-west coast of the Wash.

The site is located approximately 0.7km to the west of the town, in Wyberton Fen, on land bracketed by the North and South Forty Foot Drains. It comprises a sub-rectangular unit extending to c.12ha, the majority of which is in agricultural use. The remaining area is currently utilised as playing fields, with a sports pavilion, by Boston Rugby Club (Fig. 2). The survey was confined to the northern part of the site, on land that has recently supported a pea crop, the remnants of which were visible on the surface. Drains bound the site along the north-eastern and south-western edges, and a road runs along the northern edge. The southern and north-western edges of the site are unbounded. A dwelling and restaurant are situated immediately to the south of the eastern end of a drain, which divides the playing fields from the agricultural land to the north.

The ground surface, which lies at c. 3.0m OD, undulates gently, and drops very slightly toward the south. A slight ridge traverses the site from east to west across the southern part of the survey area.

The drift geology is composed of Quaternary deposits; these are 10-20m in depth and are comprised of the Barroway Drove Beds and older Marine Deposits (of the 3rd- 4th millennia BC), all sealed by silty clay saltmarsh deposits. The solid geology is composed of a series of Jurassic deposits, with the Amphill Clay formation overlying the West Walton and Oxford Clay Formations (B.G.S. 1995).

Central National Grid Reference TF 2955 4390.

3.0 Archaeological and historical background

Although the town of Boston is a medieval foundation, this part of the fen basin appears to have been exploited and/or settled from at least the later Iron Age. However, land use and settlement was somewhat transient, being influenced by a succession of extended marine transgressions and shorter periods of flooding. More recently, the construction of the South and North Forty Foot Drains, in 1636 and 1720 respectively, must have had a profound effect upon the nature of settlement and the utilisation of the land in and around Wyberton Fen.

There is considerable evidence for settlement in Wyberton Fen and its environs during the Romano-British period. Enclosures were found and recorded c. 80m to the south-west of the proposed development, suggesting occupation of the area between the 2nd and the 4th centuries AD. Surface finds and associated cropmarks, approximately 2km to the west, provide further evidence of Romano-British occupation, while cropmarks and Iron Age and Romano-British pottery have been recorded c. 2km to the south-east. Many of these sites are thought to have been associated with salt production and distribution.

4.0 Methodology

Detailed area survey using a fluxgate gradiometer is a non-intrusive means of evaluating the archaeological potential of a site. The fluxgate gradiometer detects magnetic anomalies caused 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 composition of the soil and the introduction of intrusive materials such as brick and stone. These features create detectable magnetic anomalies. In addition, activities which 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 produced features and the natural background level can result from:

- different depth or density of fill, with respect to the depth or density of surrounding soils magnetically similar to the 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
- the magnetic susceptibility of areas of burning, as opposed to unburnt areas

- the magnetic properties of localised, naturally deposited minerals, such as occur in the fill of palaeo-channels, in contrast to those of the surrounding soils.

The area survey was conducted using a *Geoscan Research* fluxgate gradiometer (model FM36) with an electronic sample trigger set to take 4 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 southern edge of the survey area (Fig.2).

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 the 9th, 13th and 16th of October 2000.

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	09/10/99 Cool, blustery, showers 13/10/99 Fine, sunny 16/10/99 Fine, sunny`
Area surveyed	3.0ha

