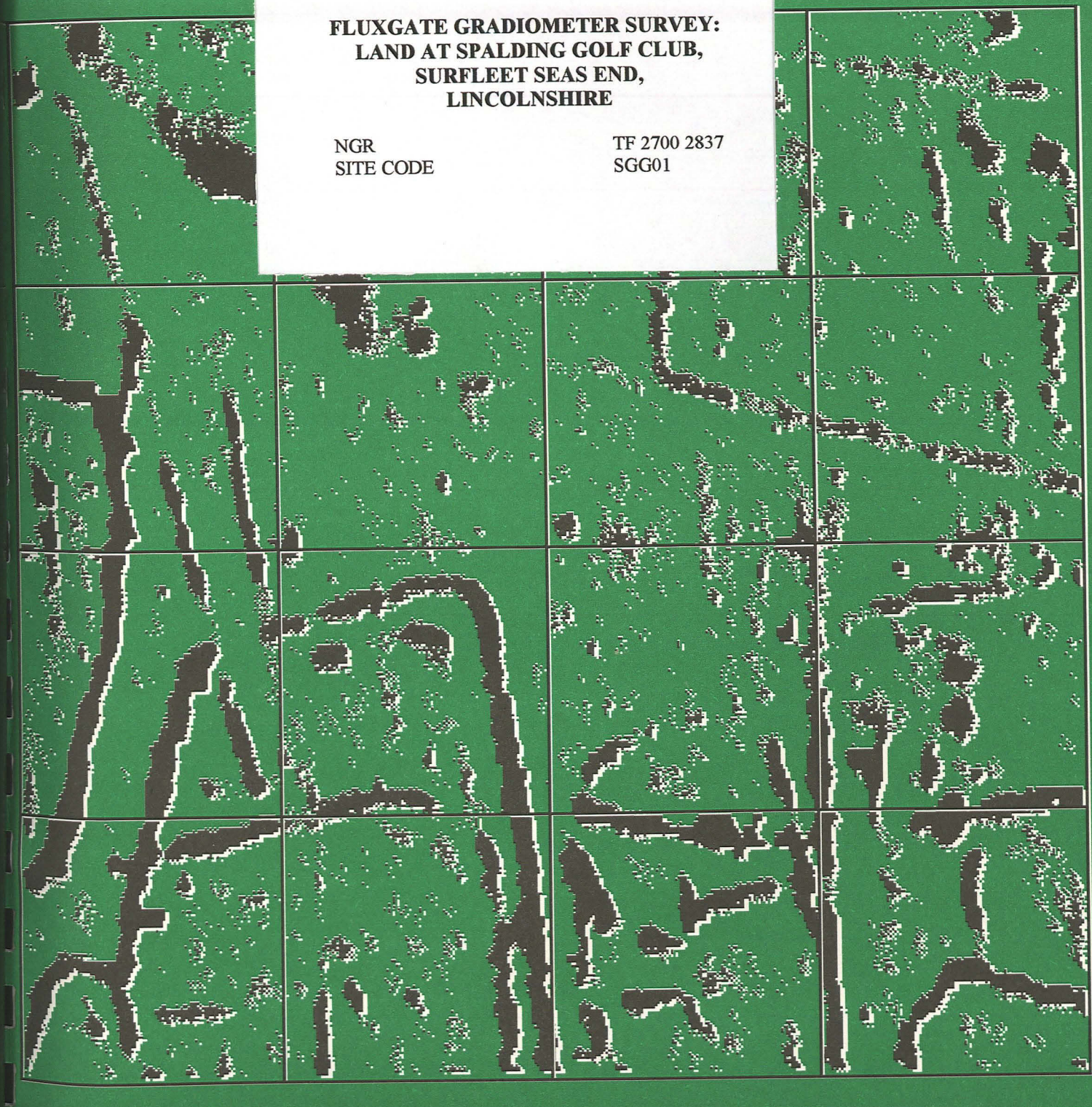
M1/021

PRE-CONSTRUCT GEOPHYSICS

FLUXGATE GRADIOMETER SURVEY: LAND AT SPALDING GOLF CLUB, SURFLEET SEAS END, LINCOLNSHIRE

NGR	TF 2700 2837
SITE CODE	SGG01



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Report prepared for Bill Hawthorn (Golf Irrigation Doctor)
on behalf of Spalding Golf Club
by Jim Rylatt & David Bunn

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January 2001

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Summary

- *A fluxgate gradiometer survey was undertaken on 1.0 hectare of land at Spalding Golf Club, Surfleet Seas End, Spalding, 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 are associated with modern agricultural activities, such as ploughing*
- *Other anomalies possibly reflect sub-surface archaeological features, that may be associated with medieval salt processing*
- *Small discrete anomalies distributed across the site suggest the presence of ferrous and ceramic debris in the topsoil*

