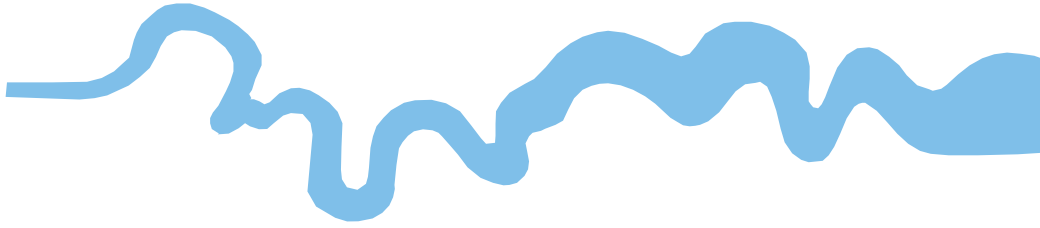


T V A S



EAST MIDLANDS

**Land east of Newmarket Road,
Worlington, Suffolk**

Geophysical Survey (Magnetic)

by Kyle Beaverstock

Site Code: NMW20/177

(TL 7005 7223)

Land east of Newmarket Road, Worlington, Suffolk

Geophysical Survey (Magnetic) Report

For Shockingly Fresh Limited

by Kyle Beaverstock

Thames Valley Archaeological Services Ltd

Site Code NMW
20/177

March 2021

Summary

Site name: Land east of Newmarket Road, Worlington, Suffolk

Grid reference: TL 7005 7223

Site activity: Magnetometer survey

Date and duration of project: 23rd - 25th of February 2021

Project coordinator: Tim Dawson

Site supervisor: Kyle Beaverstock

Site code: NMW20/177

Area of site: c.20.7ha

Summary of results: The geophysical survey revealed few magnetic anomalies across the site. These are most likely modern or natural in origin although a small number of isolated circular positive anomalies may represent buried pits of potential archaeological interest.

Location of archive: The archive is presently held at Thames Valley Archaeological Services, Reading in accordance with TVAS digital archiving policies.

*This report may be copied for bona fide research or planning purposes without the explicit permission of the copyright holder. All TVAS unpublished fieldwork reports are available on our website:
www.tvas.co.uk/reports/reports.asp.*

Report edited/checked by: Steve Ford✓ 02.03.21 Tim Dawson✓ 02.03.21
--

Land east of Newmarket Road, Worlington, Suffolk A Geophysical Survey (Magnetic)

by Kyle Beaverstock

Report 20/177b

Introduction

This report documents the results of a geophysical survey (magnetic) carried out at land to the east of Newmarket Road, Worlington, Suffolk (TL 7005 7223) (Fig. 1). The work was commissioned by Helen Ansell, of Shockingly Fresh Ltd., Gyleview House, 3 Redheughs Rigg, Edinburgh, EH12 9DQ.

Planning consent is to be sought from West Suffolk Council for the erection of polytunnels and associated infrastructure on a c. 20 ha parcel of land north of Bay Farm. This is in accordance with the *National Planning Policy Framework* (NPPF 2019), and the Council's policies on archaeology. The fieldwork was undertaken by Kyle Beaverstock and Luciano Cicu between the 23rd to the 25th of February and the site code is NMW20/177.

The archive is presently held at Thames Valley Archaeological Services, Reading in accordance with TVAS digital archiving policies.

Location, topography and geology

The site is located approximately 1km north of the village of Red Lodge, in the south of the parish of Worlington, which lies in the north-west corner of Suffolk roughly equally distant from Newmarket to the south-west and Bury St Edmunds to the south-east (Fig. 1), and 3km to the south of Mildenhall. The site is a relatively flat, sub rectangular parcel of land at a height of c.15m above ordinance datum. It is currently being utilised for arable farming and the underlying geology is stated as Holywell Nodular Chalk Formation and New Pit Chalk Formation (BGS 1982).

Site history and archaeological background

A full history and background can be found in the desk-based assessment for the site (Preston 2020). To summarise, there has been little in the way of archaeological investigations in the immediate vicinity of the site, however numerous Bronze Age and Paeleolithic sites have been identified in the wider landscape as well as some Anglo-Saxon activity to the south.