Table 1: Summary of survey parameters

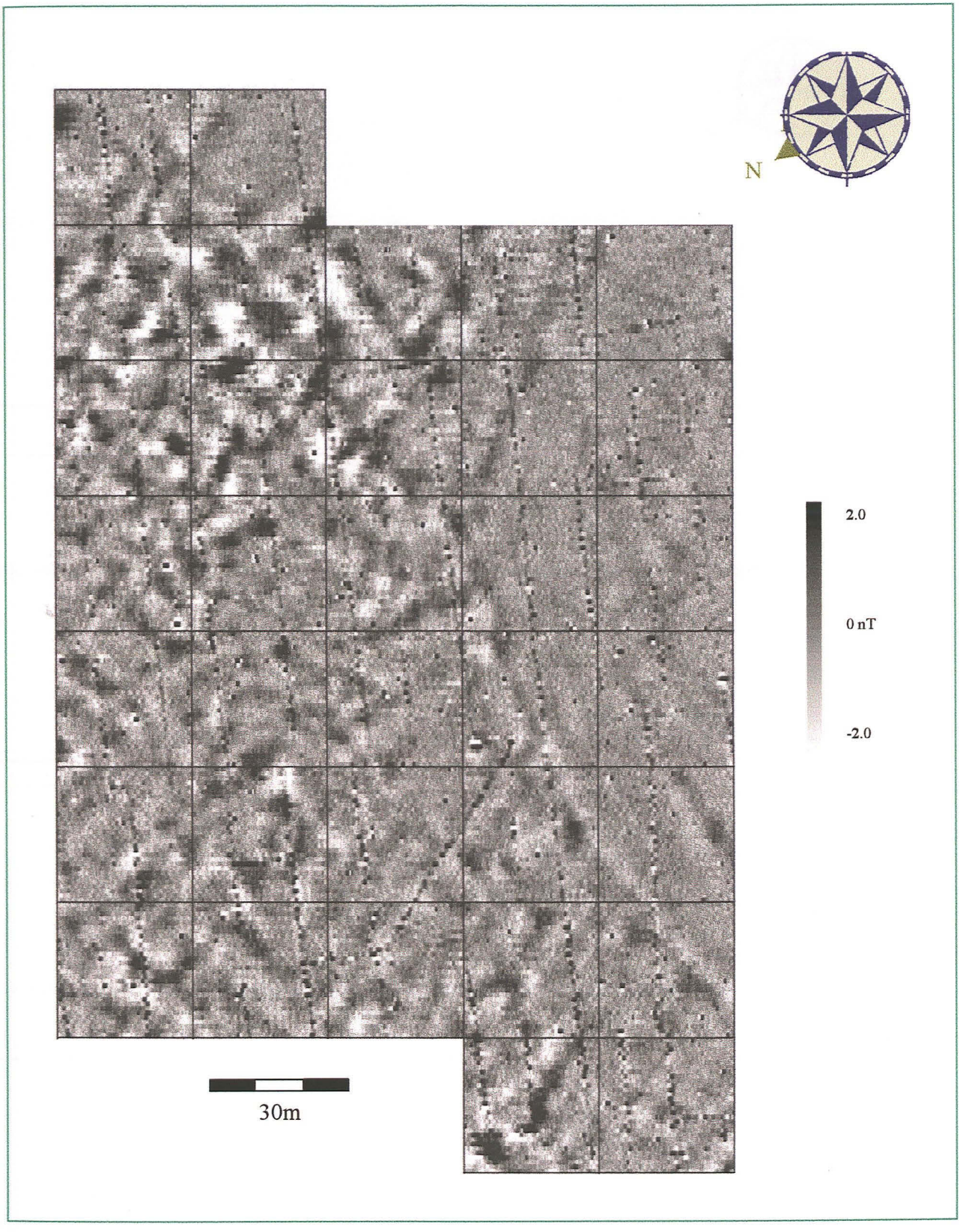


Fig.3: Greyscale image showing the location of the grids.
1:1250

Fig.4: Trace plot of raw data 1:1250

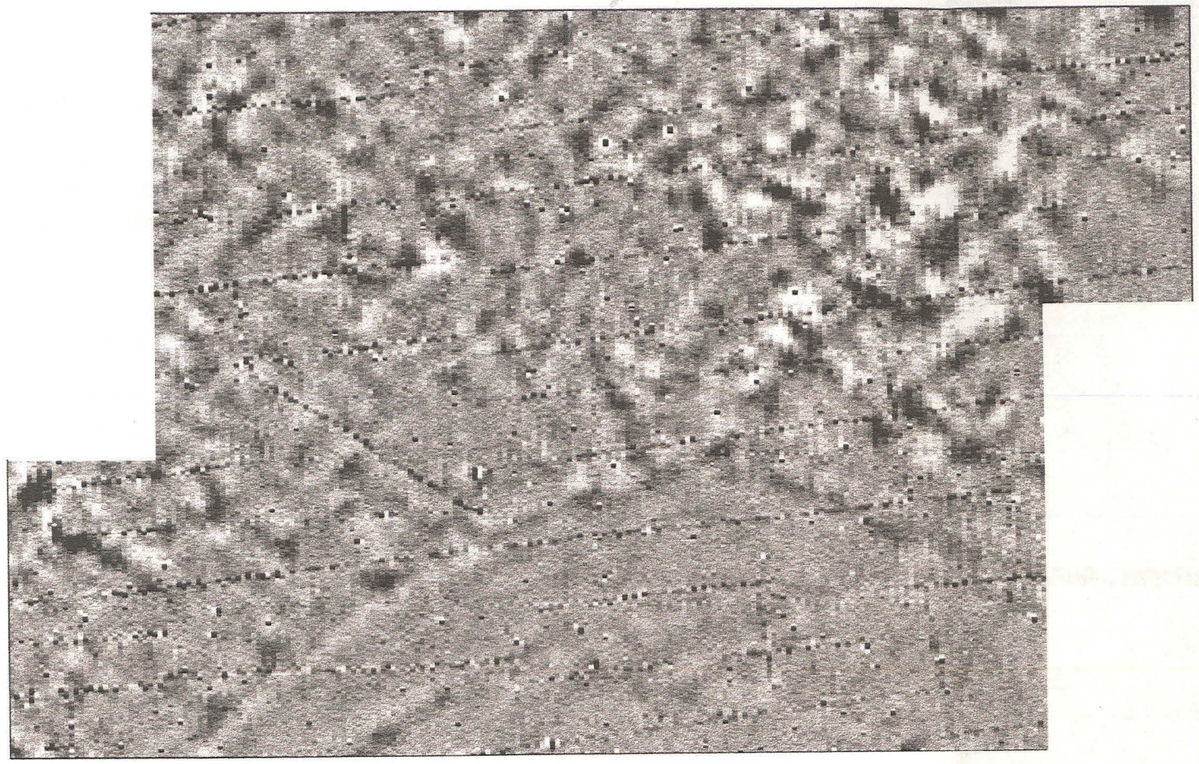
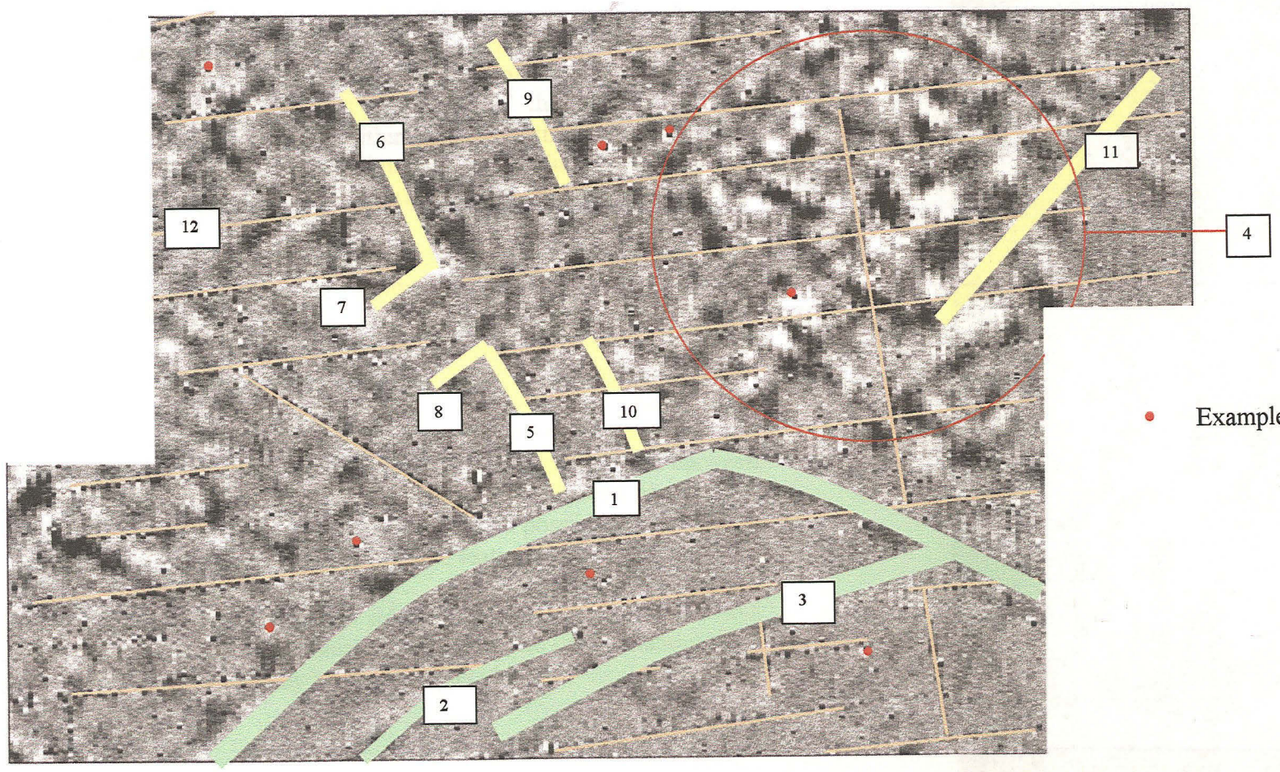


Fig.5: Greyscale image. 1:1250



• Example of discrete anomaly

Fig.6: Interpretive image. 1:1250

5.0 Results, interpretation and discussion

Distinct variations in the magnetic characteristics of the soils were detected across the survey area (Figs. 3 & 4). The northern part of the survey contains an apparently random and mottled distribution of magnetic anomalies in comparison to the magnetically quieter southern area.