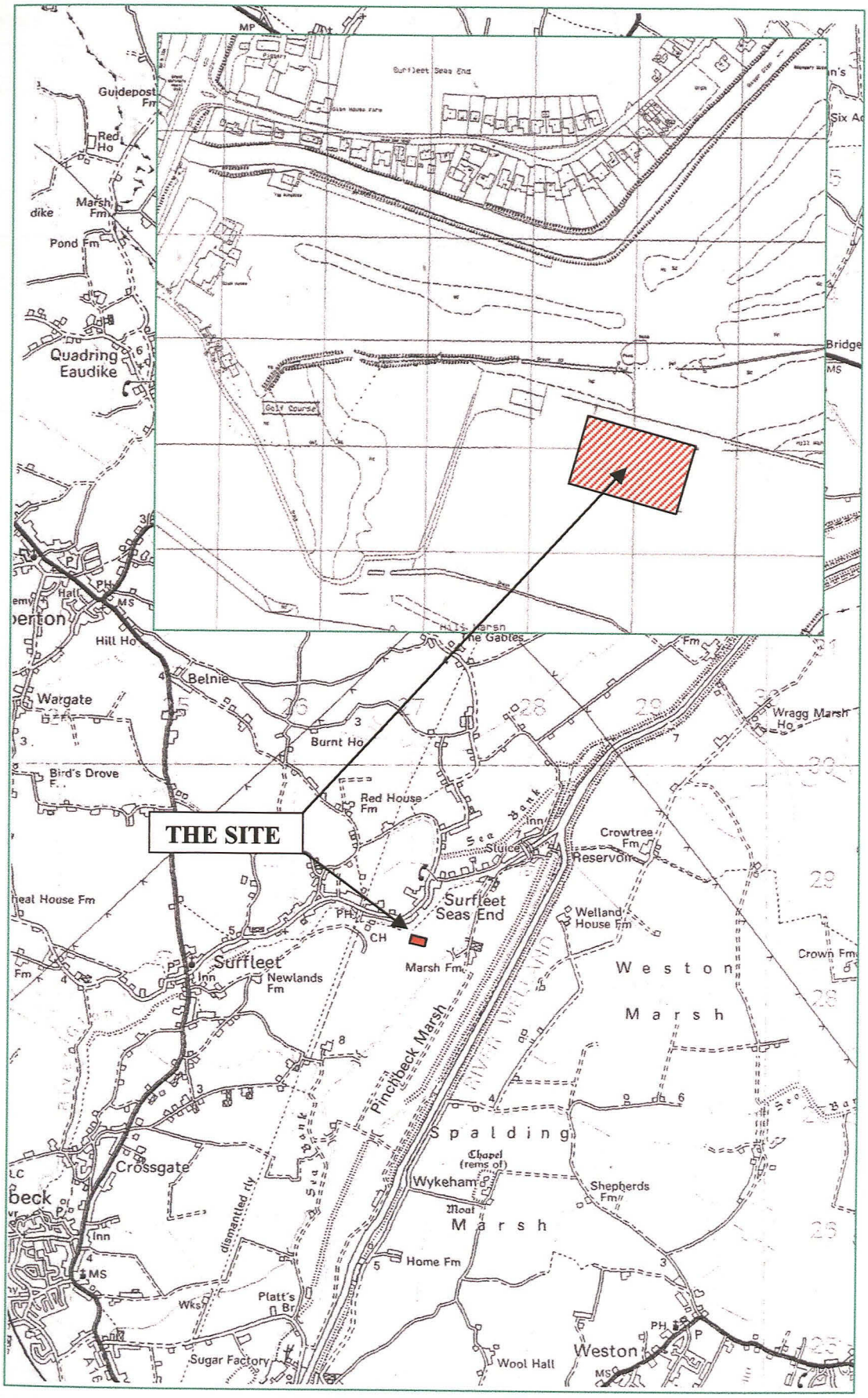


Fig.1: Location of site. **Scale 1:25000 (Inset 1:5000)**

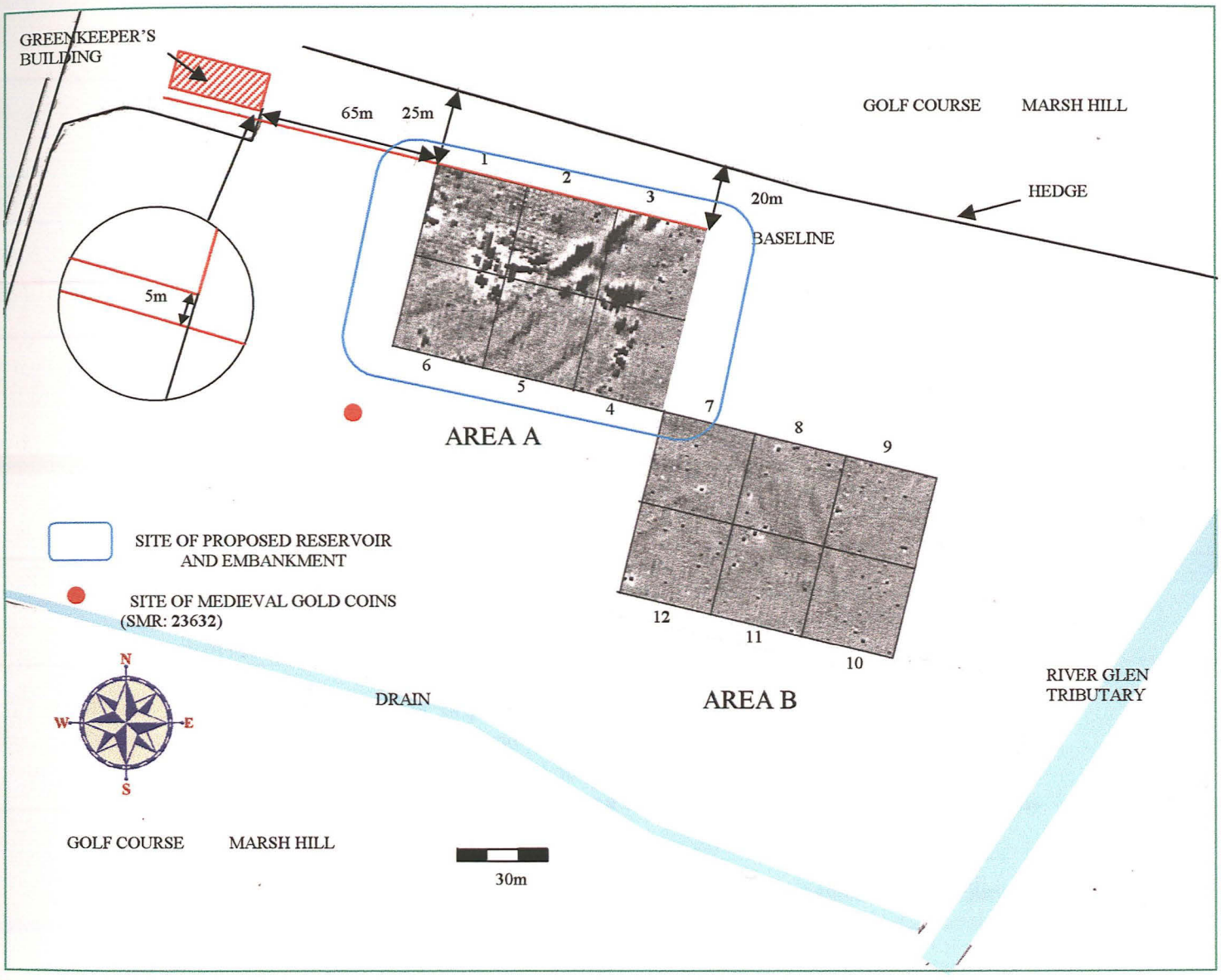


Fig.2: Location of survey. Scale 1:2000

1.0 Introduction

Bill Hawthorn (Golf Irrigation Doctor), on behalf of Spalding Golf Club, commissioned Pre-Construct Geophysics to undertake a fluxgate gradiometer survey of land at Spalding Golf Club, Surfleet Seas End, Lincolnshire. This work was carried out as part of an archaeological assessment of the site, conducted to discharge a requirement of South Holland District Council and Lincolnshire County Council Built Environment Section, which was placed upon a planning application for the construction of an irrigation reservoir.

The survey was undertaken according to a specification prepared by Pre-Construct Archaeology (Palmer-Brown, 2001).

The 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

Spalding is situated on the northern edge of the Fens of south Lincolnshire, approximately 21km south-south-west of Boston.

The site of the proposed reservoir is situated at Spalding Golf Club, which lies to the north-east of the town, on the southern bank of the River Glen, at Surfleet Seas End, and comprises a 0.8ha component of a c. 7.0ha field. The latter currently supports a ground cover of recently sown grass and is bounded to the north by hedging, to the west by an access track, a drain to the south, and a tributary of the River Glen to the east.