Methodology

Sample interval

Data collection involved the traversing of the survey area along straight and parallel lines using two cart-mounted Bartington Grad601-2 fluxgate gradiometers. Even coverage was achieved with the use of regularly spaced markers at the ends of traverses and the real-time positional trace plot. Readings were taken at 0.25m intervals along traverses 1m apart, providing an appropriate methodology balancing cost and time with resolution. Traverses were walked at an alternating east to west zig-zag orientation across the survey area. The site was mostly unobstructed however due to severe rutting in the northern area and the southwestern area of the site, these areas were not able to be surveyed. Conditions were dry and bright.

The Grad 601-2 has a typical depth of penetration of 0.5m to 1.0m. This would be increased if strongly magnetic objects have been buried in the site. Under normal operating conditions it can be expected to identify buried features >0.5m in diameter. Features which can be detected include disturbed soil, such as the fill of a ditch, structures that have been heated to high temperatures (magnetic thermoremnance) and objects made from ferro-magnetic materials. The strength of the magnetic field is measured in nano Tesla (nT), equivalent to 10^{-9} Tesla, the SI unit of magnetic flux density.

Equipment

The purpose of the survey was to identify geophysical anomalies that may be archaeological in origin in order to inform a targeted archaeological investigation of the site prior to development. The survey and report generally follow the recommendations and standards set out by both European Archaeological Council (EAC 2015) and the Chartered Institute *for* Archaeologists (2002, 2014).

Magnetometry was chosen as a survey method as it offers the most rapid ground coverage and responds to a wide range of anomalies caused by past human activity. These properties make it ideal for the fast yet detailed surveying of an area.

The detailed magnetometry survey was carried out using two dual sensor Bartington Instruments Grad 601-2 fluxgate gradiometers mounted upon a Bartington non-magnetic cart. A two-wheeled lightweight structure pushed by hand, the cart consisted a bank of four vertically-mounted Bartington Grad601-2 magnetic sensor tubes at 1m apart and a Trimble Geo 7x centimetre edition GPS. Readings were collected by two Bartington Grad601-2 loggers and collated using MLgrad601 software on a Linx 12x64 tablet running Windows 10 mounted at the rear of the cart. This enables readings to be taken of both the general background magnetic field

and any localised anomalies with the difference being plotted as either positive or negative buried features. All sensors are calibrated to cancel out the local magnetic field and react only to anomalies above or below this base line. On this basis, strong magnetic anomalies such as burnt features (kilns and hearths) will give a high response as will buried ferrous objects. More subtle anomalies such as pits and ditches can be seen from their infilling soils containing higher proportions of humic material, rich in ferrous oxides, compared to the undisturbed subsoil. This will stand out in relation to the background magnetic readings and appear in plan following the course of a linear feature or within a discrete area.

The Trimble Geo7x centimetre edition GPS system with centimetre real-time accuracy was used to tie the cart traverses into the Ordnance Survey national grid. This unit offers both real-time correction and post-survey processing; enabling a high level of accuracy to be obtained both in the field and in the final post-processed data.

Data gathered in the field was processed using the TerraSurveyor software package. This allows the survey data to be collated and manipulated to enhance the visibility of anomalies, particularly those likely to be of archaeological origin. The table below lists the processes applied to this survey, full survey and data information is recorded in Appendix 1.

Process	Effect
Clip from -16.50 to 16.58 nT	Enhance the contrast of the image to improve the appearance of possible archaeological anomalies.
De-stripe: median, all sensors	Removes the striping effect caused by differences in sensor calibration, enhancing the visibility of potential archaeological anomalies.
De-spike: threshold 1, window size 3×3	Compresses outlying magnetic points caused by interference of metal objects within the survey area.
De-stagger: all grids, both by -1 intervals	Cancels out effects of site's topography on irregularities in the traverse speed.

The raw data plot is presented as a greyscale plot shown in relation to the site (Fig. 2) with the processed data then presented as a second figure (Fig. 3), followed by a third plan to present the abstraction and interpretation of the magnetic anomalies (Fig. 4). Anomalies are shown as colour-coded lines, points and polygons.