Anomaly **1** forms the boundary between these two contrasting areas. The abrupt change in the magnetic characteristics of the soils to the north and south of this anomaly suggest that it represents a single feature, despite significant magnetic variation from one end to the other; it is magnetically weaker at its western end. The alignment of the western end of **1** is paralleled by anomalies **2** and **3**, which are located to the south. At first sight this group of anomalies could be interpreted as ditches or boundary features. However, given the fenland location and the gross magnetic differences between the northern and southern part of the site, outlined above, it is possible that these anomalies are of natural origin. Redundant creeks or paleo-channels are common within the Fens; these anomalies and the area to the south of **1** may result from the successive northerly migrations of a large watercourse, which subsequently developed into a rodden. The lateral movement of a watercourse would rework existing sediments and could produce the contrasting geological and magnetic differences visible in the greyscale (Fig. 5). A slight ridge corresponds with the location of anomalies **1** and **2**. Such topographical variation is characteristic of the formation of a rodden, providing corroborative support for this interpretation.

The mottled area in the northern half of the survey (example circled in red, Fig.6: **4**) is almost certainly the result of natural processes, a phenomenon recorded elsewhere by gradiometry (Llyall 1995; Snee and Bunn 1999). Such strong magnetic variation often results from the formation of iron panning. This interpretation is supported by the inspection of augered soil samples taken at the time of the survey. Greater concentrations of yellow silt were encountered within the area of these anomalies than in the more neutral area to the south. Such pigmentation is characteristic of the enrichment of soils as a result of the leaching of minerals from overlying deposits.

However, evidence of natural processes does not pre-suppose that all of the anomalies detected are of non archaeological origin. The strengths and density of the magnetic field produced by natural features may be masking more subtle archaeological remains. A number of diffuse linear anomalies (**5-11**) have been tentatively flagged as possibly showing archaeological potential. Anomalies **5-10** seem to display some regularity and spatial associations. Anomalies **5** and **6** share the same north-south orientation, while **7** and **8** run perpendicular and abut them. Collectively, anomalies **5-8** form two 'L' shaped features which mirror each other, with a gap of c. 30m between them. Further east, two faintly discernable linear anomalies (**9**, **10**) extend parallel to **5** and **6**. While **5** and **10** appear to terminate at anomaly **1**, it is possible that the latter has reworked any southerly continuation of these possible features.

Linear anomaly **11**, located towards the eastern side of the survey area, extends on a similar orientation to the western part of anomaly **1**. However, no other relationship is apparent, so this superficial correlation may be purely co-incidental.

A series of parallel linear anomalies (fig.6: **12**) traverse the survey area. The majority run east to west, but others are orientated differently. These anomalies are characteristic of ceramic land drains.

The random distribution of small, discrete anomalies (fig.6: examples shown as red) across the site probably represent ferrous/brick and tile debris which are often the result of agricultural practices (midden spreading, land drainage, thrown horseshoes, etc).

6.0 Conclusions

The survey area appears to contain anomalies predominantly of natural origin. These seem to result from iron pan formation and the migration and infilling of a paleo-channel. While the latter may have become redundant at any time since the deposition of the older Marine Beds (c. 3rd millennium BC), it is tempting to see a relationship with the controlled drainage of Wyberton Fen. The creation of the South Forty Foot Drain in 1636, c. 500m to the south of this anomaly, and the North Forty Foot Drain in 1720, c. 600m to the north, would have had a profound effect upon the landscape. The dark band of material marked as anomaly **1** may represent organic material trapped in the relict channel once it had ceased to serve as a conduit for water.

A series of faint linear anomalies were detected which display characteristics of boundary features. This interpretation is offered tentatively, due to the amount of magnetic variability, which may be obscuring and/or masking any archaeological remains. Consequently, the existence and nature of any archaeological features has not been conclusively determined by the survey.

7.0 Acknowledgements

Pre-Construct Geophysics would like to extend thanks to KMB Architects for all the help and assistance given during this survey.

8.0 Bibliography

Clark, A. J. 1990 *Seeing Beneath the Soil*. London, Batsford.

David, A. 1995 *Geophysical Survey in Archaeological Field Evaluation*. London, English Heritage: Research & Professional Guidelines No.**1**.

Gaffney, C., Gater, J., & Ovendon, S. 1991 *The Use of Geophysical Techniques in Archaeological Field Evaluation*. London, English Heritage: Technical Paper No. **9**.

B.G.S. 1995 *Boston, England and Wales Sheet **128**.* Solid and Drift Geology. 1:50,000 Series. Keyworth, British Geological Survey.

Lyall, J. 1995 *Fluxgate Gradiometer Survey at White House Lane, Fishtoft, Lincolnshire.* Landscape Research Centre. Unpublished report.

Palmer-Brown, C.P.H. 2000 *Specification for an Archaeological Field evaluation: Proposed Rugby and Athletics Stadium, Great Fen Road, Boston.* Pre-Construct Archaeology (Lincoln). Unpublished.

Snee, J. & Bunn, D.B. 1999 *Fluxgate Gradiometer Survey, Land at Newton on Trent, Lincoln.* Pre-Construct Geophysics. Unpublished report.