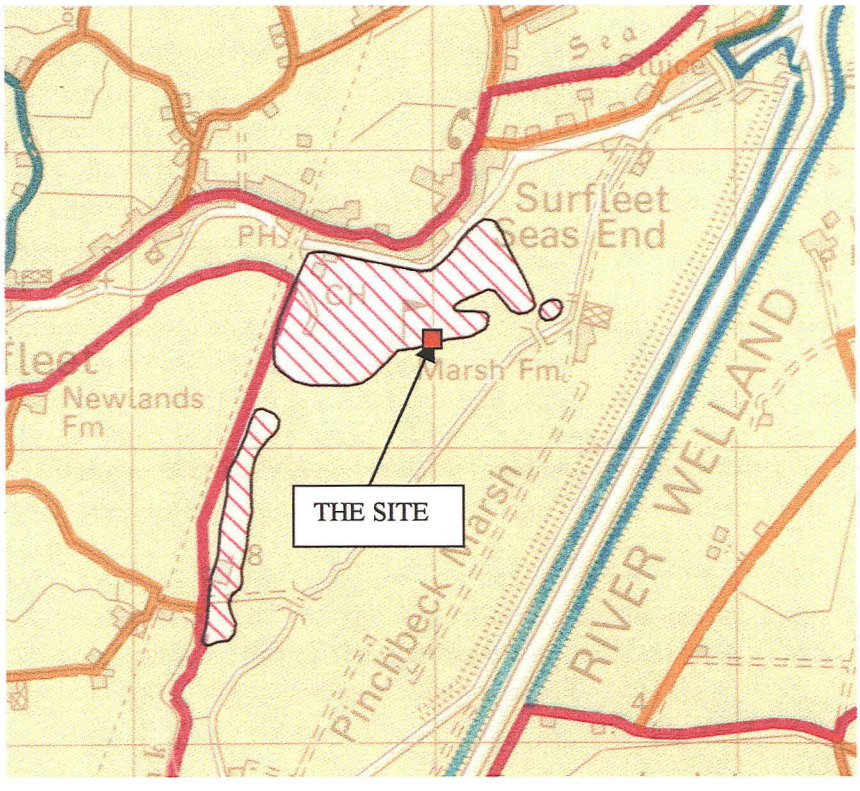
1.0ha was surveyed: 0.54ha (90m x 60m) within the application area (**Area A**), and 0.54 ha (90m x 60m, **Area B**) to its immediate south-east, the latter on land which may provide an alternative location for the reservoir, subject to planning approval.

East, west and south-facing slopes extend from the highest ground, which is located within grid 3 (Fig.2) and the land to its immediate east. The south-facing slope predominates and is more pronounced in the middle and northern part of the field. This area also gently undulates. Grid 8 (**Area B**) coincides with the position of a low ridge, orientated north-west to south-east.

A modern building, which serves as a base for the club's maintenance facility, is situated in the north-west corner of the field.

There are a series of drift deposits within the area, which are up to 20m in depth, that were laid down during the Quaternary era. 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., 1992). 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.

The golf course, which lies to the south of the River Glen, is largely situated within an area previously identified as raised ground, the by-product of medieval salt extraction industries (Fig.3). These deposits derive from the indigenous silts described above. The high ground within the site probably represents the southern extent of such ground raising activity.



Terrington Beds: younger marine alluvium; salt marsh, tidal creek and river deposits (sandy silt, sand and clay)

Made Ground. Silt mounds from medieval salterns

Fig.3: Geological map: Surfleet Seas End (BGS, 1992) 1:25000

Central National Grid Reference TF 2700 2837.

3.0 Archaeological and historical background

There has been little archaeological research conducted within the village of Surfleet Seas End, or its immediate environs, and consequently there is an absence of evidence for prehistoric activity, which, if it exists, may be sealed beneath subsequent alluvial silts.

There is evidence of occupation of the area from at least the Late Saxon period. The *Domesday Survey* of 1086, records Surfleet, c. 1.0km to the west of the site, as *Sverefelt*, meaning '*sour stream*' (Mills, 1993). It is possible that Surfleet Seas End marked the position of the coastline or the extent of reclaimed land during this period; the suffix 'Seas End' is self-explanatory. The gift of Surfleet church to Spalding Priory, by *Jocelin son of Helpon,* entitled the monastery to farm the glebe land and

receive the entire income of the church, in the form of tithes and customary offerings, such as unpaid labour (Owen, 1971). These would have enabled the clergy to provide the resources for land reclamation and salt procurement. The population of Surfleet Seas End may have been associated with these works. However, the modern settlement is largely situated on the north bank of the River Glen, whereas the medieval saltern mounds occur on the south bank (Fig.3).

Salt manufacturing during the medieval period predominately took the form of 'sand washing', which involved three main stages; collection of salt rich sand and silts, filtration and evaporation of the resultant brine. Residue of the latter processes could include traces of filter beds and areas of burning (burnt peat and clay lined oven remains). It is thought that such remains were uncovered in the 1980's, in an area to the north of the site, during drainage work on the golf course (*pers. comm.*, J. Ward: head greenkeeper).

The archaeological potential of the site is reinforced by the earlier discovery of 99 medieval gold coins within 30m of the south-west edge of **Area A** (Fig.2), together with buried timbers and a large number of cobbles (SMR: 23632).