The greyscale plot of the processed data is exported from TerraSurveyor in a georeferenced portable network graphics (.PNG) format, a raster image format chosen for its lossless data compression and support for transparent pixels, enabling it to easily be overlaid onto an existing site plan. The data plot is combined with grid and site plans in QGIS 2.18.15 and exported again in .PNG format in order to present them in figure templates in Adobe InDesign CS5.5, creating .INDD file formats. Once the figures are finalised, they are exported in .PDF format for inclusion within the finished report.

Results

Although the geophysical survey did not reveal an extensive number of magnetic anomalies across the site it did reveal a number of small circular positive anomalies. These anomalies may represent buried pits or similar isolated discrete features but with no discernible pattern. There were also small strips and patterns of dipolar positive and negative responses with a low amplitude that coincide with areas damaged by farming activity. These most likely represent some minor subsurface disturbances. Finally, there were a small number of magnetic spikes which are represented by bipolar responses of a high amplitude and were most likely caused by ferrous objects.

Conclusion

The geophysical survey revealed relatively few magnetic anomalies across the site other than some isolated circular anomalies, most likely buried pits or a similar feature of possible archaeological interest. No other anomalies of archaeological interest were detected.

References

- BGS, 1982, *British Geological Survey*, 1:50,000, Sheet 189, Solid and Drift Edition, Keyworth
- CI/A, 2014, 'Standard and Guidance for archaeological geophysical survey', Reading
- EAC, 2015, *EAC Guidelines for the use of Geophysics in Archaeology: Questions to Ask and Points to Consider*, EAC Guidelines 2, Namur
- IFA, 2002, 'The Use of Geophysical Techniques in Archaeological Evaluation', IFA Paper No. 6, Reading
- NPPF, 2019, *National Planning Policy Framework (revised)*, Ministry for Housing, Communities and Local Government, London
- Preston, S, 'Land east of Newmarket Road, Worlington, Suffolk, a desk-based assessment', unpub. report 20/177, Reading

Appendix 1. Survey and data information

Programme:

Name: TerraSurveyor
Version: 3.0.25.0

Stats

Max: 106.57
Min: -108.32
Std Dev: 4.05
Mean: 0.44
Median: 0.45
Composite Area: 6.3163 ha
Surveyed Area: 3.9615 ha

Raw data

Filename: Worlington A RAW.xcp
Instrument Type: MLgrad Import
Units:
UTM Zone: 30
Survey corner coordinates (X/Y):
Northwest corner: 569853.801987892, 272192.495151144 m
Southeast corner: 570269.541987892, 271969.675151144 m
Direction of 1st Traverse: 90 deg
Collection Method: Parallel
Sensors: 2 @ 1 m spacing.
Dummy Value: 32702

Dimensions

Survey Size (meters): 416 m x 223 m
X&Y Interval: 0.13 m
Source GPS Points: Active: 231663, Recorded: 231663

Stats

Max: 104.18
Min: -109.71
Std Dev: 3.12
Mean: -0.43
Median: -0.43
Composite Area: 9.2635 ha
Surveyed Area: 7.2732 ha

Filename: Worlington B RAW.xcp
Instrument Type: MLgrad Import
Units:
UTM Zone: 30
Survey corner coordinates (X/Y):
Northwest corner: 569795.970287631, 272381.049774178 m
Southeast corner: 570268.910287631, 272158.749774178 m
Direction of 1st Traverse: 90 deg
Collection Method: Parallel
Sensors: 2 @ 1 m spacing.
Dummy Value: 32702

Dimensions

Survey Size (meters): 473 m x 222 m
X&Y Interval: 0.13 m
Source GPS Points: Active: 266199, Recorded: 266199

Stats

Max: 106.92
Min: -109.72
Std Dev: 3.94
Mean: 1.57
Median: 1.52
Composite Area: 10.513 ha
Surveyed Area: 8.3558 ha

Filename: Worlington C RAW.xcp
Instrument Type: MLgrad Import
Units:
UTM Zone: 30
Survey corner coordinates (X/Y):
Northwest corner: 569790.700628834, 272479.233296287 m
Southeast corner: 570268.450628834, 272347.023296287 m
Direction of 1st Traverse: 90 deg
Collection Method: Parallel
Sensors: 2 @ 1 m spacing.
Dummy Value: 32702

Dimensions

Survey Size (meters): 478 m x 132 m
X&Y Interval: 0.13 m
Source GPS Points: Active: 124983, Recorded: 124983