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 composition of the soil and the introduction of materials such as brick and stone. These features 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 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, 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 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. A base line was established along the northern edge of the survey area (Fig.2), parallel to the southern face of the building. Pegs were placed at all grid corners to facilitate the 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.1.1ha

Table 1: Summary of survey parameters

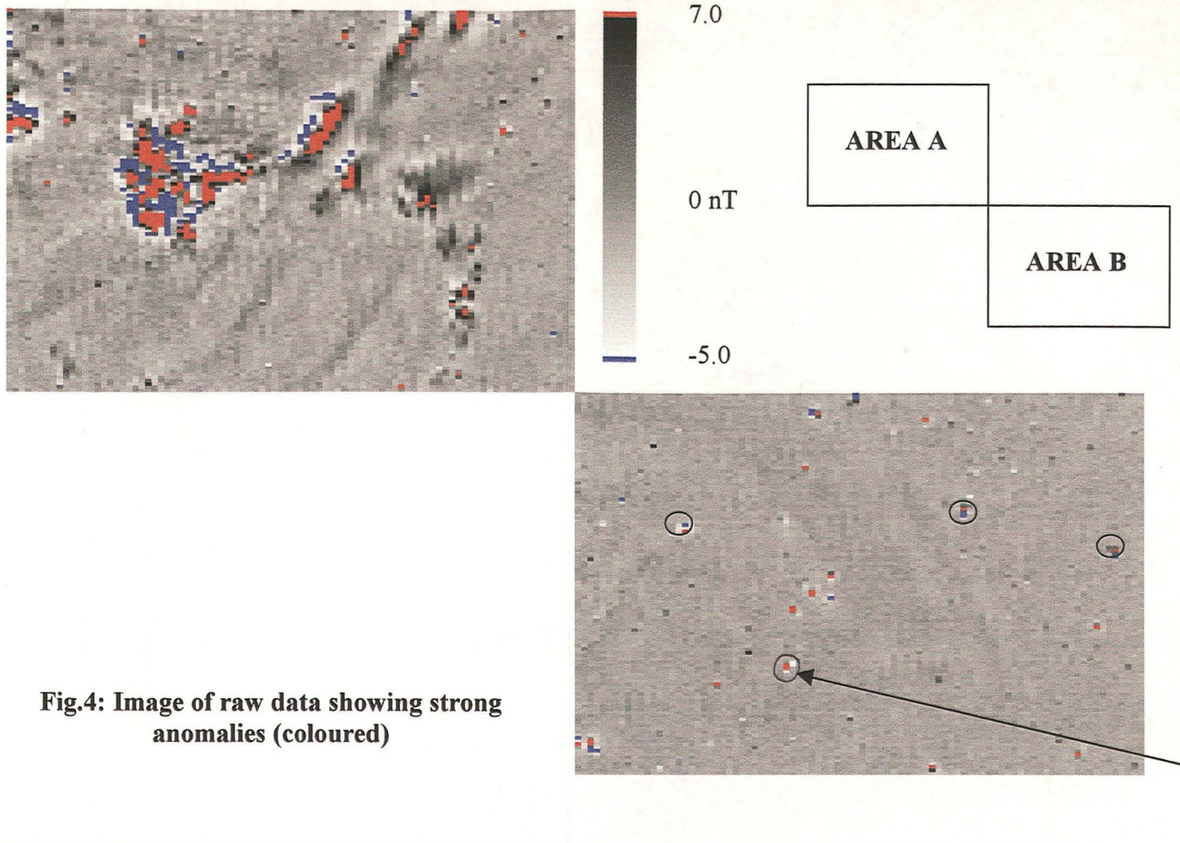


Fig.4: Image of raw data showing strong anomalies (coloured)

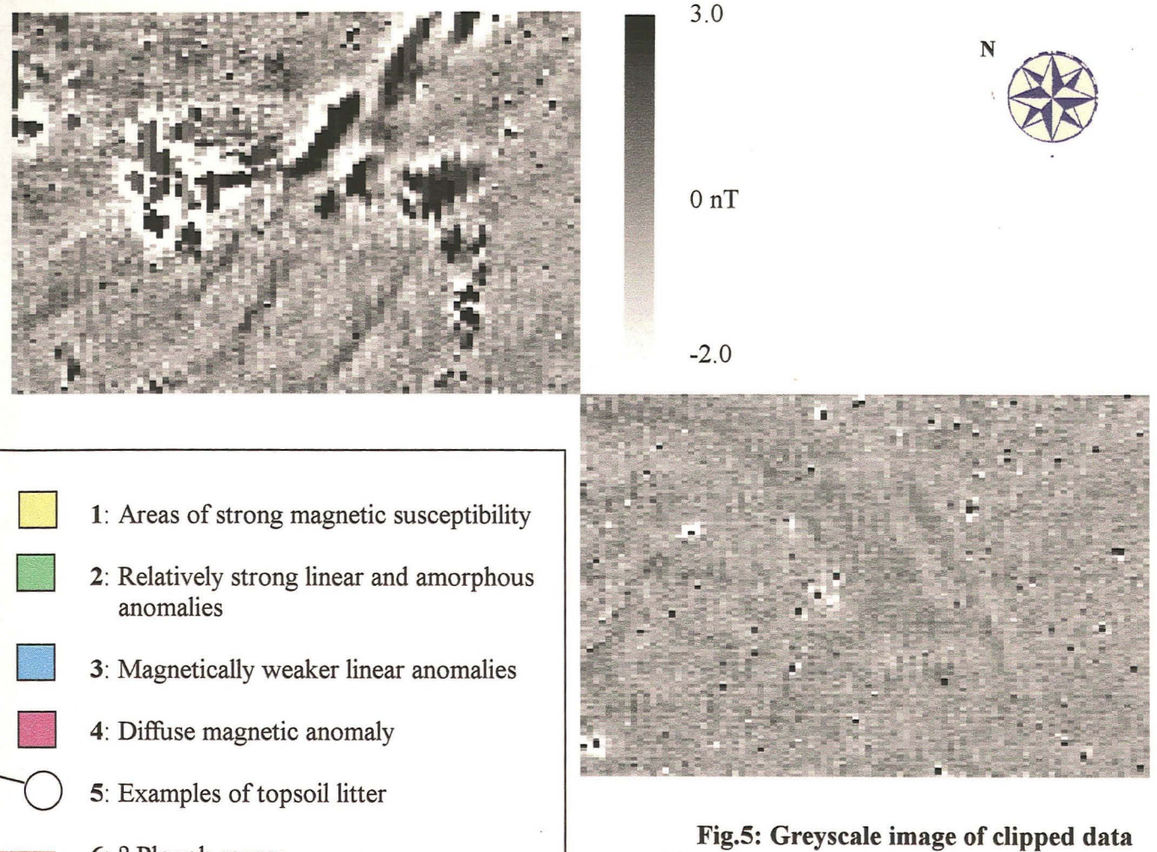


Fig.5: Greyscale image of clipped data

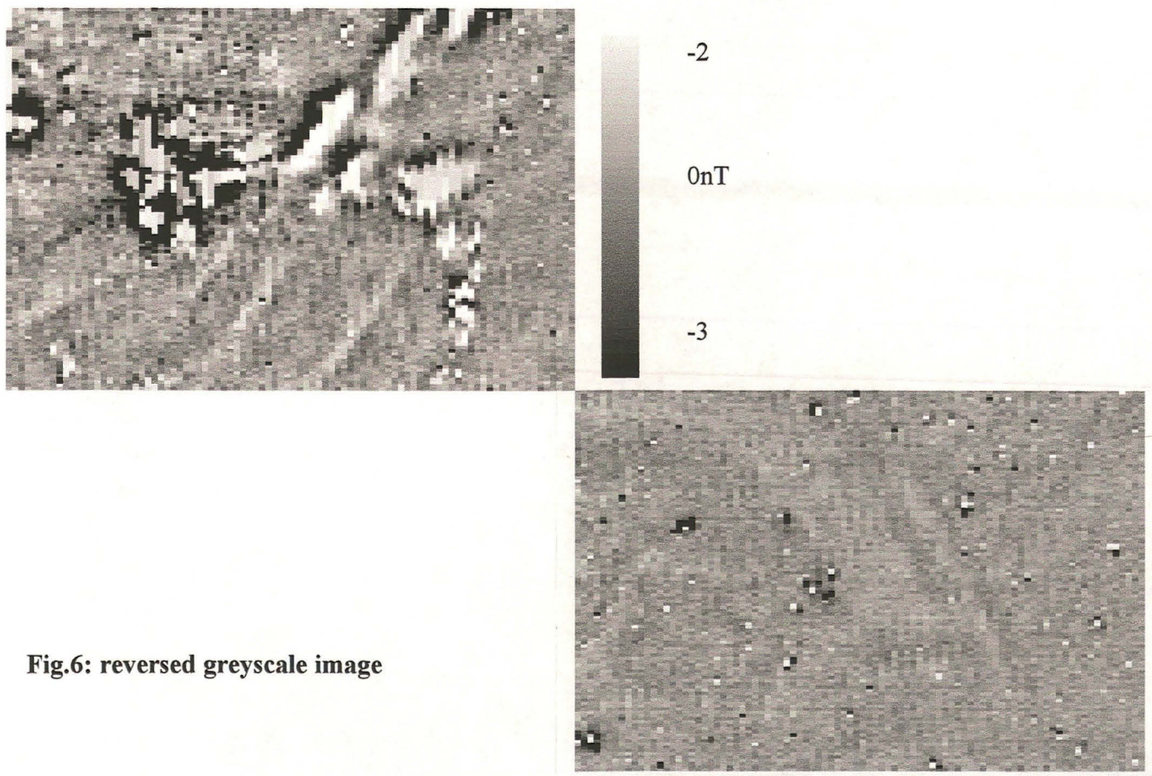


Fig.6: reversed greyscale image

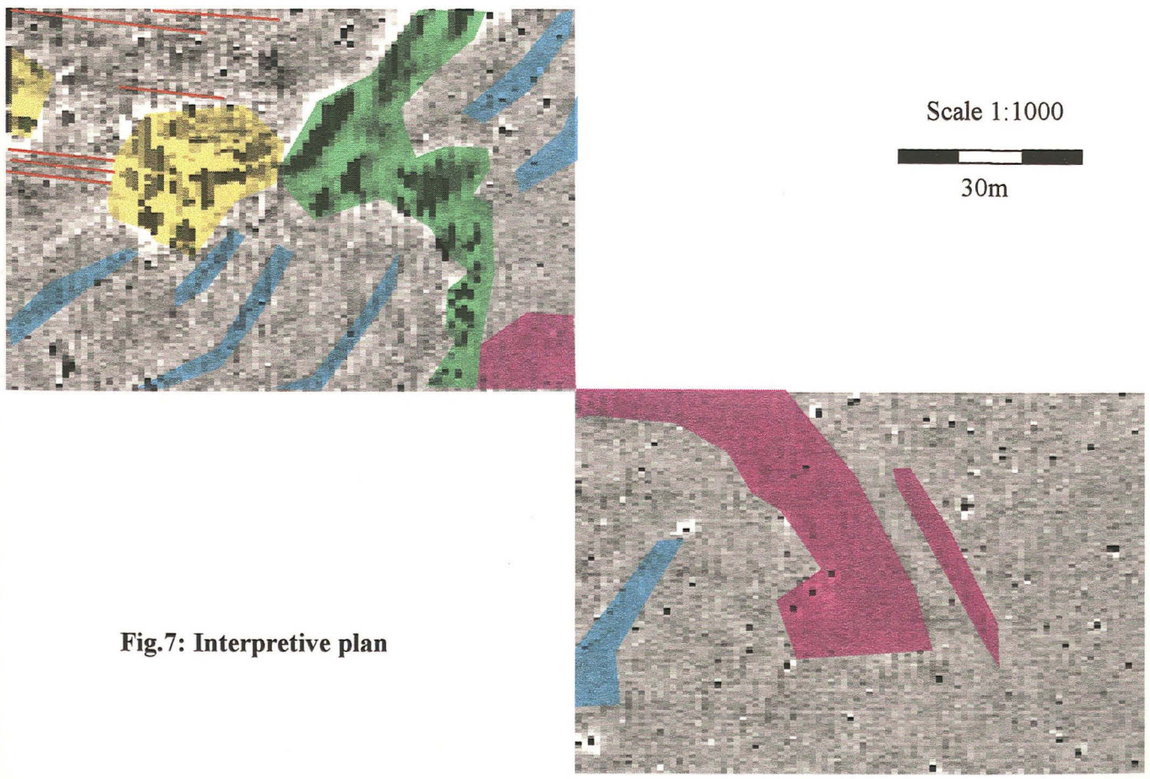


Fig.7: Interpretive plan

5.0 Results

The survey detected a range of magnetic anomalies, some of which appear to indicate the presence of archaeological features.

Figure 4 represents the raw data, with the strongest anomalies shown in red and blue; figures 5 and 6, represent an enhancement of magnetically weak anomalies, which has resulted from further processing.

Figure 4 and the trace plot of the raw data (Figure 8) graphically indicate the differences in magnetic variation across the survey area. The greatest concentrations of this magnetic disturbance were detected within **Area A**. Two areas of relatively strong magnetic susceptibility (fig.7: **1**) occur in the northern and central part of the latter. It is possible that they represent areas of burning or traces of burnt materials, and/or ceramic and ferrous debris. These may be of modern origin (for example, the location of bonfires). However, the geological evidence suggests that the site lies towards the southern extent of ground that has been artificially raised as a result of salt processing. As such, it is possible that anomaly group **1** may be evidence of burnt remains that are associated with this process.

A series of slightly weaker anomalies, **2**, were detected to the east of **1**. These may reflect smaller, less concentrated deposits of the materials responsible for anomaly **1**. However, some of the elements of **2** appear to have a linear format, which implies an association with anomaly group **3**. The latter are orientated east-north-east to west-south-west.

An irregular, diffuse anomaly, **4**, was detected in **Area B,** and possibly in the south-eastern corner of **Area A**. Orientated from north-west to south–east, this area of magnetic variation appears to correspond with the location a low ridge, that was noted during the survey (see Section 2). It is paralleled to the east by a narrower, though magnetically similar example. These features could also represent material that was deposited as a result of salt processing. It is notable that the land to the south of **4** seems to mark the southern limit of the raised area.

A number of discrete anomalies (examples circled, Fig.4: **5**) may be the result of modern agricultural activity, possibly resulting from the presence of horseshoes, ploughshares, and ferrous materials contained within the topsoil. The strong dipolar characteristics of these anomalies are apparent on the trace plot of the raw data (Fig. 8).

A series of parallel linear anomalies, **6**, were detected in the north-west corner of **Area A**. It is possible that these reflect traces of modern plough scores.