Processed data

Filename: Worlington A.xcp

Stats

Max: 16.58

Min: -16.50

Std Dev: 1.78

Mean: 0.07

Median: 0.02

Composite Area: 9.2635 ha

Surveyed Area: 7.2732 ha

GPS based Proce4

1 Base Layer.

2 Unit Conversion Layer (Lat/Long to UTM).

3 DeStripe Median Traverse:

4 Clip from -15.00 to 15.00

Filename: Worlington B.xcp

Stats

Max: 16.58

Min: -16.50

Std Dev: 2.28

Mean: 0.07

Median: 0.03

Composite Area: 10.513 ha

Surveyed Area: 8.3558 ha

GPS based Proce4

1 Base Layer.

2 Unit Conversion Layer (Lat/Long to UTM).

3 DeStripe Median Traverse:

4 Clip from -15.00 to 15.00

Filename: Worlington C.xcp

Stats

Max: 16.58

Min: -16.50

Std Dev: 2.06

Mean: 0.04

Median: 0.02

Composite Area: 6.3163 ha

Surveyed Area: 3.9615 ha

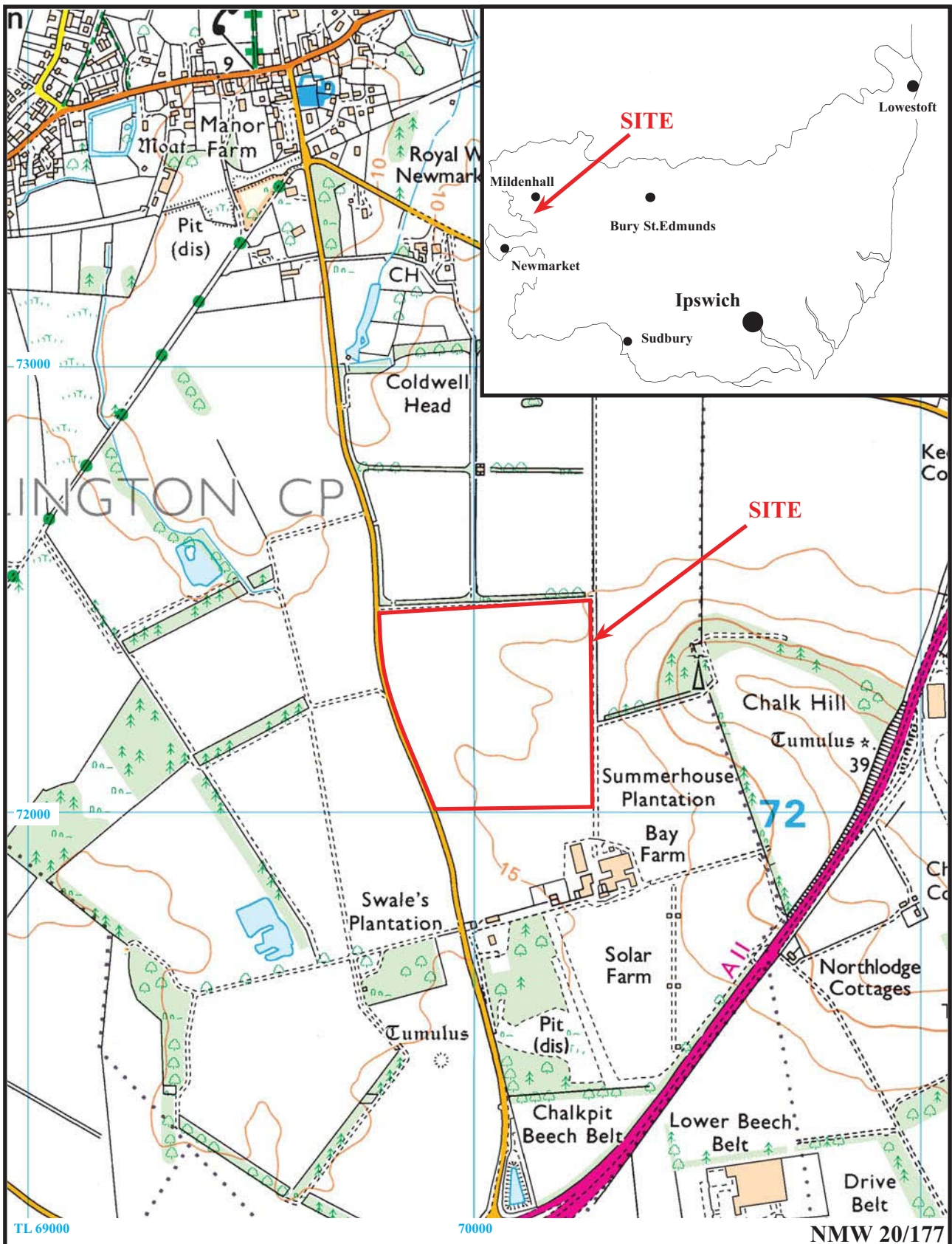
GPS based Proce4

1 Base Layer.

2 Unit Conversion Layer (Lat/Long to UTM).

3 DeStripe Median Traverse:

4 Clip from -15.00 to 15.00



**Land east of Newmarket Road,
Worlington, Suffolk, 2021
Geophysical Survey (Magnetic)**

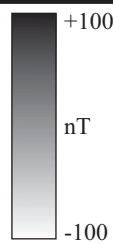
Figure 1. Location of site within Worlington and Suffolk.

Reproduced under licence from Ordnance Survey Explorer Digital mapping at 1:12500
Crown Copyright reserved





**Land east of Newmarket Road,
Worlington, Suffolk, 2021
Geophysical Survey (Magnetic)**
Figure 2. Plot of raw gradiometer data.





**Land east of Newmarket Road,
Worlington, Suffolk, 2021