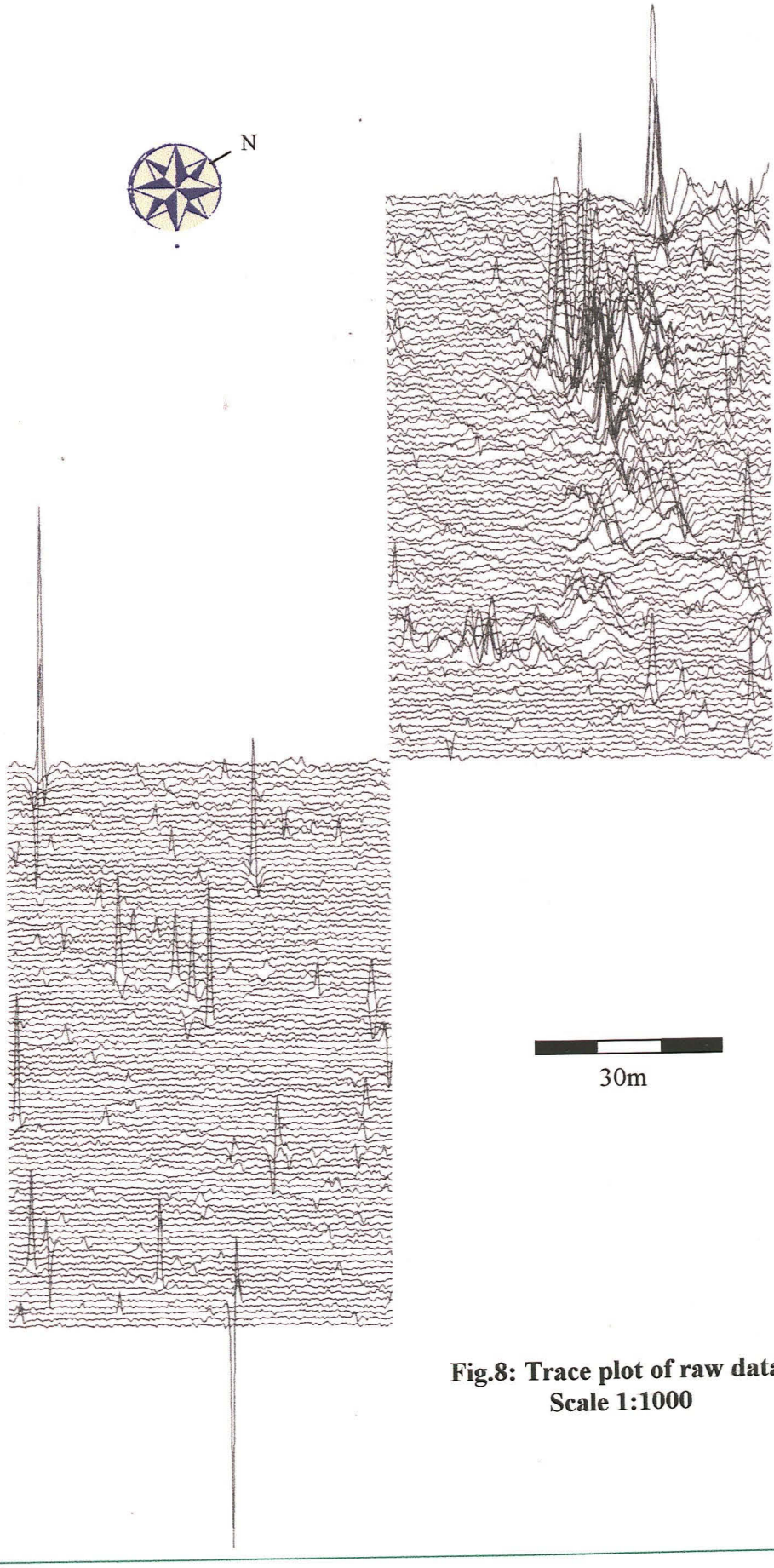


Fig.8: Trace plot of raw data.
Scale 1:1000

6.0 Conclusions

A series of magnetic anomalies have been detected across the survey area. The greatest density and the strongest anomalies occur within the northern grid block, **Area A**, with weaker examples being recorded in the southern block.

The location of this site, and its proximity to known areas of medieval salt processing, strongly suggests that some of the anomalies are a direct reflection of marine salt processing, although this cannot be clarified without the use of intrusive methods. Excavations that have been carried out in Lincolnshire and elsewhere show that the processing of salt often involved heating and burning, where brine was boiled to remove water. It is the residues of these activities (in the form of redundant ovens, ash spreads and fired clays) that create magnetic anomalies that contrast with the background magnetic signature.

The anomalies that have been detected cannot be resolved into discrete features, with an identifiable morphology. It is possible, for example, that anomaly group **1** represents a series of disturbed ovens, although this cannot be clarified on present information.

It is understood that some flexibility is possible regarding the location of the proposed irrigation lagoon. On present evidence, **Area B** would be the more appropriate candidate. This area contains relatively few magnetic anomalies, suggesting either that this area lies beyond a focus of activity, or that archaeological remains in this area are less capable of being detected by gradiometry.

7.0 Acknowledgements

Pre-Construct Geophysics would like to thank Bill Hawthorn and Spalding Golf Club for this commission, and Mr. Ward for information provided during the course of the survey.

8.0 Bibliography

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