Geophysical Survey (Magnetic)**
Figure 3. Plot of processed gradiometer data.

0m 250m

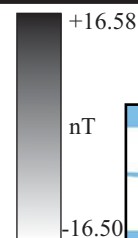






Plate 1. Northeastern area of the site looking southwest from the northeastern corner.



Plate 2. Northwestern corner of the site looking southeast including area of disturbed ground.



Plate 3. Northern area of the site looking east from western boundary including area of disturbed ground.



Plate 4. Central area of the site looking east from western boundary including disturbed ground.

NMW 20/177

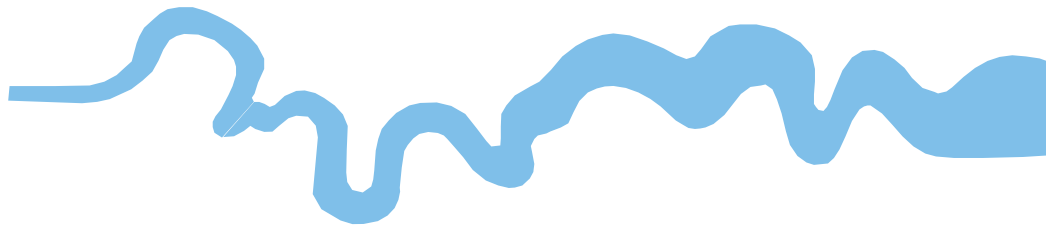
**Land east of Newmarket Road,
Worlington, Suffolk, 2021
Geophysical Survey (magnetic)
Plates 1 to 4.**



TIME CHART

	Calendar Years
Modern _____	AD 1901
Victorian _____	AD 1837
Post Medieval _____	AD 1500
Medieval _____	AD 1066
Saxon _____	AD 410
Roman _____	AD 43 AD 0 BC
Iron Age _____	750 BC
Bronze Age: Late _____	1300 BC
Bronze Age: Middle _____	1700 BC
Bronze Age: Early _____	2100 BC
Neolithic: Late	3300 BC
Neolithic: Early	4300 BC
Mesolithic: Late	6000 BC
Mesolithic: Early	10000 BC
Palaeolithic: Upper	30000 BC
Palaeolithic: Middle	70000 BC
Palaeolithic: Lower	2,000,000 BC





**TVAS (East Midlands),
4 Bentley Court, Wellingborough
Northamptonshire, NN8 4BQ**

**Tel: 01933 277 377
Email: eastmidlands@tvas.co.uk
Web: www.tvas.co.uk/eastmidlands**

*Offices in:
Reading, Brighton, Taunton and Stoke-on-Trent*